JOURNAL

OF THE

ARNOLD ARBORETUM

HARVARD UNIVERSITY

VOLUME XXIV

JAMAICA PLAIN, MASS.
1943

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Arnold Arboretum of Harvard University
KRAUS REPRINT CORPORATION
New York
1968

DATES OF ISSUE

No. 1 (pp. 1–117, 1 pl.) issued January 15, 1943.
No. 2 (pp. 119–242, 6 pl.) issued April 15, 1943.
No. 3 (pp. 243–374, 12 pl.) issued July 15, 1943.
No. 4 (pp. 375–518, 6 pl.) issued October 15, 1943.

Printed in U.S.A.

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VOL. XXIV — JANUARY, 1943 — NUMBER 1

THE AMERICAN SPECIES OF DRIMYS

A. C. SMITH

With three text-figures

THE family Winteraceae is composed of six genera, of which only one, *Drimys* J. R. & G. Forst., is found in both hemispheres. The family is a very homogeneous one, the various genera having in common a distinct type of wood structure, leaf vascularization, staminal structure and vascularization, and pollen grain. Prof. I. W. Bailey and the writer (1, 10) have already expressed agreement with the prevalent opinion that the Winteraceae is entirely distinct from the Magnoliaceae, and a study of the family as a whole is in preparation. The scope of the present paper is merely a taxonomic revision of the American species, which belong entirely to the genus *Drimys*. A large part of my discussion is based upon the careful analyses made by Prof. Bailey, who has prepared material in substantial quantities for anatomical study. An attempt to correlate the anatomical characters with the gross morphology and the geographic distribution has been made. I am also indebted to Dr. I. M. Johnston for assistance during the preparation of the manuscript.

Often cited as an illustration of a genus with a bihemispheric-Antarctic distribution, *Drimys* also illustrates the varying degree of differentiation which may be found in two sections of a widespread genus. The representatives in the New and the Old Worlds have a great deal in common, and attempts to break up the complex into two genera — *Drimys* in America and *Tasmannia* in the Old World — are not generally accepted, nor does this division seem merited. However, it is obvious that two good sections, or perhaps subgenera, are recognizable. The American representatives of *Drimys* are hermaphrodite trees or shrubs, with always perfect flowers, and the stigmatic surface of the carpels is limited to the apical or subapical region, the small stigma being usually short-stipitate. The Old World species, on the other hand, are dioecious or polygamo-dioecious (the staminate flowers usually bearing sterile carpels, the pistillate flowers being either with or without functional stamens), and the stigmatic surface is extended along the entire ventral suture of the carpel.

The fact that the above-mentioned characters are so firmly fixed in the western and eastern hemispheres respectively seems to indicate that the original division of the genus into these two populations was ancient. In its Old World area (Australia, New Guinea, Borneo, the Philippines, and perhaps a few adjacent islands), *Drimys* shows great polymorphy and about 36 well marked species are recognizable. This variation extends to great diversity in foliage and floral characters. In America, on the other hand, no such extensive variability is evident, and a smaller degree of specific stability has been evolved. It is obvious that the genetic composition of the genus is much more diverse in the Old World than in the New. To this extent, *Drimys* is an excellent illustration of the degree to which the potential polymorphy of a group may vary in different parts of its area.

Many students have taken *Drimys* to include some very diverse elements in the Old World, but, as already expressed (10), I find it advisable to follow van Tieghem (11) and Hutchinson (7) in segregating the genera *Bubbia, Belliolum, Exospermum, Zygogynum,* and the New Zealand species (referred by van Tieghem to "*Wintera* Forst."). With these elements removed, *Drimys* is sharply distinguished from other members of the Winteraceae by having a calyx which completely encloses the bud, composed of two (or rarely three) sepals which are papyraceous to membranaceous in texture. Occasionally these sepals are calyptrate and soon deciduous, but in most American specimens they are more or less persistent, often remaining attached to one another at their basal margins while losing their connection with the torus; on mature plants the sepals are thus often found as a coherent unit encircling the pedicel but free from it. Many of the Old World species customarily lose the sepals entirely before anthesis. The remaining genera of Winteraceae have a more ordinary calyx, composed of two to several more or less deltoid or irregular lobes which persist through anthesis and which do not enclose the bud, or at least not after the very earliest stages of ontogeny. The stamens of *Drimys* are composed of a carnose essentially terete filament, to the apex of which the two subvertical locules are laterally adnate, quite free from one another and dehiscing laterally or subextrorsely. In other members of the Winteraceae the stamens show various and often conspicuous modifications. The combination of calyx- and stamen-characters here discussed serves to set *Drimys* apart from the rest of the family in such a sharp manner that there can be no serious question of merging other genera with it.

Drimys was founded by J. R. and G. Forster upon two species, *D. Winteri* from the Straits of Magellan and *D. axillaris* from New Zealand. Since these two species are not congeneric, the genotype of *Drimys* must be designated. Van Tieghem (11), who first broke up the older generic concept, took *D. Winteri* to be the genotype, referring *D. axillaris* to "*Wintera* Forst." (not *Wintera* Murr.). In this latter decision he is thwarted by the International Rules, since *Wintera* Murr. was proposed specifically to replace *Drimys* J. R. & G. Forst., and "*Wintera* Forst." is merely an incorrect use of Murray's generic name. The typification of *Drimys* has been discussed by Dandy (in Jour. Bot. **71**: 119–122. 1933), who has proposed the generic name *Pseudowintera* for *D. axillaris* and its allies in New Zealand.

There has been a vast difference of opinion among taxonomists as to the nomenclatural subdivision of the American population of *Drimys,* which ranges from Cape Horn to southern Mexico, with representatives in Juan Fernandez and in eastern Brazil, adjacent Paraguay and Argentine, and on Mt. Roraima. No specimens have yet been reported from Bolivia or Ecuador, but the discovery of the genus in these countries seems possible, in view of the fact that a specimen from the Andes of northern Peru has recently been collected. I have seen no specimens from Honduras, El Salvador, or Nicaragua, but this may be due to our poor material from these regions. In general, the genus may be said to occur in mountains throughout the western hemisphere south of Mexico; toward the south it occurs at or near sea-level. In certain regions it is very common; such areas are the Magellanic region, central Chile, Minas Geraes, Colombia, and Costa Rica. Elsewhere in its range the genus occurs sporadically, but future collections will show whether the above-mentioned centers are actual or whether they merely represent the best-known parts of the generic range.

Among the early students who considered the genus, some, such as De Candolle (2, 3), were inclined to recognize several species with distinct geographic areas; the number of specimens available to such workers was very limited and naturally they had an incomplete idea of the amount of variability within any given portion of the population. Then followed a period in which it was customary to refer all American members of the genus to *D. Winteri,* as varieties, forms, or merely unstable variants. This trend, given weight by Hooker (6), persisted until Miers (8, 9) considered the genus as a whole. With his customary narrow specific delimitation, Miers arranged the population into nine distinct species, separating them into four groups on the basis of the position and branching of the inflorescence (one division including the New Zealand *D. axillaris,* which must be removed from the genus). An examination of the material now available shows definitely that no satisfactory specific lines can be based upon the position of the inflorescence. Miers utilized the terminal versus the axillary position of the inflorescence, but it appears that the inflorescence is always terminal at its inception, the umbels (or single flowers) being borne about the growing point of the branchlets. As the plant develops, this growing point protrudes through the cluster of inflorescences, leaving them lateral and often pseudoaxillary. Sometimes the inflorescences thus appear in two or more whorls toward the apices of branchlets, and whether they are terminal or lateral appears to depend merely upon the stage of development. It seems likely that in certain parts of the population (e.g. the Magellanic area, etc.) growth is sharply seasonal, and in these parts the inflorescences are most likely to appear terminal. In other areas (e.g. Colombia, etc.) growth is more or less continuous, and the inflorescences develop with a more loose arrangement rather than all at one time at the apex of the branchlets. Therefore, the apical or lateral position of the flowers can be given little weight in a taxonomic consideration. Whether the flowers are single or aggregated into umbels or fascicles is also susceptible to variation in the same individual and therefore cannot be too rigidly interpreted, although to be sure there are definite trends in this respect in different geographic areas. Thus, practically all the Magellanic specimens have the flowers single, while those in the higher Andes of Chile and Argentine have a strong tendency in this direction. In the rest of the population the flowers are predominantly umbellate, but the single-flowered character is shown here and there throughout.

Miers' treatment has not been accepted by other workers. Eichler (4), taking up the whole American population for his treatment in Flora Brasiliensis, referred it all to *D. Winteri,* recognizing five forms. The most recent regional treatment of importance is that of Hauman (5), who, discussing the Argentine plants, recognized two species, *D. Winteri* and *D. brasiliensis,* the former with two varieties and one form, the latter with two varieties. The various treatments of other workers need not be examined in detail; the current tendency in herbaria is to follow the line of least resistance and refer all the material to *D. Winteri.* From a casual examination of the material in any single herbarium, one would indeed have difficulty in following any other course, as the population appears remarkably homogeneous. And yet, any two specimens are likely to be quite different in such details as number and size of floral parts, but to the casual observer these differences do not seem concomitant with geographic distribution and thus they are commonly disregarded. Differentiation in the various geographic areas, to be sure, is incomplete, and one searches in vain for definite and rigid characters upon which a classification can be based. In the following paragraphs I shall consider the various parts of the plant in turn, pointing out the degree of variability, if any, which occurs in different parts of the population.

HABIT. The American representatives of *Drimys* are shrubs or low trees, most often occurring in cool moist temperate forest. Individuals growing in very exposed situations apparently trend to be gnarled and often to have the leaves closely crowded toward the apices of branchlets. Other individuals are more symmetrical and have the leaves scattered along the branchlets. This character is very likely a reflection of environment and is not dependable. In general, the more southern members, as the Magellanic population, have a more compact habit, with stouter branchlets and petioles; the Colombian specimens, which are comparatively large, also have uniformly thick branchlets. The branchlets throughout are brownish to cinereous, sometimes glaucous when young, subterete or essentially so, and usually longitudinally striate or rugulose.

FOLIAGE. The leaves are alternate and often irregularly crowded, sometimes appearing essentially whorled about the growing points of the branchlets. The length and thickness of the petiole varies substantially in any geographic area or even on an individual. In general, the most southern part of the population has the strongest petioles, but the proportion of length to diameter of this organ is too variable to receive systematic attention.

The leaf-blades are coriaceous in varying degrees, variously shaped but most often oblong or elliptic to obovate, with a stout costa and immersed or faintly prominulous secondary nerves. The degree to which the secondaries are immersed bears a vague correlation to geographic distribution, but this character is quite undependable and cannot be considered anything more than a trend, subject to local fluctuation. The direction of the secondaries has a certain stability in each region. In color, the leaf-blades vary on the upper surface from pale green to dark brown, usually being glaucous beneath when young.

The lower surface of the leaf-blades has a slightly different aspect in the different parts of the population, and an analysis of this character is found to be of use. Although it is an obscure character and furthermore is not rigid and entirely dependable, nevertheless it may serve as a subsidiary criterion. In using this character, the lower surface of the leaf-blades should be examined under a magnification of about 50 diameters. The stomata are always depressed, and the depression is filled with wax-like and very finely granular material. It is due to these stomatic areas that the lower leaf-surfaces, not only in *Drimys* but throughout the family, appear to be "punctate" with white or pale dots when dry. In *Drimys* Sect. *Wintera,* the stomatic areas appear to vary in size from about 0.02 to 0.05 mm. in diameter.

The lower leaf-surface between the stomata may be essentially free of wax-like granular material, or this material may cover the entire surface in a more or less uniform layer. In the latter case the entire surface appears to be whitish or glaucous. It should be noted that the glaucous appearance is frequently lost in herbarium specimens, due to variations in methods of drying. In general, the stomatic areas are more conspicuous in the southern populations (*D. Winteri* and *D. confertifolia*), while in *D. granadensis* and *D. brasiliensis* they are often obscure.

In most specimens of *D. brasiliensis* the lower epidermis is papillate, the papillae being club-shaped or knob-like protuberances arising from epidermal cells and distributed between the stomatic areas. The papillae may be covered with wax-like granules, like the plane surfaces mentioned above.

The above-described characters of the lower leaf-surface are not sufficiently well fixed in each part of the population to be considered more than trends, although the extreme forms are readily recognized. I am indebted to Prof. Bailey for the above analysis.

Inflorescences. I have already remarked on the inconstant nature of the position and type of the inflorescence — whether terminal or lateral, umbellate or single-flowered. These differences may be taxonomically used only with great caution and at best they demonstrate somewhat inconsequential trends rather than fixed characters. The proportionate length of the peduncle and pedicels varies greatly on the same individual. The inflorescences are usually subtended by imbricate papyraceous bracts, which are generally oblong and obtuse, sometimes up to 15 mm. long and 7 mm. broad. When the inflorescences are umbellate, the pedicels are subtended by a whorl of bracteoles similar to the bracts but smaller, not exceeding 10 by 4 mm. Both bracts and bracteoles are very early caducous and are seldom seen on herbarium material; they appear to offer no points of difference in the various populations, although they may be a little more persistent toward the south.

SEPALS. The sepals are usually two, rarely three, and vary in texture from membranaceous to papyraceous; they may be essentially opaque and apparently eglandular or with conspicuous glands. In shape they are usually suborbicular-deltoid, the variations in size being fairly constant in different geographic areas. In general, the specimens from the northern part of the range have thicker and larger sepals than those from the south, but there are many individual exceptions to this generality.

PETALS. The petals are uniformly white and are extremely variable in number, ranging from 4 to 17 and occasionally being as many as 22 or 25 (in forms from Peru and Panama). They are whorled on the torus and from 1- to 3-seriate. Although the number of petals is inconstant within any given geographic population, there are certain broad tendencies which may be noted. For instance, specimens from Chile, Patagonia, and Juan Fernandez have the petals 4–14 in number, while in other parts of the range, according to my observations, the petals are 8–17, and rarely as many as 25. The matter of petal-size is too variable in each geographic region to make any generalization possible, although it may be noted that the largest petals have been found in the Colombian population. In texture, it may be observed that the southernmost specimens have the petals usually pellucid-glandular or apparently eglandular, while specimens from the north and from Brazil have the glands usually opaque and more obvious.

STAMENS. The torus is uniformly subglobose or short-cylindric, the stamens occurring in several (2–4 or rarely 5) whorls, being 15–50 (rarely to 65) in number. There appears to be an incipient tendency toward more numerous stamens in the northern part of the range. The southern specimens have 15–40 stamens, the northern and Brazilian specimens 18–50 (sometimes as many as 65). The filaments are carnose and essentially terete, more or less glandular with immersed and inconspicuous glands. The distal portion of the filament, to which the anther-locules are attached and to which I shall refer as the connective, offers a more or less dependable character in its glandular marking. Specimens from Chile, Patagonia, and Juan Fernandez have the connective eglandular or with very inconspicuous and essentially colorless glands, which are scarcely apparent, even under considerable magnification. The northern and Brazilian specimens, on the other hand, have the connective with numerous immersed glands and toward the apex usually bear a few conspicuous yellowish superficial glands. These are often very obvious under small magnification and only rarely lacking. A specimen from Mt. Roraima has the connective produced into a small apiculum, but otherwise this organ is essentially truncate. The anther-locules are elliptic to oblong, variable in size within rather narrow limits which appear to have only inconsequential geographic significance. The stamens are often noted as yellow by collectors.

CARPELS. The carpels are usually arranged in a single whorl around the blunt apex of the torus, being from 3 to 12 in number (rarely 2–24). The only geographic significance which can be attached to the number of carpels is found in the more common occurrence of high numbers toward the north (up to 24 in a single Panama specimen). However, the great variation in number of carpels which is found in any geographic area indicates that this character is nearly useless for taxonomic purposes. The shape of the carpels is essentially uniform throughout, and their size is similarly quite uniform. The stigma is either lateral toward the ventral apex or subterminal. Sometimes it is sessile, sometimes short-stipitate, sometimes obviously exceeding the body of the carpel and sometimes exceeded by that blunt surface. In general, the southern specimens have the stigma lateral or at least exceeded by the body of the carpel, while the northern and Brazilian specimens have the stigma obviously stipitate, subterminal, and exceeding the body of the carpel. Carpellary characters are not firmly fixed in geographic regions, and the above-mentioned trends are at best only incipient points of differentiation. The ovules are biseriate on the two ventral placentas, varying from 6 to 26 in number. As regards the number of ovules, a distinct geographic differentiation is discernible. The Juan Fernandez specimens have uniformly (16–)18–26 ovules, while in the remainder of the population the ovules are less than 16 (except for one or two Chilean plants which have 18 ovules). In Chile and Patagonia the ovules are 9–16(–18); in the northern mountains and in Brazil the ovules are 6–12.

Fruits are very uniform throughout the range of the genus in America and offer no stable characters for specific identification. Usually only a few carpels per flower develop, but sometimes all reach maturity. The carpels become obovoid or ellipsoid and often slightly falcate berries, 6–15 mm. long and 4–8 mm. broad at maturity. They are dark purple or reddish black, at length becoming deep black, and as a rule they are short-stipitate to obtuse at base and rounded to obtuse at apex. The pericarp becomes soft and subcarnose at maturity and is often conspicuously yellow-glandular. The seeds are usually fewer than the ovules (often reduced to 2 or 3 in number) and are imbedded in a thin evanescent pulp; they are black or castaneous, polished, inequilaterally obovoid and usually strongly falcate, 3–5 mm. long, 1.5–2 mm. broad, acute or subacute at base, rounded at apex, and with a thin and brittle testa. Miers (9: 127) has described in detail the structure of the seed, although his terminology may not be accepted by morphologists. The characters discussed in the above paragraph are so uniform throughout the American species that they are not repeated in the specific descriptions given below.

CONCLUSIONS. From the above notes it is perceived that there are no clear-cut characters in the American population which can be associated with geographic areas. It seems likely that the various geographic populations of *Drimys* in America have slightly different genetic compositions, as indicated by the diverse trends which I have pointed out above. None of these trends has been carried far enough to be recognized as an absolute character, but nevertheless they can be used in classification, provided that they are recognized as merely trends or tendencies and are not taken as definite rigid characters. Single specimens, taken at random from the range of the genus in America, often defy classification, but when numerous specimens from each area are examined one perceives the direction of morphological trends. It might almost be assumed that, given enough time and continuation of the present-day geographic isolation, the various geographic populations of *Drimys* will become narrower in their respective tendencies until even casually selected individuals will be rigidly characterized.

The question which faces the taxonomist is whether species or even subspecific units should be established on characters which, instead of being firmly established, are merely indicated by broad general trends. The conclusion at which I have arrived is somewhat intermediate between the despairing attitude of Hooker and most recent herbarium workers and the optimistic viewpoint of Miers that several good species are discernible. I am able to recognize four major groups which, in my opinion, are sufficiently stable and recognizable to be designated as species. These groups are (1) the Juan Fernandez population, (2) the population from Chile and southern Argentine, (3) the population from Peru to western Venezuela and Mexico, and (4) the Brazilian, Paraguayan, and northern Argentinian population, this latter including specimens from Mt. Roraima. From the lack of definite morphological barriers it may be assumed that these populations would be interfertile, but the fact remains that they are not interfertile in nature simply because of their present-day geographic isolation from one another. The morphological trends in each population, although often trivial and obscure, are nevertheless quite apparent.

Within each of the above-mentioned populations (except the small and compact group from Juan Fernandez) I have been able to recognize several minor groups which I designate as varieties. The morphological tendencies within each of these varieties are not emphatic, but each variety is geographically restricted and shows a certain amount of incipient differentiation.

In citations of literature, I have taken the liberty of correcting the spelling of the generic name, when necessary, to *Drimys* (the original spelling) from *Drymis* or *Drymys*. I have examined most of the illustrations portraying the American representatives of the genus and have referred these to the proper subdivision as treated in the present paper. A few plates are not available to me, while many others are so inadequate that they do not permit positive identification; these latter are not cited. The great bulk of the illustrations has been referred to *Drimys Winteri,* but it is obvious that many do not portray the Magellanic variety upon which this name is based.

Citations of specimens are reasonably complete for the larger American herbaria, but of course additional collections of most entities will be found in European institutions. I am greatly indebted to the directors and curators of the following institutions for the loan of material: Arnold Arboretum (A); Field Museum of Natural History (F); Gray Herbarium (GH); Missouri Botanical Garden (M); New York Botanical Garden (NY); University of California (UC); U. S. National Herbarium (US). The parenthetical letters indicate the place of deposit of the cited specimens.

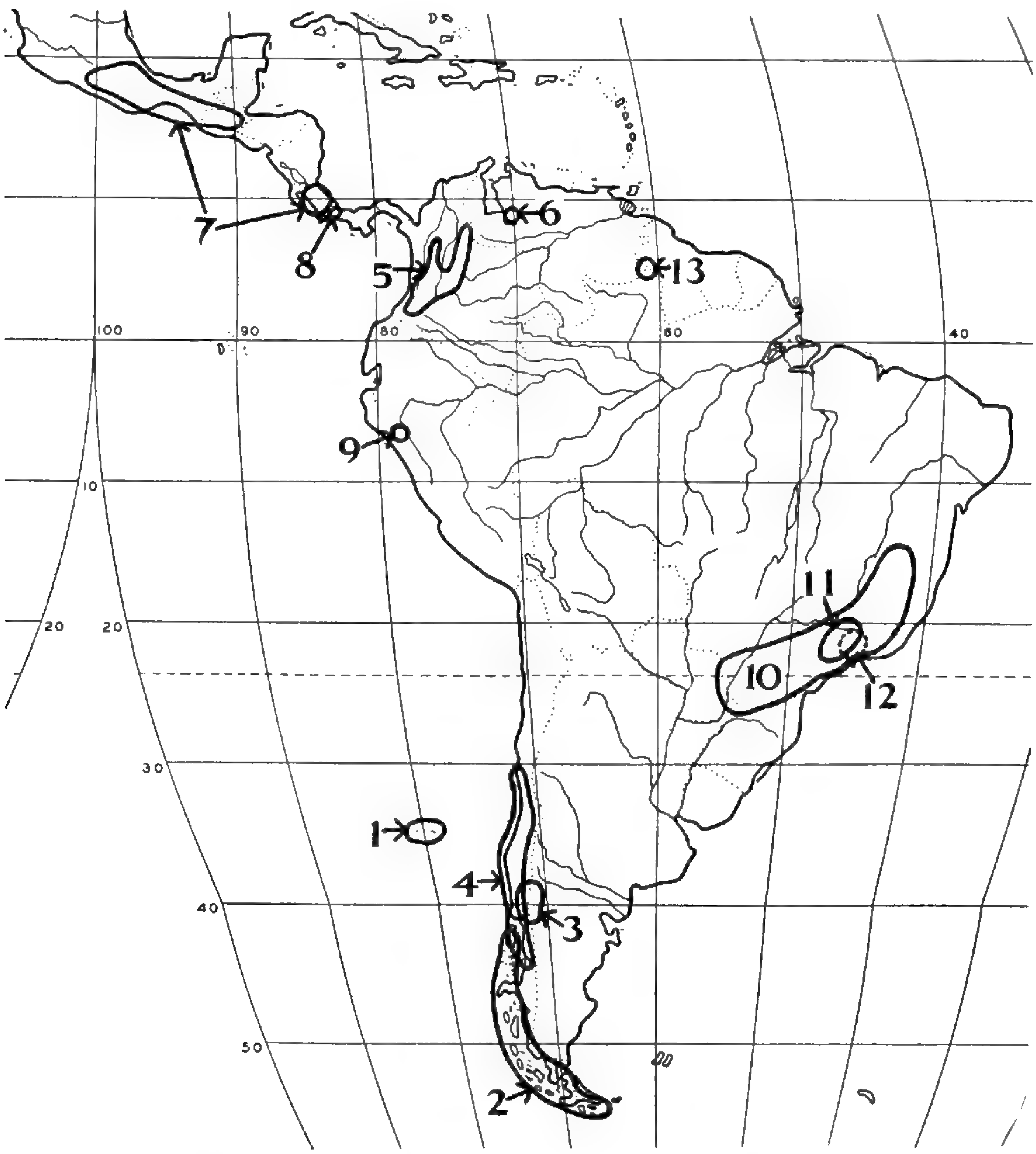

FIG. 1. Approximate known distribution of *Drimys* in America; 1. *D. confertifolia;* 2. *D. Winteri* var. *punctata;* 3. *D. Winteri* var. *andina;* 4. *D. Winteri* var. *chilensis;* 5. *D. granadensis* var. *grandiflora;* 6. *D. granadensis* var. *uniflora;* 7. *D. granadensis* var. *mexicana;* 8. *D. granadensis* var. *chiriquiensis;* 9. *D. granadensis* var. *peruviana;* 10. *D. brasiliensis* var. *campestris;* 11. *D. brasiliensis* var. *retorta;* 12. *D. brasiliensis* var. *angustifolia;* 13. *D. brasiliensis* var. *roraimensis.* From Goode's series of base maps, no. 201HCW.

TAXONOMIC TREATMENT

Drimys J. R. & G. Forst. Char. Gen. 83. 1776; Forst. f. in Nova Acta Reg. Soc. Sci. Ups. **3**: 181. 1780; Lam. Encycl. **2**: 330. 1786; Juss. Gen. Pl. 280. 1789; DC. Reg. Veg. Syst. Nat. **1**: 442. 1817, Prodr. **1**: 78. 1824; St. Hil. Fl. Bras. Merid. **1**: 24. 1825; Lindl. Nat. Syst. Bot. ed. 2. 17. 1836; Meisn. Pl. Vasc. Gen. 3 (pars alt. 5) 1836; Spach, Hist. Nat. Veg. **7**: 436. 1839; Endl. Gen. Pl. 839. 1839, Enchir. Bot. 428. 1841; Gay, Fl. Chil. **1**: 60. 1845; Lindl. Veg. Kingd. ed. 2. 419. 1847; Miers in Ann. Mag. Nat. Hist. III. **2**: 37. 1858, Contrib. Bot. **1**: 126. 1861; Benth. & Hook. f. Gen. Pl. **1**: 17. 1862; Eichl. in Mart. Fl. Bras. **13**(1): 133. 1864; Baill. Hist. Pl. **1**: 156, 190. 1867–69; Prantl in E. & P. Nat. Pfl. III. **2**: 19. 1891; Parment. in Bull. Sci. Fr. & Belg. **27**: 222 seq., pro parte. 1896; v. Tiegh. in Jour. de Bot. **14**: 280–290. 1900; Pilger in E. & P. Nat. Pfl. Nachtr. **2**: 108. 1906; Hutchinson in Kew Bull. **1921**: 190. 1921; Hauman in Comun. Mus. Nac. Buenos Aires **2**: 45. 1923.

Wintera Murr. Syst. Veg. ed. 14. 507. 1784; Pers. Syn. Pl. **2**: 84. 1806; Humb. & Bonpl. Pl. Aequin. **1**: 205. 1808; Lindl. Introd. Nat. Syst. Bot. 26. 1830.

In the above citations I have listed the most important references to the genus as a whole, omitting those in which only the Old World species are considered. The genus is readily divided into two sections as follows:

Plants hermaphrodite, the flowers always perfect; carpels with the stigmatic surface limited to the apical or subapical region, the stigma small, subpeltate, often short-stipitate; flowers solitary or fasciculate or arranged in umbels; American species...
.... Section *Wintera*.

Plants dioecious or polygamo-dioecious, the staminate flowers usually bearing sterile carpels, the pistillate flowers either with or without functional stamens; carpels with the stigmatic surface extended along the ventral suture, the stigma not stipitate; flowers solitary or fasciculate, never in umbels; Old World species..........
.... Section *Tasmannia*.

The present treatment is concerned in detail only with the Section *Wintera*. A sectional name for the Old World representatives was apparently first proposed by F. v. Mueller (Pl. Indig. Col. Vict. **1**: 20. 1860) as *Drimys* Sect. *Tasmannia*, based on *Tasmannia* R. Br. ex DC. Reg. Veg. Syst. Nat. **1**: 445. 1817. The more detailed synonymy of the Section *Wintera* follows:

Drimys Sect. **Wintera** (Murr.) DC. Reg. Veg. Syst. Nat. **1**: 443. 1817, Prodr. **1**: 78. 1824.

Magellania Commers. ex Lam. Encycl. **2**: 330, as synonym. 1786.

Magallana Commers. ex DC. Reg. Veg. Syst. Nat. **1**: 443, as synonym. 1817; Endl. Enchir. Bot. 428, as synonym. 1841; non Cav.

Winterana Sol. ex Endl. Enchir. Bot. 428, as synonym. 1841; non L.

Canella Domb. ex Endl. Enchir. Bot. 428, as synonym. 1841; non P. Br.

Boique Molin. ex Endl. Enchir. Bot. 428, as synonym. 1841.

Drimys Sect. *Eudrimys* v. Tiegh. in Jour. de Bot. **14**: 288. 1900; Pilger in E. & P. Nat. Pfl. Nachtr. **2**: 108. 1906; non DC.

Drimys Sect. *Polyacra* v. Tiegh. in Jour. de Bot. **14**: 289. 1900; Pilger in E. & P. Nat. Pfl. Nachtr. **2**: 108. 1906.

Drimys Sect. *Monopleura* v. Tiegh. in Jour. de Bot. **14**: 289. 1900; Pilger in E. & P. Nat. Pfl. Nachtr. **2**: 108. 1906.

Drimys Sect. *Polypleura* v. Tiegh. in Jour. de Bot. **14**: 289. 1900; Pilger in E. & P. Nat. Pfl. Nachtr. **2**: 108. 1906.

The first attempt to divide the genus *Drimys* into groups was made in 1817 by De Candolle, who erected the Section *Drimys* on *D. axillaris* and the Section *Wintera* on *D. Winteri* and three other American species. In

1824 De Candolle maintained the same classification, except that he used the sectional name *Eudrimys* for *D. axillaris.* The fact that De Candolle selected the New Zealand species of the Forsters as the basis of his Section *Drimys* (or *Eudrimys*) does not affect the typification of the genus.

No further serious attempt to break up the genus into sections was made until 1900, when van Tieghem proposed four sections, which seem to be based on neither essential morphological characters nor geography. His Section *Eudrimys* is based upon *D. Winteri, D. angustifolia,* and six Old World species, but, since it excludes *D. axillaris,* it is not the same entity as De Candolle's Section *Eudrimys.*

Van Tieghem was the first student to realize that *D. Winteri* and *D. axillaris* are not congeneric, and he definitely retained the generic name for the first of these entities. *Drimys axillaris* and two other New Zealand species were referred by Dandy to his newly proposed *Pseudowintera* in 1933.

KEY TO THE AMERICAN SPECIES

Sepals membranaceous or submembranaceous; petals 4–14, eglandular or sparsely pellucid-glandular; stamens 15–40, the connectives eglandular or rarely with a few very inconspicuous colorless apical glands; stigma usually lateral near apex of carpel, subsessile or short-stipitate, exceeded or equalled by the body of the carpel; ovules 9–26; lower leaf-surface appearing white- or gray-punctate, due to the usually distinct and conspicuous stomatic areas.

Ovules (16–)18–26 on elongate placentas; inflorescence always umbellate; leaf-blades narrowly oblong or elliptic or obovate-lanceolate, usually 5–12 by 1.3–3.5 cm.; Juan Fernandez..1. *D. confertifolia.*

Ovules 9–18 on short or slightly elongate placentas; inflorescence umbellate or fasciculate or the flowers single; leaf-blades various; Chile and adjacent southern Argentine...2. *D. Winteri.*

Sepals often papyraceous, sometimes membranaceous; petals 8–17(–25), usually yellow-glandular with opaque glands; stamens 18–50(–65), with glandular connectives, these usually with a few obvious apical yellow glands; stigma usually subterminal, sometimes lateral near apex of carpel, short-stipitate (except in *D. brasiliensis* var. *roraimensis*) and usually exceeding the body of the carpel; ovules 6–12; lower leaf-surface usually not obviously punctate, the stomatic areas not conspicuously paler than the rest of the leaf-surface.

Leaf-blades elliptic-oblong or narrowly so, 5–16(–17.5) by 1–5.5 cm., usually obtuse at apex, the secondary nerves 8–19 per side, prominulous to immersed on both surfaces; lower leaf-surface not papillate; peduncle 7–65(–90) mm. long; sepals 4.5–10(–12) by 5–11(–13) mm.; southern Mexico to western Venezuela and Peru...3. *D. granadensis.*

Leaf-blades variously shaped, often elliptic-obovate, sometimes nearly lanceolate, rarely exceeding 11 by 4 cm., rounded or broadly obtuse or emarginate at apex, the secondary nerves 6–10(–14) per side, often obscure; lower leaf-surface often papillate; peduncle less than 40 mm. long; sepals 4–7 by 4–8 mm.; southeastern Brazil, adjacent Paraguay and Argentine, and Mt. Roraima region...4. *D. brasiliensis.*

1. **Drimys confertifolia** Phil. in Anal. Univ. Chile [**13**]: 163. May 1856, in Bot. Zeit. **14**: 641. Sept. 1856, in Ann. Sci. Nat. IV. **7**: 100. 1857.

Drimys fernandeziana Steud. in Flora **39**: 408. July 1856.

Drimys Fernandezianus Miers in Ann. Mag. Nat. Hist. III. **2**: 48. 1858, Contrib. Bot. **1**: 137. *pl. 27B.* 1861; Pilger in E. & P. Nat. Pfl. Nachtr. **2**: 108, as *D. fernandeziana.* 1906.

Drimys Winteri var. *fernandeziana* Steud. ex Reiche, Fl. Chil. **1**: 27. 1896.

Drimys Winteri var. *confertifolia* Johow, Estud. Fl. Juan Fernandez 113, 245. 1896; Skottsb. Nat. Hist. Juan Fern. and Easter Isl. **2**: (Phanerog. Juan Fern. Isl.) 127. 1921.

Tree, often large, up to 15 m. high, the trunk probably often 50 cm. in diameter, the branchlets brownish, rugulose, subterete, 2–4 mm. in diameter toward apices; leaves crowded toward apices of branchlets; petioles rugulose, shallowly canaliculate, 3–14 mm. long, 1–2 mm. in diameter, often narrowly winged, slightly swollen at base; leaf-blades coriaceous, dark brown or olivaceous above when dried, slightly paler to glaucous beneath and appearing distinctly punctate, narrowly oblong or elliptic or obovate-lanceolate, (3–)5–12 cm. long, (0.8–)1.3–3.5 cm. broad, attenuate at base and decurrent on the petiole, obtuse or rounded at apex, slightly recurved at margin, conspicuously so toward base, the costa shallowly canaliculate above, prominent beneath, the secondary nerves 6–10 per side, ascending at an angle of 40–55°, prominulous or rarely immersed on both surfaces, usually anastomosing toward margin, the veinlets immersed or inconspicuously prominulous beneath; inflorescences clustered at apices of branchlets, umbellate, the peduncle 7–40 mm. long, the flowers 3–6 per inflorescence, the pedicels 6–45 mm. long; sepals membranaceous, pellucid-glandular, suborbicular-ovate, 6–8 mm. long and broad, inconspicuously apiculate at apex; petals 7 or 8 (rarely to 12), membranaceous, sparsely and obscurely pellucid-glandular, oblong, 8–14 mm. long, 2.5–5 mm. broad, obtuse at apex; stamens 30–40, 3- or 4-seriate, the filaments eglandular, 1.5–3 mm. long, the connective eglandular or essentially so, the locules 0.8–1.2 mm. long; carpels 3–6, obovoid, about 3 mm. long at anthesis, the stigma lateral near apex, short-stipitate, not exceeding the body of the carpel, the ovules 18–26 (rarely 16) on elongate placentas. (FIG. 2, a–f.)

DISTRIBUTION: Juan Fernandez; the plant is said by Skottsberg to be one of the commonest forest trees on Masatierra, ranging from 200 m. upward to the highest ridges, while on Masafuera it is not seen much lower than 500 m. and occurs up to about 1200 m. In addition to the collections cited below, the species is represented by material obtained by Philippi (the type collection), Germain, and Johow; Miers cites *Cuming 1328*, and Skottsberg lists several of his numbers which are not available to me.

JUAN FERNANDEZ: Masatierra: *Bertero 1453* (type coll. of *D. fernandeziana* Steud.; also cotype coll. of *D. Fernandezianus* Miers, M, NY), *Moseley* (F, GH), *Reed* (GH); Cumberland Bay, *Hastings 255* (NY, UC, US); Salsipuedes, *Skottsberg 88* (US), *88b* (NY); Portezuelo, *Skottsberg 6* (NY); slopes of Yunque, *Bock 49* (F, GH, M, NY, US); Masafuera: *Chapin 1074* (NY).

NATIVE NAME: *Canelo.*

This species was independently proposed by Philippi, Steudel, and Miers within a period of two years; furthermore, Steudel and Miers used the same specific epithet and based their concepts upon the same collection.

Drimys confertifolia is a biological entity with considerable stability of number and form of parts. Of all the groups in *Drimys* in America, this most obviously merits specific rank and can be submerged in a continental species only if all the American representatives are combined. Its closest relative is *D. Winteri* (and especially var. *chilensis*), with which it has in common eglandular stamens, a lateral stigma not exceeding the body of the carpel, obscurely glandular petals, and a lower leaf-surface with conspicuous stomatic areas. *Drimys confertifolia* is further characterized by its crowded narrow leaves, always umbellate flowers, an essentially fixed number of petals (usually 7 or 8), few carpels, and numerous ovules. The last is the most definite character and, in spite of its trivial nature, seems dependable enough to be the principal basis of the species.

2. **Drimys Winteri** J. R. & G. Forst. Char. Gen. 84. 1776.

Shrub or small tree, the branchlets brownish or dark cinereous, rugulose or sometimes smooth, subterete, 3–6 mm. in diameter toward apices; petioles rugulose, canaliculate, 3–27 mm. long, 1–4 mm. in diameter, slightly swollen toward base; leaf-blades coriaceous or thick-coriaceous,

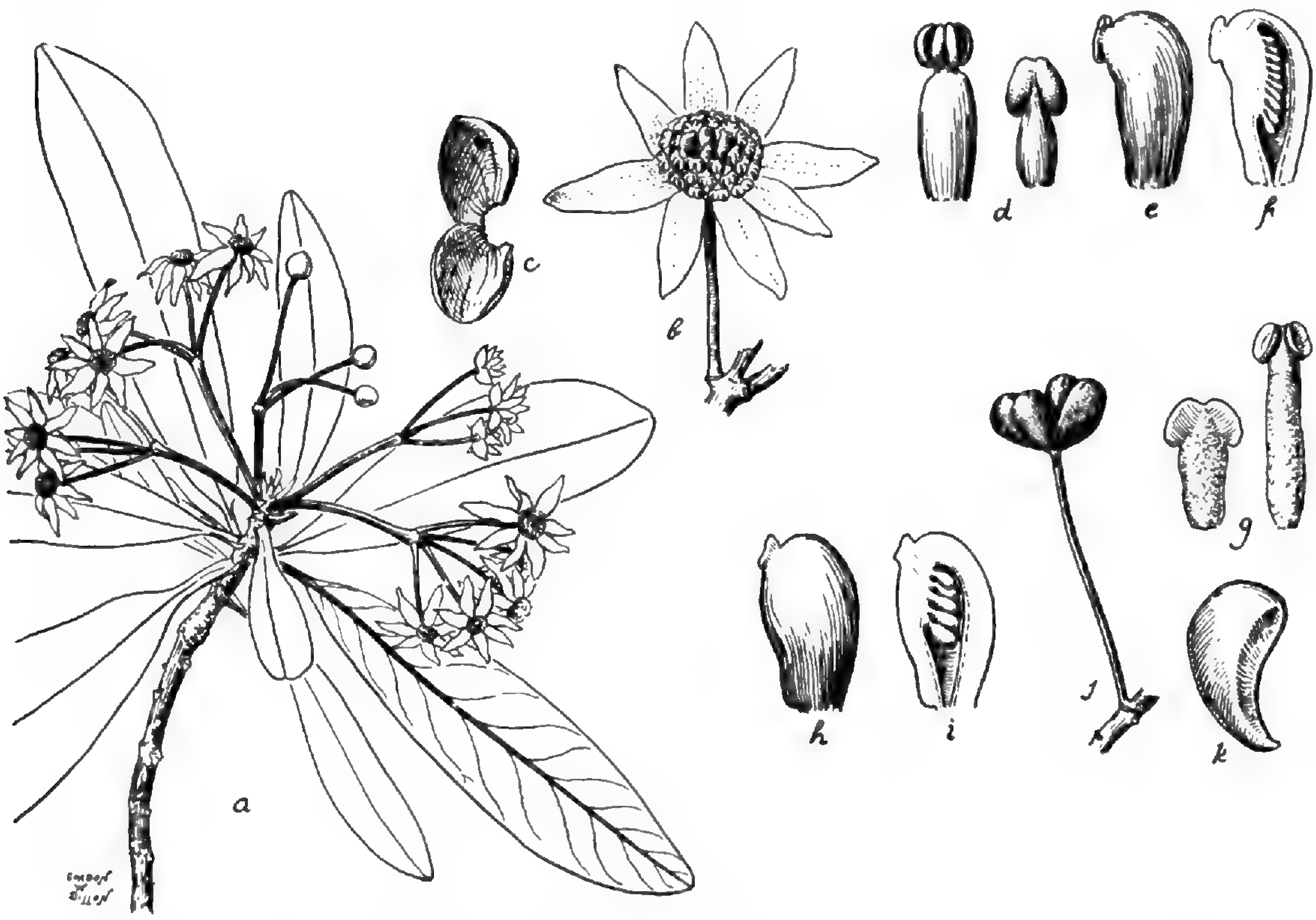

FIG. 2. *a–f. Drimys confertifolia,* drawn from *Bock 49*: *a.* flowering branchlet, × ½; *b.* flower, × 1½; *c.* detached calyx, × 1½; *d.* stamens, extrorse and introrse views, × 5; *e.* carpel, × 5; *f.* carpel, longitudinal section, × 5. *g–k. Drimys Winteri* var. *andina,* drawn from *Werdermann 1245*: *g.* stamens, introrse and extrorse views, × 5; *h.* carpel, × 5; *i.* carpel, longitudinal section, × 5; *j.* fruit, showing four mature carpels, × ½; *k.* seed, × 3.

pale green to dark brown above when dried, glaucous or at least paler beneath and usually appearing distinctly punctate, usually obovate-oblong to elliptic, (4–)6–15(–18) cm. long, (1.3–)1.8–6.5(–7) cm. broad, attenuate to obtuse at base and decurrent on the petiole, obtuse or rounded and sometimes faintly emarginate at apex, slightly recurved at margin, the costa nearly plane or shallowly canaliculate above, prominent beneath, the secondary nerves 5–15 per side, ascending or erecto-patent, prominulous or immersed, obscurely anastomosing toward margin; inflorescences usually clustered at or near apices of branchlets, umbellate or the flowers single or fasciculate, the peduncles (if present) up to 50 mm. long, the pedicels 10–70 mm. long; sepals membranaceous or submembranaceous, usually obscurely pellucid-glandular, sometimes copiously so, broadly ovate to suborbicular or reniform, 4–7 mm. long, 4–12 mm. broad, apiculate to rounded at apex; petals 4–14, membranaceous, sparsely pellucid-glandular, oblong to narrowly obovate, 6–20 mm. long, 2–6(–7) mm. broad, obtuse at apex; stamens 15–40, 2–4-seriate, the filaments carnose, eglandular or nearly so, 0.8–3 mm. long, the connective eglandular or rarely with a few very inconspicuous colorless apical glands, the locules 0.5–1 mm. long; carpels (2–)3–10, obovoid or ellipsoid, 2–3.5 mm. long at anthesis, the stigma lateral near apex or rarely subterminal, peltate, subsessile or short-stipitate, exceeded or equalled by the body of the carpel, the ovules 9–18 on short or slightly elongate placentas.

DISTRIBUTION: Central Chile (Coquimbo) southward to Cape Horn and in adjacent Argentine from Neuquén southward. The type was collected by the Forsters on Cook's second voyage, but previous to that time the Magellanic plant had been known from other collections and had been freely mentioned in literature. The old common name of "Winter's bark" is derived from the observations of William Winter, who obtained some specimens from the Straits of Magellan on Drake's voyage in 1578; these specimens were the basis of Dalechamps' and Clusius' discussions cited below. The bark has tonic and antiscorbutic properties and was widely used medicinally in Europe.

I have not been able to limit the species *D. Winteri* to the southern form upon which it was originally based, but on the other hand I prefer not to extend the specific concept to include all the American representatives of the genus. As mentioned in the preliminary portion of this treatment, the specimens of *Drimys* from Chile and adjacent southern Argentine seem sufficiently distinct from the remainder of the population to merit specific recognition as *D. Winteri*. Within this complex, at least three groups are discernible which appear to merit varietal recognition. Although these three groups have different aspects which make them recognizable, these aspects are difficult to analyze and do not have a basis in definite clear-cut characters.

ESSENTIAL DIAGNOSTIC CHARACTERS OF THE VARIETIES

Tree, often compact, sometimes up to 17 m. high; leaves crowded on distal portions of branchlets; branchlets stout, 4–6 mm. in diameter toward apices; petioles stout, 1.5–4 mm. in diameter, 3–15 mm. long; leaf-blades coriaceous or thick-coriaceous, dark brown above when dried, usually pale to dark brown beneath, usually definitely obovate and obviously revolute at margin toward base, the secondary nerves 7–11 per side, ascending at an angle of 35–45°, immersed or sometimes prominulous on both surfaces; flowers single, very rarely umbellate; petals 5–7, 8–15 by 3.5–6(–7) mm.; ovules 10–18; southern Chile (south of lat. 42°) and adjacent Argentine.. 2a. var. *punctata*.

Shrub or small tree, less than 5 m. high, the branches often contorted; leaves evenly distributed along branchlets; branchlets 3–5 mm. in diameter toward apices; petioles 1–2 mm. in diameter, 5–18 mm. long; leaf-blades coriaceous, pale green to olivaceous or pale brown above when dried, conspicuously pale and glaucous beneath, often tending to be elliptic, not conspicuously recurved at margin toward base, the secondary nerves 5–7 per side, ascending at an angle of 35–45°, immersed or faintly prominulous on both surfaces; flowers single, rarely umbellate; petals 4–9, 8–18 by 2.5–5 mm.; ovules 10–12; southern Chile and adjacent Argentine (lat. about 38° to 41°) at high elevations (760–2300 m.).......... 2b. var. *andina*.

Shrub or tree 3–15 m. high; leaves evenly distributed along branchlets; branchlets 3–5 mm. in diameter toward apices; petioles 1–3 mm. in diameter, 5–27 mm. long; leaf-blades coriaceous, pale or dark green above when dried, glaucous or at least paler beneath, often essentially oblong, usually conspicuously revolute at margin toward base, the secondary nerves (5–)7–15 per side, erecto-patent or ascending at an angle of 40–60°, usually prominulous and obvious on both surfaces; inflorescences umbellate, the flowers very rarely single; petals 6–14, 6–20 by 2–5 mm.; ovules 9–16; central Chile (lat. about 30°30′ to 44°40′) at comparatively low altitudes. . . . . .2c. var. *chilensis*.

2a. **Drimys Winteri** var. **punctata** (Lam.) DC. Reg. Veg. Syst. Nat. **1:** 443. 1817, Prodr. **1:** 78. 1824; Hauman in Comun. Mus. Nac. Buenos Aires **2:** 48. 1923; Hauman & Irigoyen in An. Mus. Nac. Buenos Aires **32:** 228. 1923.

Winteranus cortex Dalechamps, Hist. Gen. Pl. 1858. 1586; Clus. Exot. 75. 1605; Parkinson, Theatr. Bot. 1652. 1640.

Laurifolia Magellanica cortice acri Bauhin, Pinax Theatr. Bot. 461. 1623.

Arbor laurifoliae Magellanicae . . . Jonston, Dendr. Hist. Nat. 232. 1662.

Periclymenum rectum foliis laurinis . . . Sloan in Phil. Trans. Roy. Soc. London **17**(204): 923. *pl. 1.* 1693.

Boigue Cinnamomifera oliva fructu Feuillée, Hist. Pl. Méd. 10. *pl. 6.* 1725.

Cortex Winteranus Gars. Fig. Pl. Anim. Med. **1:** 27. *pl. 35B.* 1764.

Drimys Winteri J. R. & G. Forst. Char. Gen. 84. *f. 42, m–z.* 1776; Forst. f. in Nova Acta Reg. Soc. Sci. Ups. **3:** 181. 1780; L. f. Suppl. 269. 1781; Lam. Encycl. **2:** 331. 1786; DC. Reg. Veg. Syst. Nat. **1:** 443. 1817, Prodr. **1:** 78. 1824; Hayne, Getreue Darst. Arzn. Gewächse, 9. *pl. 6.* 1825; Nees, Pl. Offic. **2:** *pl. 372* (in text). 1828; Spach, Hist. Nat. Veg. **7:** 438. 1839; Endl. Enchir. Bot. 430. 1841; Hook. f. Fl. Antarct. **2:** 229. 1845; Gay, Fl. Chil. **1:** 63. 1845; Carson, Ill. Med. Bot. **1:** *pl. 5.* 1847; Dec. Bot. Voy. Pole Sud **2:** 64. *pl. 19* (in Atlas). 1853; A. Gray, Bot. U. S. Expl. Exped. **1:** 24. 1854; Good, Family Flora **2:** *pl. 89.* 1854; Steud. in Flora **39:** 408. 1856; Miers in Ann. Mag. Nat. Hist. III. **2:** 45. 1858, Contrib. Bot. **1:** 135. *pl. 25A.* 1861; Eichl. in Mart. Fl. Bras. **13**(1): 133. 1864; Baill. Hist. Pl. **1:** 157. *f. 200–202.* 1867–69, Traité Bot. Méd. Phan. 503. *f. 1192–1194.* 1884, Dict. Bot. **2:** 474, 475. 1886; Franch. in Bot. Miss. Sci. Cap Horn, 322. 1889; Dujard.-Beaumetz & Egasse, Pl. Méd. 249. *f. 312–315.* 1889; Prantl in E. & P. Nat. Pfl. III. **2:** 19. 1891; Reiche, Fl. Chil. **1:** 26. 1896; Speg. in An. Mus. Nac. Buenos Aires **5:** 46. 1896; De Wildem. Bot. Phan. Terres Magel. 18, 102. 1905; Macloskie in Rep. Princeton Univ. Exped. Patagonia **8:** 419. *f. 71* (excl. fr.). 1905; Pilger in E. & P. Nat. Pfl. Nachtr. **2:** 108. 1906; Karsten & Schenck, Veg.-Bild. **4:** *pl. 14.* 1907; Skottsb. in Kungl. Sv. Vetens. Handl. **56**(5): 226. 1916; Hauman in Bull. Soc. Bot. Belg. **58:** *pl. 11.* 1926.

Winterana aromatica Soland. ex Fothergill in Medical Obs. and Inq. **5:** 46. *f. 1.* 1776; non *Drimys aromatica* F. v. Muell. (1860).

Wintera aromatica Murr. Syst. Veg. ed. 14. 507. 1784, Apparat. Medic. **4:** 557. 1787; Forst. f. in Comment. Soc. Reg. Sci. Goett. **9:** 34. *pl. 7.* 1787; Willd. Sp. Pl. **2:** 1239. 1800; Pers. Syn. Pl. **2:** 84. 1806; Humb. & Bonpl. Pl. Aequin. **1:** 209. 1808; Nees, Pl. Offic. **2:** *pl. 372.* 1828.

Drimys punctata Lam. Encycl. **2:** 330. 1786, Ill. **2:** *pl. 494.* 1797.

Drimys aromatique Descourt. Fl. Pitt. & Med. Ant. **1:** 188. *pl. 40.* 1821.

Drimys Winteri f. *magellanica* Eichl. in Mart. Fl. Bras. **13**(1): 134. *pl. 30, f. 2.* 1864; Macloskie in Rep. Princeton Univ. Exped. Patagonia **8:** 420. 1905.

Drimys aromatica Descourt. ex Baill. Hist. Pl. **1:** 157. 1867–69.

Drimys polymorpha Spach ex Baill. Hist. Pl. **1:** 157. 1867–69.

Drimys Winteri var. *Morenonis* Kuntze, Rev. Gen. **3**(2): 2. 1898; Macloskie in Rep. Princeton Univ. Exped. Patagonia **8:** 420. 1905.

Drimys Winterana Thell. in Bull. Herb. Boiss. II. **8:** 781. 1908.

Tree, often compact, sometimes up to 17 m. high, the branchlets stout, 4–6 mm. in diameter near apices; leaves crowded on distal portions of branchlets; petioles 3–15 mm. long, stout, 1.5–4 mm. in diameter; leaf-blades coriaceous or thick-coriaceous, dark brown above when dried, glaucous to pale or dark brown beneath, obovate or obovate-oblong, (4–)6–13(–14) cm. long, (1.5–)2–5.5(–7) cm. broad, subattenuate to obtuse at base, usually obviously and narrowly revolute at margin toward base, the secondary nerves 7–11 per side, ascending at an angle of 35–45°, immersed or faintly impressed or faintly prominulous above, immersed or prominulous beneath, the veinlets immersed; flowers single, clustered near apices of branchlets, the inflorescences rarely umbellate and then with 2 or 3 flowers on peduncles less than 10 mm. long, the pedicels 10–37 mm. long; sepals 5–7 mm. long, 5–12 mm. broad; petals 5–7, 8–15 mm. long, 3.5–6(–7) mm. broad; stamens 20–35, the filaments 0.8–3 mm. long; carpels 3–9, the ovules 10–18.

DISTRIBUTION: Southern Chile from lat. about 42° (Chiloé) southward to Cape Horn, and in the adjacent Argentine section of Tierra del Fuego. The specimens cited below represent only a fraction of those recorded, as the plant has been obtained by essentially all collectors in the region (see above-cited references by Hauman, Spegazzini, De Wildeman, Skottsberg, etc.). It is apparently abundant at sea-level in the Magellan region, and according to some writers it also ascends the hills to at least several hundred meters. The following citations are arranged, in general, from northwest to southeast.

CHILE: Chiloé: Chiloé I., Huite, *Cunningham* (NY); Aysen: Wellington I., Eden Harbor, *Ball* (NY, US); Magellanes: Cerro Paine, *Donat 398* (F, GH, NY); Straits of Magellan, without detailed locality, *Moreno* (NY, type of *D. Winteri* var. *Morenonis*), *Lenormand* (M), *Andersson* (NY, US), *Douglass* (GH); Penins. Muñoz Gamero, Puerto Tamar, *Safford 358* (US); Penins. Córdova, Borja Bay, *Lee* (US); Brunswick Penins., Fortescue Bay, *Safford* (NY, US); Port Gallant, *Blake* (GH); Punta Arenas, *Blake* (GH); Port Famine, *Lee* (US); Hoste I., Hardy Penins., Orange Bay, *U. S. Expl. Exped.* (GH, M, NY, US), *Hyades* (NY), *Collector?* (F); Hermite I., *Hooker* (F, GH).

ARGENTINE: Tierra del Fuego: La Maire Straits, *Banks & Solander* (co-type coll. of *Winterana aromatica*, GH, US).

NATIVE NAMES: *Canelo, ouchkouta* (wood), *liouch* (leaves), *usskútta, ciûla, shâahlku, shâlakuâhr*. The second and third names were apparently first recorded by Franchet, the last four by Spegazzini.

The first variety founded upon the Magellanic form of *D. Winteri* was var. *punctata,* based upon *D. punctata* Lam. This binomial was based upon a specimen collected by Commerson in the Magellan region, sent to Lamarck by Jussieu. Lamarck's description and plate leave no doubt that this species is identical with the Forsters'. Thus, while the type of the variety is Commerson's plant and the type of the species is the Forsters', there can be no doubt that the same entity is involved and that var. *punctata* is to be construed as the typical variety of the species.

Garsault's name cited above is not intended as a binomial in the Linnaean sense, "cortex" not being proposed as a genus. The entire work of Garsault may be excluded from nomenclatural consideration, since the Linnaean system of binary nomenclature for species was not consistently employed (Int. Rules Bot. Nomenclature Art. 68 [4]. 1935). Therefore Thellung's combination *Drimys Winterana,* based on Garsault's "binomial," is not acceptable to supplant the binomial *D. Winteri.*

A great deal of confusion has been caused by Murray's substitution of the binomial *Wintera aromatica* for *Drimys Winteri.* Not liking the generic name *Drimys,* Murray simply substituted *Wintera,* which thus can have no other connotation than as a direct synonym of *Drimys* J. R. & G. Forst. Murray's specific epithet is derived from *Winterana aromatica* Soland., published in the same year as *Drimys Winteri* Forst. Which of these two specific epithets has strict priority is not known to me, but at any rate the use of *Drimys aromatica* for the Magellanic plant (as proposed by Baillon in 1867–69) is excluded by the earlier *Drimys aromatica* F. v. Muell. (1860) for an Australian species.

The typical variety of *D. Winteri* is characterized by its stout branchlets, its crowded and coriaceous leaves, of which the petioles are thick and the blades dark brown and usually obovate, with ascending secondaries, and its usually single flowers with comparatively few petals. These few characters impart to the plants an impression quite distinct from that given by the other two varieties described below.

2b. **Drimys Winteri** var. **andina** Reiche in Anal. Univ. Chile **100:** 535. Apr. 1898, Fl. Chil. **2:** 371. 1898.

Drimys Winteri var. *quinoensis* Kuntze, Rev. Gen. **3**(2): 2. Sept. 1898.

Drimys Winteri var. *chilensis* f. *andina* Hauman in Comun. Mus. Nac. Buenos Aires **2:** 50. 1923; Hauman & Irigoyen in An. Mus. Nac. Buenos Aires **32:** 228. 1923.

Shrub or small tree up to 5 m. high, often less than 1 m. high, the branches often contorted, the branchlets 3–5 mm. in diameter near apices; leaves evenly distributed along branchlets; petioles 5–18 mm. long, 1–2 mm. in diameter; leaf-blades coriaceous, pale green to olivaceous or pale brown above when dried, conspicuously pale and glaucous beneath, obovate-oblong or -lanceolate or elliptic, (4–)6–11.5 cm. long, (1.3–)1.8–4.5 cm. broad, acute to attenuate at base, not conspicuously recurved at margin toward base, the secondary nerves 5–7 per side, ascending at an angle of 35–45°, faintly prominulous or immersed on both surfaces, the veinlets immersed; flowers single, rarely 2–4 in umbels (on peduncles up to 25 mm. long), clustered near apices of branchlets, the pedicels 10–70 mm. long; sepals 5–6 mm. long, 5–7 mm. broad; petals 4–9, 8–18 mm. long, 2.5–5 mm. broad; stamens 15–40, the filaments 1–2.5 mm. long; carpels (2–)3–8, the ovules 10–12. (Fig. 2, g–k.)

Distribution: Mountains of south-central Chile (Cautín and Valdivia) and adjacent Argentine (common in region of Lake Nahuel Huapí); Reiche also mentions the variety from Llanquihue, and Hauman reports it from the Río Aluminié in Neuquén. The plant is said to occur from 760 to 2300 m., in open woods or in forest, often associated with *Nothofagus* and *Araucaria.*

Chile: Cautín: Río Quino, *Kuntze* (NY, type of *D. Winteri* var. *quinoensis,* US); Baños de Trolguaca, *Sargent* (A, M); along road from Termas de Trolguaca to Laguna Malleco, *Morrison & Wagenknecht 17480* (GH); Volcán de Trolguaca, *Pennell 12785* (GH); Volcán Llaima, *Werdermann 1245* (A, F, GH, M, NY, UC, US); west foot of Volcán Llaima, *West 4900* (GH, M, UC); Valdivia: Dept. Osorno, Cordillera Pelada, *Morrison 17639* (GH).

Argentine: Río Negro: Region of Lake Nahuel Huapí, *Cordini 131* (US); Puerto Blest and vicinity, *Cabrera & Job 268* (NY), *Parodi 11783* (GH), *West 4730* (GH, M); between Puerto Blest and Lake Todos los Santos, *Elwes* (A); Laguna Frias, Cerro Riggi, *Cabrera 6047* (F); Brazo Viento, Cantaros, Lake Nahuel Huapí, *Ljungner 947* (NY).

Native name: *Canelo.*

The two varietal names *andina* and *quinoensis* were both published in 1898, but the first has priority. Reiche did not cite a type, but there seems no doubt that the present variety is the one described by him.

The var. *andina* is characterized by its small compact habit; it is distinguished from var. *punctata* by having the leaves comparatively spaced, the branchlets and petioles less robust, and the leaf-blades thinner and paler in color and more definitely elliptic, without the strongly recurved basal margins. It is apparently a montane form and in many respects suggests a link between the other two varieties of *D. Winteri*, but on the whole it has sufficiently strong characteristics to make recognition advisable. As a matter of fact, Prof. Bailey's anatomical study of preparations of the leaves of this variety incline him to believe it unusually well marked and homogeneous. He finds it to be more stable and more readily characterized than the other two varieties of *D. Winteri.*

A collection from the vicinity of the south shores of Lake Argentine, Santa Cruz, Argentine (*Furlong 62* [GH, NY]) does not fit well into any of the proposed varieties of *D. Winteri*, but I believe that it is best placed with var. *andina*, although it occurs far south of otherwise known localities of this variety. It differs from the rest of the material of this variety in having the leaf-blades somewhat darker above (as in var. *punctata*), the margins slightly more conspicuously revolute toward base, the secondaries slightly more obvious, the flowers umbellate on peduncles up to 30 mm. long, the stamens only 14 and with unusually large locules, and the ovules 14. I have not included these extreme variations in the above description of var. *andina*. Future collections may permit the more accurate placing of the Furlong specimen.

2c. **Drimys Winteri** var. **chilensis** (DC.) A. Gray, Bot. U. S. Expl. Exped. **1**: 24. 1854; Eichl. ex Kuntze, Rev. Gen. **3**(2): 2. 1898; Eichl. ex Hauman in Comun. Mus. Nac. Buenos Aires **2**: 49. 1923; Eichl. ex Hauman & Irigoyen in An. Mus. Nac. Buenos Aires **32**: 227. 1923.

Drimys chilensis DC. Reg. Veg. Syst. Nat. **1**: 444. 1817; Deless. Ic. Sel. **1**: 22, *pl. 83*. 1820; DC. Prodr. **1**: 78. 1824; Hook. in Bot. Misc. **3**: 134, *pro parte*. 1832; Gay, Fl. Chil. **1**: 61, *pro parte*. 1845; Carson, Ill. Med. Bot. **1**: *pl. 6*. 1847; Steud. in Flora **39**: 408. 1856; Miers in Ann. Mag. Nat. Hist. III. **2**: 47. 1858, Contrib. Bot. **1**: 136. *pl. 26C*. 1861; Pilger in E. & P. Nat. Pfl. Nachtr. **2**: 108. 1906.

Drimys Winteri sensu Hook. f. in Curt. Bot. Mag. **80**: *pl. 4800*. 1854; Demilly in Rev. Hort. n. s. **12**: 18. *f. 3, 4*. 1912; non J. R. & G. Forst.

Drimys paniculata Steud. in Flora **39**: 408. 1856.

Drimys chilensis var. *latifolia* Miers in Ann. Mag. Nat. Hist. III. **2**: 47. 1858, Contrib. Bot. **1**: 136. 1861.

Drimys Winteri f. *chilensis* Eichl. in Mart. Fl. Bras. **13**(1): 135. *pl. 30, f. 1*. 1864.

Drimys magnoliaefolia Kunth ex Eichl. in Mart. Fl. Bras. **13**(1): 135, as synonym. 1864.

Drimys Winteri chilensis Macloskie in Rep. Princeton Univ. Exped. Patagonia **8**: 420, excl. spec. 1905.

Shrub or tree 3–15 m. high, the branchlets 3–5 mm. in diameter toward apices; leaves usually scattered along distal portions of branchlets; petioles 5–27 mm. long, 1–3 mm. in diameter; leaf-blades coriaceous, pale or dark green above when dried, sometimes fuscous, glaucous or at least paler beneath, oblong or obovate-oblong, (5–)9–15(–18) cm. long, (1.5–)2.5–6.5(–7) cm. broad, usually obtuse (or subacute to subtruncate) at base and strongly revolute at margin toward base, the secondary nerves (5–)7–15 per side, erecto-patent or ascending at an angle of 40–60°, usually prominulous and obvious on both surfaces, rarely subimmersed above, the veinlets immersed or obscurely prominulous on both surfaces; inflorescences often densely crowded at apices of branchlets, very rarely axillary, umbellate (flowers occasionally fasciculate, rarely single), the peduncle (0–)8–50 mm. long, the flowers (1–)3–8(–12) per inflorescence, the pedicels 10–55 mm. long, rarely branched and 2-flowered; sepals 4–7 mm. long, 4–9 mm. broad; petals 6–14, 6–20 mm. long, 2–5 mm. broad; stamens 24–35, the filaments 1–2.5 mm. long; carpels 4–10, the ovules 9–16.

DISTRIBUTION: Central Chile, from Coquimbo (lat. about 30°30′) to Aysen (lat. about 44°40′), often near the coast, at altitudes up to 700 m. (rarely to 1000 m.). The plant is said to grow in forests or in woods, often in sheltered locations or near water.

CHILE: Coquimbo: Dept. Ovalle, Fray Jorge, *Muñoz B117* (GH); Aconcagua: Valparaiso and vicinity, *Cuming 8644* (NY), *Ball* (NY), *Harvey* (GH), *Buchtien* (US), *Claude-Joseph 3692* (US), *Behn* (F); Las Zorras, near Valparaiso, *Harshberger 1036* (NY, US); Cerro Campana, *Philippi & Borchers* (F); Santiago: Nuñoa, vicinity of Santiago, *Claude-Joseph 1755* (GH, US); Melipilla, *Gay 171* (GH); Esmeralda, near Melipilla, *Reed* (GH); "Winganis," *Hastings 355* (NY, UC, US); Río Clarillo, *Grandjot* (M); Rungue, Cerro El Roble, *Montero 173* (GH, M); Colchagua: Tagua-tagua, *Bertero 229* (type coll. of *D. paniculata*, M, NY); Talca: Camarico, Río Claro, *Moreira* (GH); Río Claro, *Reiche?* (A); Nuble: Chillan, *Philippi* (US); near Racinto, *West 5117* (GH, M, UC); Concepción: Vicinity of Concepción, *Germain* (F); Bio-Bio: Angol, *Kuntze* (NY, US); Cautín: Temuco, *Claude-Joseph 1178* (US); Valdivia: *Philippi* (GH); Valdivia and vicinity, *Buchtien* (UC), *Junge* (M), *Lechler 550* (US); Río Calle-Calle, *Buchtien* (F, US); Corral, *Gunckel 1795* (UC), *3498* (M), *Thaxter* (GH); Amargos, *Gunckel 86* (F); Antilhue, *Sargent* (A); Panguipulli, *Hollermayer 1926* (US); Chiloé: Dept. Llanquihue, road from Hotel Ensenada to Cochamo and Laguna Patos, *Morrison 17580* (GH); Isla de Chiloé, Castro, *Pennell 12605* (GH, NY, US); Aysen: Ins. Magdalena, Calqueman, *Werdermann 73* (A, F, GH, NY, M, UC, US); without definite locality: *Dombey s. n.* or *601* (TYPE COLL. of *D. chilensis*, F), *Gay* (GH).

CULTIVATED SPECIMENS: *Nicholson* (cult. Kew) (A); *Anderson* (cult. J. I. Hort. Institute, England) (M); cult. Hort. Berol. (M); cult. Jardin des Plantes, Caen (US).

NATIVE NAMES: *Canelo, boighe.*

Although the specimens cited above cannot be given specific recognition, they appear to represent a well-marked variety of *D. Winteri*, characterized primarily by the slender habit, the numerous and comparatively spreading and obvious secondary nerves of the leaf-blades, the predominantly umbellate inflorescences, and the more numerous petals. The ranges of this variety and var. *punctata* apparently overlap in Chiloé and Aysen, but, in general, var. *chilensis* occurs only toward the north of the range of the species and does not ascend to as high an elevation as is characteristic for var. *andina*.

Prof. Bailey calls my attention to the fact that four of the above-cited specimens (*Muñoz B117, West 5117, Pennell 12605,* and *Werdermann 73*) demonstrate anatomical characters in the leaf which are more to be expected in var. *punctata* than in var. *chilensis*. However, in the gross morphological characters which I have used to separate the two varieties, the four specimens agree better with var. *chilensis* than with var. *punctata;* that is, they have ample and umbellate inflorescences, comparatively numerous petals, and more or less spreading secondary nerves. Thus it appears that the anatomical and morphological characters within *D. Winteri* are not always correlated in such a way that the two varieties under discussion are obvious. To be sure, one might expect the occurrence of unusually variable individuals where the ranges of the two varieties overlap, and therefore the disagreement of characters found in the Pennell and Werdermann specimens, from Chiloé and Aysen, is not unexpected. That the West and Muñoz specimens (the latter the most northern known collection of *D. Winteri*) should show anatomical characters of var. *punctata* is a phenomenon which I cannot explain at present.

3. **Drimys granadensis** L. f. Suppl. 269. 1781.

Shrub or small tree up to 13 m. high, the branchlets brownish or cinereous, sometimes glaucous when young, rugulose, subterete (or short lateral ones sometimes flattened), 2–7 mm. in diameter toward apices; petioles rugulose, flattened to obviously canaliculate above, often narrowly winged distally, 4–25 mm. long, 1–3 mm. in diameter; leaf-blades thick-coriaceous to subcoriaceous, olivaceous to brown above when dried, glaucous or pale beneath and appearing uniform in color rather than punctate, elliptic-oblong or narrowly so, 5–16(–17.5) cm. long, 1–5.5 cm. broad, acute to attenuate at base and decurrent on the petiole, usually obtuse at apex and narrowly recurved at margin, the costa shallowly canaliculate to nearly plane above, prominent beneath, the secondary nerves 8–19 per side, ascending to erecto-patent, prominulous to immersed on both surfaces, often freely anastomosing, the veinlets immersed or prominulous; inflorescences terminal or axillary, umbellate or fasciculate or 1-flowered, the peduncle often slightly flattened, 7–65(–90) mm. long, the flowers 1–6(–8) per inflorescence, the pedicels 5–60(–90) mm. long; sepals papyraceous to submembranaceous, more or less opaque, usually inconspicuously yellow-glandular, suborbicular-deltoid, 4.5–10(–12) mm. long, 5–11(–13) mm. broad, rounded to obscurely apiculate at apex; petals 8–17(–25), membranaceous or submembranaceous, opaquely yellow-glandular (sometimes obscurely so), oblong to elliptic- or ovate-oblong, 5–20(–25) mm. long, 1.5–8(–11) mm. broad, cuneate to obtuse at base, obtuse at apex; torus short-cylindric, usually conspicuous; stamens 25–50(–65), 2–4(–5)-seriate, the filaments carnose, somewhat flattened, often sparsely yellow-glandular, 0.5–3 mm. long, the connective glandular and usually with a few obvious apical yellow glands, the locules 0.3–1 mm. long; carpels 3–12(–24), obovoid, 2–5 mm. long at anthesis, usually contracted at base, rounded at apex, the stigma subterminal or obliquely terminal on a short stipe 0.3–0.7 mm. long, exceeding the body of the carpel, the ovules 7–12 on short placentas.

DISTRIBUTION: Southern Mexico to western Venezuela and Peru; five varieties are here circumscribed. The type of the species was collected by Mutis in Colombia; it falls into the variety *grandiflora*, which thus, although not based upon the type of the species, is nevertheless the typical variety.

In the original publication of this species the name was spelled *granadensis*, but in 1817 De Candolle took up the spelling *granatensis*, which has been followed by most writers using the name. There appears to be no reason for this change, and throughout this paper I have used the original spelling, regardless of the spelling used by the cited author, in order to avoid further complications of the synonymy. Various writers have accredited the specific name to Mutis, but in the original publication Mutis is mentioned merely as the collector.

ESSENTIAL DIAGNOSTIC CHARACTERS OF THE VARIETIES

Branchlets tending to be thick (3–7 mm. in diameter toward apices); leaf-blades coriaceous or thick-coriaceous, elliptic-oblong, (5–)7–14.5 by (1–)1.5–5.5 cm., with definitely obtuse or subrounded apices, the secondary nerves obvious on both surfaces, rarely obscure, freely anastomosing toward margin; inflorescences axillary or congested toward apices of branchlets but comparatively scattered; flowers usually umbellate, rarely single; sepals thick in texture, never membranaceous, averaging large (6–10[–12] by 7–11[–13] mm.); petals comparatively few, 8–13(–15), large (9–20[–25] by 4–8[–11] mm.); stamens 25–50(–60), the anthers comparatively large, the locules 0.6–1 mm. long; carpels 5–12(–14), 2.5–5 mm. long at anthesis; Colombia..3a. var. *grandiflora*.

Branchlets 2–5 mm. in diameter toward apices; leaf-blades coriaceous, elliptic-oblong, 5.5–10.5 by 1.5–3.5 cm., rounded or definitely obtuse at apex, the secondary nerves immersed and scarcely visible; flowers single, aggregated at apices of branchlets; sepals submembranaceous, about 8 by 9 mm.; petals about 10, 9–12 by 3–5 mm.; stamens about 30, the anthers with locules 0.5–0.6 mm. long; carpels about 6, 2–2.5 mm. long at anthesis; western Venezuela.................3b. var. *uniflora*.

Branchlets 2–5 mm. in diameter toward apices; leaf-blades subcoriaceous, narrowly elliptic-oblong, (5–)7–16(–17.5) by 1.5–4.5(–5.5) cm., obtuse or subacute at apex, the secondary nerves obvious on both surfaces or usually so, freely anastomosing toward margin; inflorescences aggregated at or near apices of branchlets; flowers umbellate, rarely single; sepals papyraceous to submembranaceous, averaging comparatively small (4.5–8 by 5–9 mm.); petals 9–17, comparatively small (6–17 by 1.5–6 mm.); stamens 25–45(–55), the anthers with locules 0.5–0.8 mm. long; carpels 5–12, 2–3 mm. long at anthesis; southern Mexico to Costa Rica..3c. var. *mexicana*.

Branchlets 2–4 mm. in diameter toward apices; leaf-blades subcoriaceous, elliptic-oblong, 6–12(–14) by 1.5–4(–5.5) cm., obtuse at apex, the secondary nerves faint but usually visible on both surfaces; inflorescences aggregated near apices of branchlets; flowers umbellate, rarely single; sepals submembranaceous, comparatively small (5–6 by 6–7 mm.); petals numerous, 14–25, small (5–8 by 1.5–2.5 mm.); stamens numerous, 50–65, the anthers small, with locules 0.3–0.5 mm. long; carpels 8–24, about 2 mm. long at anthesis; Chiriquí region in Panama..3d. var. *chiriquiensis*.

Branchlets about 4 mm. in diameter toward apices; leaf-blades coriaceous, oblong-lanceolate, 5–9 by 1–2 cm., obtuse at apex, the secondary nerves faintly prominulous on both surfaces; inflorescences aggregated at or toward apices of branchlets, the flowers umbellate; sepals submembranaceous, 8–9 mm. long and broad; petals numerous, about 22, the outer and larger ones 10–13 by 5–7 mm.; stamens about 40, the locules 0.6–0.7 mm. long; carpels 3–7, 2–2.5 mm. long at anthesis; Peru. ....3e. var. *peruviana*.

3a. **Drimys granadensis** var. **grandiflora** Hieron. in Bot. Jahrb. **20:** Beibl. 49: 10, as *D. granatensis* Mutis var. *g*. 1895.

Drimys granadensis L. f. Suppl. 269. 1781; Lam. Encycl. **2:** 330. 1786; DC. Reg. Veg. Syst. Nat. **1:** 444. 1817; H. B. K. Nov. Gen. & Sp. **5:** 53. 1821; DC. Prodr. **1:** 78. 1824; Endl. Enchir. Bot. 430. 1841; Miers in Ann. Mag. Nat. Hist. III. **2:** 43. 1858, Contrib. Bot. **1:** 133. *pl. 27A*. 1861; Tr. & Pl. in Ann. Sci. Nat. IV. **17:** 24. 1862; Cortés, Fl. Colomb. **1:** 86. 1898; Pilger in E. & P. Nat. Pfl. Nachtr. **2:** 108. 1906; U. S. Bur. Pl. Industr. Pl. Immigr. **132:** 1148. 1917.

Wintera granadensis Murr. Syst. Veg. ed. 14. 507. 1784; Willd. Sp. Pl. **2:** 1239. 1800; Pers. Syn. Pl. **2:** 84. 1806; Humb. & Bonpl. Pl. Aequin. **1:** 205. *pl. 58*. 1808.

Drimys Winteri f. *granadensis* Eichl. in Mart. Fl. Bras. **13**(1): 135. *pl. 31, f. 1.* 1864.
Drimys Winteri var. *granadensis* Eichl. ex Dusén in Arch. Mus. Nac. Rio **13**: 62, excl. spec. 1905; Pittier, Man. Pl. Us. Venez. 159. 1926.

Tree (or sometimes shrub) up to 13 m. high, the branchlets stout (3–7 mm. in diameter toward apices); leaves scattered along branchlets; petioles 5–15 mm. long, often stout (1–3 mm. in diameter); leaf-blades coriaceous or thick-coriaceous, usually shining and fuscous above when dried, elliptic-oblong, (5–)7–14.5 cm. long, (1–)1.5–5.5 cm. broad, obtuse or subrounded at apex, usually sharply but narrowly recurved at margin, often strongly so toward base, the secondary nerves 8–19 per side, ascending or erecto-patent at an angle of 40–60°, prominulous or nearly plane above, prominulous and obvious (rarely obscure) beneath, freely anastomosing toward margin, the veinlets immersed above, faintly prominulous or obscure beneath; inflorescences near apices of branchlets but not crowded at actual apex, umbellate or sometimes 1-flowered or fasciculate, the peduncle 16–50(–90) mm. long, the flowers 3–6 per inflorescence (or single), the pedicels 15–60(–80) mm. long; sepals papyraceous, 6–10(–12) mm. long, 7–11(–13) mm. broad (or slightly narrower when 3 rather than 2); petals 8–13(–15), 9–20(–25) mm. long, 4–8(–11) mm. broad; stamens 25–50(–60), the filaments 1.2–3 mm. long, the locules 0.6–1 mm. long; carpels 5–12(–14), 2.5–5 mm. long at anthesis, the ovules 7–12.

DISTRIBUTION: Mountainous parts of Colombia, in all three Cordilleras, in temperate forests, shrub-zone (paramillo), or on slopes of páramos, at altitudes of 1500–3300 m.; common in parts of the range, especially in Cundinamarca. It is reported as occurring near the tree-line, being often found in association with such typical páramo plants as species of *Espeletia*.

COLOMBIA: Norte de Santander: Between Pamplona and Toledo (divide between Maracaibo and Orinoco drainage), *Killip & Smith 19897* (A, GH, NY, US); Santander: Western slope of Páramo Rico, *Killip & Smith 17817* (A, GH, NY, US); Cundinamarca: Vicinity of Bogotá, *Triana* (NY, US), *Hartweg 877* (NY), *Holton 673* (GH, NY), *Dawe 140* (US), *Ariste-Joseph* (US), *Schultze 14* (US), *Cuatrecasas 5440* (US); Guadelupe, above Bogotá, *Ariste-Joseph* (US); San Miguel, W. of the savanna of Bogotá, *Cuatrecasas 6687* (US); Monserrate, near Bogotá, *García 4813* (US); Fuentes de San Francisco, *Ariste-Joseph A106* (GH, US); Sibaté, *Popenoe 1109* (US); western slopes of Páramo de Cruz Verde, *Cuatrecasas 343* (US); Páramo de Guasca, *García 6278* (US), *Killip 34077* (A, US), *Balls 5749* (US); above Ubague, *Pennell 1897* (GH, NY, US); Usaquén, *García 8087* (US); Tolima: "Rosalito," near Páramo de Ruiz, *Pennell 2963* (GH, M, NY, US); Antioquia: Vicinity of Medellín, *Toro 718* (NY); Santa Elena, *Archer 1202* (US); San Pedro, *Daniel & Tomás 1255* (A), *1305* (F); Caldas: "Pinares," above Salento, *Pennell 9222* (GH, NY, US); El Cauca: Río Paez basin, *Pittier 1367* (US); Mt. El Trueno, *Pennell 7542* (GH); "Paletara," *Pennell 6945* (GH, NY, US); without definite locality: *Mutis 1049* (US), *2525* (US), *3839* (TYPE COLL. of *D. granadensis* L. f., US)[1], *4483* (US), *4609* (US), *Purdie* (GH).

NATIVE NAMES: *Canelo, canela de páramo, ají, palo de ají, quinon, cupis.* Several writers have briefly mentioned the tonic and stimulant qualities of this plant.

The first varietal name which appears referable to the biological entity described above is Hieronymus' var. *grandiflora*. The original description of this variety clearly indicates that the typical form of the species (as

[1]In sorting the Mutis collection in the Madrid Herbarium, Mr. E. P. Killip assigned arbitrary numbers to the specimens. He has selected the best Mutis specimen of this species as the type; all the Mutis numbers here cited are essentially identical.

represented by Mutis' material) was under consideration. The type of the variety is *Lehmann 7469* from Sibaté, Dept. Cundinamarca; this variety must be construed also to include the Mutis type of the species. Dusén's reference to *D. Winteri* var. *granadensis,* although accompanied by citations of Brazilian specimens, appears to be the first use of the epithet *granadensis* as a variety; Eichler's earlier use of this epithet in a trinomial was as a form.

3b. **Drimys granadensis** var. **uniflora** (Turcz.) comb. nov.

Drimys uniflora Turcz. in Bull. Soc. Nat. Mosc. **27**(2): 280. 1854; Pilger in E. & P. Nat. Pfl. Nachtr. **2**: 108. 1906; Knuth in Rep. Sp. Nov. Beih. **43**: 331. 1927.

Small tree (?), the branchlets 2–5 mm. in diameter toward apices; leaves scattered along branchlets or somewhat crowded toward apices; petioles 8–20 mm. long, 1–1.5 mm. in diameter, swollen toward base; leaf-blades coriaceous, olivaceous to pale brown above when dried, elliptic-oblong, 5.5–10.5 cm. long, 1.5–3.5 cm. broad, rounded or obtuse at apex, narrowly recurved at margin, more conspicuously so toward base, the secondary nerves 8–12 per side, erecto-patent at an angle of about 45°, usually immersed and obscure on both surfaces, sometimes faintly prominulous beneath, the veinlets immersed; flowers single, clustered at apices of branchlets, the pedicels 25–50 mm. long; sepals submembranaceous, about 8 mm. long and 9 mm. broad; petals about 10, 9–12 mm. long, 3–5 mm. broad; stamens about 30, the filaments carnose, somewhat flattened, 1–1.5 mm. long, the locules 0.5–0.6 mm. long; carpels about 6, 2–2.5 mm. long at anthesis, the carpel-wall densely glandular, the ovules 9 or 10.

Distribution: State of Trujillo, Venezuela; known only from the type collection.

Venezuela: Trujillo: Near Agua d'Obispo, alt. about 2700 m., *Linden 1444* (type coll., F, GH).

As pointed out in the preceding diagnoses of varietal characters, var. *uniflora* differs from the typical Colombian variety chiefly in its more slender habit, obscure secondary nerves, single and terminal flowers, thinner sepals, slightly smaller petals, smaller anther-locules, and smaller carpels at anthesis. On the basis of the present material, the Trujillo specimen is maintained as a variety, but its status cannot be satisfactorily decided without more ample material from the Venezuelan Andes. The weakness of such a character as single versus umbellate flowers is indicated by such a collection as *Killip & Smith 19897,* from the part of Colombia adjacent to Venezuela. This collection has some branchlets with ample and obviously umbellate inflorescences, while other branchlets have the flowers consistently solitary, either fasciculate or single. The leaves of this collection also tend to resemble those of *Linden 1444,* having the secondaries only weakly apparent; nevertheless the inflorescences (or single flowers) are scattered along the branchlets and not aggregated at apices.

3c. **Drimys granadensis** var. **mexicana** (DC.) comb. nov.

Drimys mexicana DC. Reg. Veg. Syst. Nat. **1**: 444. 1817; Moc. & Sessé ex DC. Prodr. **1**: 78. 1824; Hemsl. Biol. Centr. Am. Bot. **1**: 14. 1879.

Drimys granadensis var. *sylvatica* sensu Schlechtend. & Cham. in Linnaea **5**: 211. 1830; Hemsl. Biol. Centr. Am. Bot. **1**: 14. 1879; non St. Hil.

Drimys Winteri sensu Goyena, Fl. Nicar. 172. 1909; Standl. in Contr. U. S. Nat. Herb. **23**: 276. 1922, in Field Mus. Publ. Bot. **18**: 438. 1937; non J. R. & G. Forst.

Shrub or tree 2–13 m. high; branchlets 2–5 mm. in diameter near apices;

leaves usually scattered on branchlets; petioles (5–)8–25 mm. long, 1–2 mm. in diameter; leaf-blades subcoriaceous, shining or dull and fuscous or dark green above, narrowly elliptic-oblong, (5–)7–16(–17.5) cm. long, 1.5–4.5(–5.5) cm. broad, obtuse or subacute at apex, slightly recurved at margin, often strongly but narrowly revolute toward base, the secondary nerves (8–)10–16 per side, ascending or erecto-patent at an angle of 40–55(–60)°, prominulous or nearly plane above, usually obvious, prominulous and obvious beneath, freely anastomosing near margin, the veinlets immersed or faintly prominulous; inflorescences aggregated at or near apices of branchlets, umbellate or rarely 1-flowered, the peduncle 7–65(–75) mm. long, the flowers (1–)2–6(–8) per inflorescence, the pedicels 5–60 mm. long (up to 90 mm. when flowers are single); sepals submembranaceous to papyraceous, 4.5–8 mm. long, 5–9 mm. broad; petals 9–17, 6–17 mm. long, 1.5–6 mm. broad; stamens 25–45(–55), the filaments sometimes yellow-glandular, often eglandular, 0.7–3 mm. long, the locules 0.5–0.8 mm. long, lateral to oblique; carpels 5–12, 2–3 mm. long at anthesis, the ovules 7–12. (FIG. 3, b–f.)

DISTRIBUTION: Southern Mexico (Veracruz and Guerrero) to Costa Rica, in mountains at altitudes of 1150–3000 m.; usually occurring in moist forest, but noted in oak and pine forest in Guerrero by Hinton; common in Costa Rica.

MEXICO: Veracruz: Inter Huatamalco et Tinzutlan (Teziutlán?), *Liebmann 1984* (US); Guerrero: Distr. Galeana, Teotepec, *Hinton 14441* (F, GH); Distr. Galeana, Piedra Ancha, *Hinton 14235* (GH); Oaxaca: Distr. Feotitlán, Cumbre de los Frailes, *Conzatti 2101* (F, US); Distr. Cuicatlán, Cerro La Raya, Cuyamecalco, *Conzatti 3475* (US); northwestern slope of Mt. Zempoaltepec, *Nelson 666* (US); Chiapas: *Ghiesbreght 117* (GH, NY); Cerro de Huitepec, *Ghiesbreght 518* (GH. M); Saxchanal, Sierra Madre, *Matuda 4287* (M, NY); State?: Laguna de Tanetze, *Hartweg 444* (NY).

GUATEMALA: Zacapa: Summit of Sierra de las Minas, vicinity of Finca Planados, *Steyermark 29993* (F).

NICARAGUA: No specimens seen; the fact that Goyena mentions *D. "Winteri"* in his Flora Nicaragüense indicates that he probably saw a specimen of the present variety from that country.

COSTA RICA: Páramos del Abejonal, *Tonduz 7897* (US); Tijar, *Quirós 152* (F); El Roble, *Stork 2034* (F); Alajuela: Palmira, Alfaro Ruiz, *Austin Smith 4139* (F), *A123* (F, M), *H524* (F); vicinity of Fraijanes, *Standley & Torres 47632* (US); Volcán de Poas and vicinity, *Tonduz 10937* (US), *Standley 34604* (NY, US), *Stork 2503* (F), *Allen 599* (A, F); Vara Blanca de Sarapiquí, *Skutch 3585* (M, NY); Heredia: Volcán de Barba, *Pittier 2130* (US); Cerro de Las Lajas, north of San Isidro, *Standley & Valerio 51443* (A, US); Cerros de Zurquí, northeast of San Isidro, *Standley & Valerio 50414* (US), *50617* (US), *50635* (US); San José: La Palma de San Ramón, *Brenes 4078* (F), *4122* (F), *4452* (F), *5718* (F); Santa Rosa de Copey, *Tonduz 7342* (*12174*) (GH, NY, US); above Los Lotes, north of El Copey, *Standley 42578* (US), *42798* (US); Las Nubes, *Standley 38789* (US), *Valerio 1398* (F); Laguna de la Chonta, northeast of Santa María de Dota, *Standley 42319;* Cerro de las Vueltas, *Standley & Valerio 43654* (US); north of El Alto de Cabeza de Vaca, on Río Sucio, *Dodge & Thomas 4948* (M); Cerros del Iscazú, *Pittier 7338* (*12300*) (GH, US); Cerro Gallito, *Valerio 1005* (F); Cartago: Cartago and vicinity, *Stevens 79* (US), *Stork 367* (US), *404* (US); Alto de La Estrella, *Standley 39058* (US); southern slope of Volcán Irazú, *Standley 36628* (US); Santa Clara, *Torres 185* (F).

CULTIVATED SPECIMEN: *Zabel* (cult. Bot. Gart. Muenden) (A).

NATIVE NAMES: *Chilillo, chachaca, palo picante, palo de chile, muelo* (in Mexico); *quiebra-muelas, chile, muelo* (in Costa Rica). Standley reports on native medicinal uses in the cited discussions of *D. Winteri*.

While this entity does not appear to merit specific recognition, it nevertheless has certain tendencies which permit its separation from the Colombian variety. In general, it is more slender in habit, with thinner and proportionately narrower leaf-blades, these tending to be more pointed at apex. The sepals are usually thinner in texture and smaller on the average, the petals are more numerous (on the whole) and somewhat smaller, the anther-locules average smaller, and the carpels are smaller at anthesis.

The above-mentioned characters are far from satisfactory as varietal criteria, but nevertheless the two entities, when ample material is examined, give different impressions, and one is generally able to place specimens without knowledge of the geographic source. There appear to be no differences of consequence between Mexican and Costa Rican specimens.

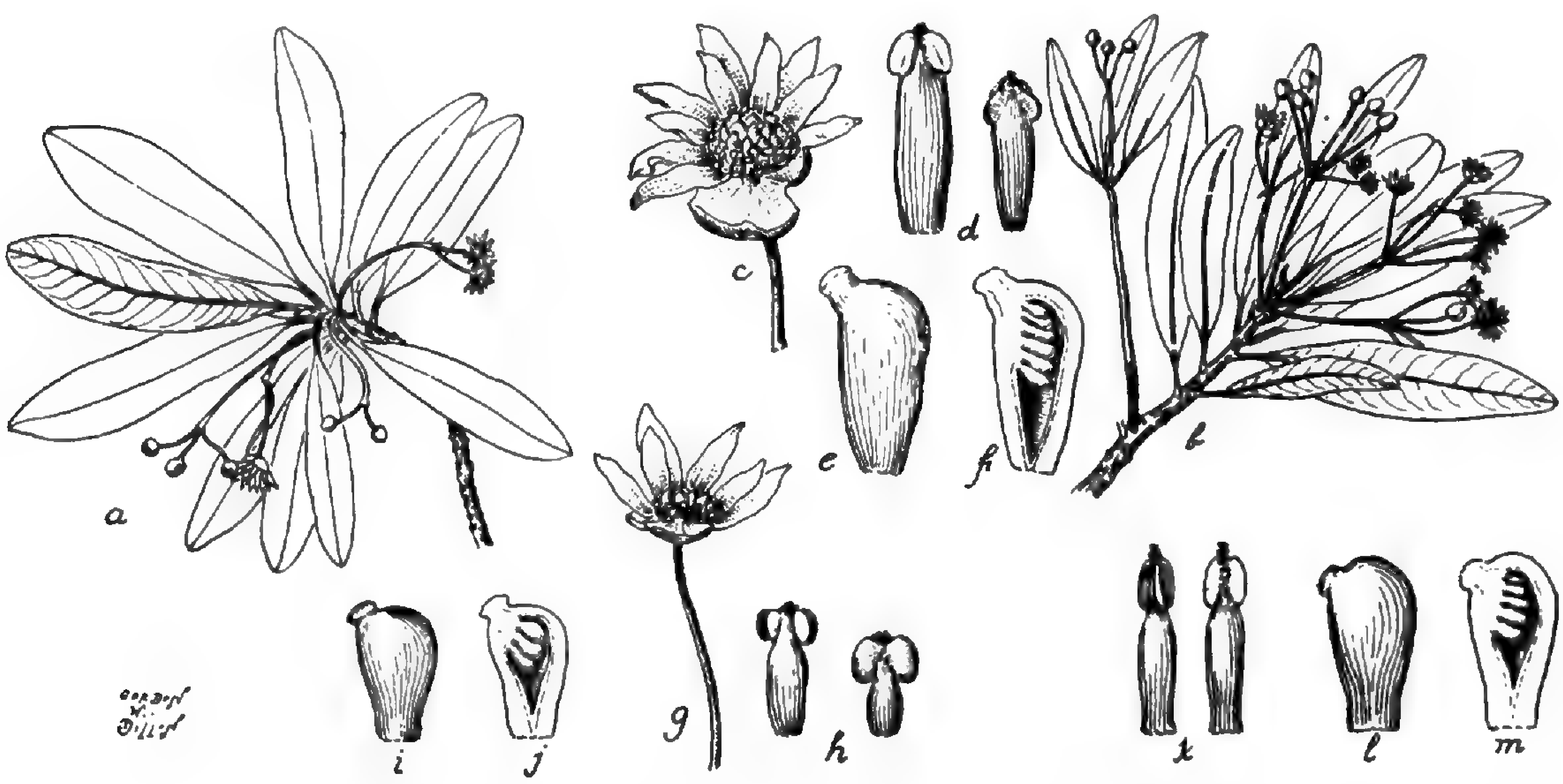

FIG. 3. *a. Drimys granadensis* var. *chiriquiensis,* drawn from the type: flowering branchlet, × 1/4. *b–f. Drimys granadensis* var. *mexicana,* drawn from *Skutch 3585: b.* flowering branchlet, × 1/4; *c.* flower, with some petals removed, × 1; *d.* stamens, extrorse and introrse views, × 5; *e.* carpel, × 5; *f.* carpel, longitudinal section, × 5. *g–j. Drimys brasiliensis* var. *campestris,* drawn from *Mexia 5791: g.* flower, with some petals removed, × 1; *h.* stamens, extrorse and introrse views, × 5; *i.* carpel, × 5; *j.* carpel, longitudinal section, × 5. *k–m. Drimys brasiliensis* var. *roraimensis,* drawn from the type: *k.* stamens, extrorse and introrse views, × 5; *l.* carpel, × 5; *m.* carpel, longitudinal section, × 5.

3d. **Drimys granadensis** var. **chiriquiensis** var. nov.

Frutex vel arbor parva, ramulis apicem versus 2–4 mm. diametro, saepe conspicue cicatricosis; foliis apicem ramulorum versus plerumque confertis; petiolis 4–20 mm. longis, 1–2 mm. diametro; laminis subcoriaceis, supra in sicco olivaceis vel pallide brunneis, elliptico-oblongis, 6–12(–14) cm. longis, 1.5–4(–5.5) cm. latis, apice obtusis, margine anguste et basim versus conspicue recurvatis, nervis secundariis utrinsecus 8–14 sub angulo 50–65° erecto-patentibus supra prominulis vel subimmersis subtus immersis vel leviter prominulis, marginem versus obscure anastomosantibus, venulis immersis; inflorescentiis apicem ramulorum versus axillaribus umbellatis vel raro 1-floris, pedunculo 10–45 mm. longo, floribus (1–)2–4 per inflorescentiam, pedicellis 7–30 mm. longis; sepalis submembranaceis, 5–6 mm. longis, 6–7 mm. latis; petalis 14–25, 5–8 mm. longis, 1.5–2.5 mm. latis; staminibus 50–65, 3–5-seriatis, filamentis eglandulosis 0.5–1.2 mm. longis, connectivo glandulas luteas 2 vel 3 interdum obscuras apice gerente, loculis 0.3–0.5 mm. longis; carpellis 8–24 falcato-ellipsoideis vel obovoideis sub anthesi circiter 2 mm. longis, ovulis 10–12. (FIG. 3, a.)

DISTRIBUTION: Known only from Chiriquí, Panama.

PANAMA: Chiriquí: Bajo Chorro, Boquete District, alt. about 1800 m., *Davidson 127* (A, TYPE, F), Jan. 14, 1938 (shrub or tree, in rain-forest; petals white; stamens yellow), *Davidson 328* (A, F, M) (small tree, in rain-forest); between Alto de las Palmas and top of Cerro la Horqueta, alt. 2100–2268 m., *Pittier 3232* (US) (in humid forest).

The biological entity described above is more closely related to var. *mexicana* than to other varieties of *D. granadensis*. It is characterized by its comparatively small and aggregated leaves and small floral parts, but principally by the unusual number of its petals, stamens, and carpels. The type specimen is extraordinary in having as many as 25 petals, 65 stamens, and 24 carpels, but other cited specimens show that substantial variation in these numbers is to be expected. On the whole, the Chiriquí specimens show such definite trends in the direction indicated above that they seem worthy of varietal recognition.

3e. **Drimys granadensis** var. **peruviana** var. nov.

Frutex ad 70 cm. altus, ramulis apicem versus circiter 4 mm. diametro; foliis secus ramulos dispositis, petiolis 6–11 mm. longis, 1–2 mm. diametro, basim versus paullo incrassatis; laminis coriaceis, supra in sicco olivaceis et nitidis, oblongo-lanceolatis, 5–9 cm. longis, 1–2 cm. latis, apice obtusis, margine anguste revolutis vel abrupte recurvatis, nervis secundariis utrinsecus 12–15 angulo 45–50° erecto-patentibus supra leviter prominulis vel immersis subtus plerumque prominulis, venulis immersis; inflorescentiis ramulorum apice vel apicem versus aggregatis umbellatis, pedunculo crasso 8–17 mm. longo, floribus 3–5 per inflorescentiam, pedicellis 17–25 mm. longis; sepalis submembranaceis, 8–9 mm. longis et latis; petalis circiter 22 et 3-seriatis, exterioribus 10–13 mm. longis et 5–7 mm. latis, interioribus paullo minoribus; staminibus circiter 40, filamentis 1–1.5 mm. longis, connectivo glandulas 2 vel 3 apice plerumque gerente, loculis 0.6–0.7 mm. longis; carpellis 3–7, sub anthesi 2–2.5 mm. longis, ovulis plerumque 12.

DISTRIBUTION: Known only from the type collection, Dept. Cajamarca, Peru.

PERU: Cajamarca: Prov. Cutervo, trail between Socota and Tambillo, alt. 3200 m., *Stork & Horton 10167* (UC, TYPE), Dec. 14, 1938 (xerophyllous shrub to 70 cm. high, in shrub-land; petals white; stamens yellow; leaves nearly pure white beneath; only one specimen observed).

The single Peruvian specimen described above is characterized by narrow oblong-lanceolate leaf-blades, numerous and comparatively short and broad petals, and comparatively few and small carpels. Its position in *D. granadensis* is indicated by such characters as the glandular anther-connective and the texture of the lower leaf-surface. It seems amply distinguished from the bulk of the population referred to this species, but this conclusion should be further checked when additional collections of *Drimys* are made in Peru and Ecuador.

4. **Drimys brasiliensis** Miers in Ann. Mag. Nat. Hist. III. **2**: 47. 1858, Contrib. Bot. **1**: 136. 1861; Pilger in E. & P. Nat. Pfl. Nachtr. **2**: 108. 1906.

Drimys granadensis sensu St. Hil. Pl. Us. Bras. *pl. 26–28*. 1825, Fl. Bras. Merid. **1**: 24. 1825; Spach, Hist. Nat. Veg. **7**: 437. 1839; non L. f.

Shrub or small tree, the branchlets brownish or cinereous (or subglaucous when young), rugulose, subterete, comparatively slender (1.5–5 mm. in diameter toward apices); petioles rugulose, shallowly canaliculate; leaf-blades coriaceous or thin-coriaceous, glaucous beneath or at length pale brown, often papillate beneath with minute club-shaped or knob-like papillae, not obviously punctate, variously shaped, often elliptic-obovate, sometimes nearly lanceolate, rarely exceeding 11 cm. in length and 4 cm. in breadth, acute or attenuate at base and decurrent on the petiole, rounded or broadly obtuse or emarginate at apex, more or less recurved to revolute at margin, the costa nearly plane or shallowly canaliculate above, prominent beneath, the secondary nerves 6–10(–14) per side, erecto-patent or spreading, sometimes immersed and obscure; inflorescences terminal or axillary, usually umbellate (flowers sometimes single or fasciculate), the peduncle less than 40 mm. long, the flowers up to 6 per inflorescence, the pedicels 5–40 mm. long (50–80 mm. in var. *roraimensis*); sepals membranaceous to papyraceous, usually obscurely glandular, 4–7 mm. long, 4–8 mm. broad, rounded to apiculate at apex; petals 8–14 (rarely to 20), membranaceous, opaquely yellow-glandular, oblong to elliptic-oblong, 6–17 mm. long, 2–6 mm. broad, obtuse at apex; stamens 18–50, 2–4-seriate, the filaments carnose, somewhat flattened, 0.5–2.5 mm. long, the connective glandular, often conspicuously yellow-glandular at apex, the locules ellipsoid, 0.4–0.8 mm. long; carpels 3–9(–13), obovoid, 1.5–2.5 mm. long at anthesis, rounded at apex, the stigma lateral near apex or subterminal, usually short-stipitate (sessile in var. *roraimensis*), the ovules 6–12, on short placentas.

DISTRIBUTION: Southeastern Brazil and adjacent Paraguay and Argentine, with one variety from Mt. Roraima on the boundary of Venezuela, Brazil, and British Guiana; four varieties are recognizable. The type of *D. granadensis* var. *campestris* St. Hil., for reasons pointed out below, is here selected as the type of *D. brasiliensis* and its typical variety (var. *campestris*).

The Brazilian population of *Drimys* was first treated by St. Hilaire, who considered his Brazilian specimens to be conspecific with the Colombian ones (*D. granadensis*) and different from the Chilean-Magellanic ones (*D. Winteri*). St. Hilaire recognized four Brazilian varieties. He considered the most common of these to be var. *campestris,* which is described in detail, whereas the remaining varieties are discussed only as to their points of difference. As long as these varieties are considered under *D. granadensis,* the question of the typification of a Brazilian species does not arise. But Miers, in erecting *D. brasiliensis,* founded it upon St. Hilaire's concept (exclusive of var. *montana,* which Miers considered specifically distinct) without designating which of St. Hilaire's varieties he wished to accept as the type.

The Brazilian plant has not generally been considered as a species, and as far as I can ascertain no author has attempted definitely to typify it. Hauman was content to accept it as outlined by Miers, with the difference that he again submerged var. *montana*. Since no author has selected a type for *D. brasiliensis,* it therefore becomes necessary to do so. St. Hilaire clearly considered var. *campestris* to be the most common of his Brazilian varieties, and since this variety is the only one he fully described, I believe that it may be taken as the principal basis of St. Hilaire's concept and considered the type of *D. brasiliensis* Miers.

Var. *campestris* is said to grow in Minas Geraes, but no definite locality is given. It grows "dans les lieux découverts (*campos*), le plus souvent sur le bord des ruisseaux." A specimen in the herbarium of the New York Botanical Garden, collected by St. Hilaire and marked "*Drymis Granatensis* var. *campestris,*" may thus be taken as a portion of the type collection of *D. brasiliensis* Miers.

St. Hilaire's second variety, var. *sylvatica,* is said to differ from var. *campestris* in having its leaf-blades proportionately narrower and its petals larger. A comparison of St. Hilaire's two plates discloses only inconsequential individual differences. A portion of the type collection of this variety (NY) also shows that the differences between it and var. *campestris* are trivial. I have no hesitation in submerging var. *sylvatica.*

St. Hilaire's third variety, var. *axillaris,* is said to occur in the vicinity of Villa Rica ("sur les montagnes ferrugineuses"). It is not illustrated, nor have I seen specimens referable to it, but I find only the most inconsequential individual differences pointed out in St. Hilaire's description.

St. Hilaire's fourth variety, var. *montana,* is said to occur in the mountains of the Serra Negra, on the boundary of the States of Minas Geraes and Rio de Janeiro. It is said to be characterized by small leaves and reduced (and sometimes 1-flowered) inflorescences, which are axillary rather than terminal. These differences also appear to be trivial, and I find no reason to maintain the variety.

The Brazilian specimens were next considered by Miers, who proposed the name *D. brasiliensis* to include three of St. Hilaire's four varieties (excluding var. *montana*). The varietal names were transferred from *D. granadensis* to *D. brasiliensis* by Miers without comment. Var. *montana* was erected as a distinct species by Miers, who differentiated it on the grounds that ". . . it differs from *D. brasiliensis,* not only in the size and form of its leaves, but in its axillary inflorescence, and in the number of the parts of its smaller flowers." These differences appear to be entirely inconsequential, the matter of axillary versus terminal inflorescence being susceptible to great variation in *Drimys,* and the number and size of floral parts being dependable only within very broad limits. The variation in the size and shape of leaves is often conspicuous even on the same individual. Therefore I have no hesitation in referring *D. montana* to *D. brasiliensis* as a synonym.

The remaining Brazilian specimens available to Miers were placed in two species, *D. retorta* and *D. angustifolia.* Both are very much reduced in foliage and appear to be reasonably good varieties of *D. brasiliensis.*

Eichler considered the genus as a whole, referring all the American specimens to *D. Winteri.* He considered the bulk of the Brazilian material to be identical with the Colombian plants, which he referred to the forma *granadensis.* However, he recognized Miers' two species *D. retorta* and

D. angustifolia to the extent of keeping them as forms of *D. Winteri* (the first as f. *revoluta*); both are well illustrated in Flora Brasiliensis.

Hauman, in discussing the occurrence of *D. brasiliensis* in the Argentine, recognized two varieties, based respectively on St. Hilaire's varieties *compestris* and *montana*. The differences pointed out by him seem inconsequential when an extensive series of collections is considered.

On the basis of the material available to me, and taking into consideration previous descriptions and illustrations of this complex, I believe that the bulk of the Brazilian material may be referred to a single variety, designated as var. *campestris*, the typical variety of the species. Miers' two species *D. retorta* and *D. angustifolia* are given varietal rank, and a fourth very distinct variety is described on the basis of collections from Mt. Roraima.

ESSENTIAL DIAGNOSTIC CHARACTERS OF THE VARIETIES

Leaf-blades narrowly elliptic-obovate or oblong or elliptic, (3–)4–11(–14) cm. long, (0.8–)1.2–4(–5) cm. broad, rounded or broadly obtuse or faintly emarginate at apex, usually narrowly recurved at margin, rarely revolute, the secondary nerves prominulous or immersed, usually visible, erecto-patent at an angle of 40–50°; inflorescences usually terminal and umbellate, the peduncle up to 40 mm. long, the pedicels 5–40 mm. long; stamens with a truncate connective; stigma short-stipitate; Bahia to Paraguay, Misiones, and Rio Grande do Sul..........4a. var. *campestris*.

Leaf-blades narrowly elliptic- or oblong-lanceolate, (2–)2.5–5.5 cm. long, (0.2–)0.3–1.5 cm. broad, usually conspicuously emarginate at apex, strongly revolute at margin, the secondary nerves completely immersed and obscure; inflorescences usually appearing axillary, the peduncle inconspicuous, up to 15 mm. long, the pedicels 15–33 mm. long; stamens with a truncate connective; stigma short-stipitate; Minas Geraes and São Paulo..4b. var. *retorta*.

Leaf-blades elongate- or linear-lanceolate, 4–10 cm. long, 0.5–0.6 cm. broad, obtuse or faintly emarginate at apex, slightly recurved at margin but essentially plane, the secondary nerves completely immersed and obscure; inflorescences terminal, the flowers usually single; southeastern Brazil ....4c. var. *angustifolia*.

Leaf-blades oblong-elliptic, 6–11 cm. long, 2.5–5 cm. broad, obtuse or rounded at apex, faintly recurved at margin, the secondary nerves usually prominulous on both sides, spreading at an angle of 55–70°; inflorescences axillary, the flowers single or paired on a slender peduncle, the pedicels 50–80 mm. long; stamens with the connective apiculate, densely glandular, and exceeding the locules by about 0.15 mm.; stigma sessile; Mt. Roraima..4d. var. *roraimensis*.

4a. **Drimys brasiliensis** var. **campestris** (St. Hil.) Miers in Ann. Mag. Nat. Hist. III. **2**: 48. 1858, Contrib. Bot. **1**: 137. *pl. 25B* (as *D. brasiliensis*). 1861; Hauman in Comun. Mus. Nac. Buenos Aires **2**: 50. 1923; Hauman & Irigoyen in An. Mus. Nac. Buenos Aires **32**: 226. 1923.

Drimys granadensis var. *campestris* St. Hil. Pl. Us. Bras. *pl. 26*. 1825, Fl. Bras. Merid. **1**: 25. 1825.

Drimys granadensis var. *sylvatica* St. Hil. Pl. Us. Bras. *pl. 27*. 1825, Fl. Bras. Merid. **1**: 25. 1825.

Drimys granadensis var. *axillaris* St. Hil. Pl. Us. Bras. sub *pl. 26*. 1825, Fl. Bras. Merid. **1**: 25. 1825.

Drimys granadensis var. *montana* St. Hil. Pl. Us. Bras. *pl. 28*. 1825, Fl. Bras. Merid. **1**: 25. 1825.

Drimys Winteri sensu Vell. Fl. Flum. 240. 1825, Fl. Flum. Ic. **5**: *pl. 132*. 1827; non J. R. & G. Forst.

Drimys granadensis sensu Spach, Hist. Nat. Vég. Phan. Atlas, *pl. 60*. 1846; non L. f.

Drimys brasiliensis var. *sylvatica* Miers in Ann. Mag. Nat. Hist. III. **2**: 48. 1858, Contrib. Bot. **1**: 137. 1861.

Drimys brasiliensis var. *axillaris* Miers in Ann. Mag. Nat. Hist. III. **2**: 48. 1858, Contrib. Bot. **1**: 137. 1861.

Drimys montana Miers in Ann. Mag. Nat. Hist. III. **2**: 44. 1858, Contrib. Bot. **1**: 133. 1861; Pilger in E. & P. Nat. Pfl. Nachtr. **2**: 108. 1906.

Drimys Winteri var. *semiglobosa* Dusén in Arch. Mus. Nac. Rio **13**: 62. 1905.

Drimys brasiliensis var. *montana* Hauman in Comun. Mus. Nac. Buenos Aires **2**: 50. 1923; Hauman & Irigoyen in An. Mus. Nac. Buenos Aires **32**: 227. 1923.

Shrub or tree, up to 13 m. high, the branchlets 2–5 mm. in diameter toward apices; leaves scattered or crowded along distal portions of branchlets, usually evenly distributed and not clustered in whorls; petioles 3–17(–30) mm. long, 1–2 mm. in diameter, somewhat swollen toward base; leaf-blades coriaceous or thin-coriaceous, pale brown to greenish and usually shining above when dried, narrowly elliptic-obovate or oblong or elliptic, (3–)4–11(–14) cm. long, (0.8–)1.2–4(–5) cm. broad, rounded or broadly obtuse or faintly emarginate at apex, narrowly recurved to conspicuously revolute at margin, often more obviously so toward base, the secondary nerves 6–10(–12) per side, erecto-patent at an angle of 40–50°, scarcely prominulous or immersed above, prominulous or immersed beneath, inconspicuously anastomosing toward margin, the veinlets immersed; inflorescences usually aggregated at apices of branchlets, rarely axillary, umbellate (flowers rarely single, occasionally fasciculate), the peduncle up to 40 mm. long, usually obviously flattened, the flowers (1–)2–6 per inflorescence, the pedicels 5–40 mm. long; sepals membranaceous or submembranaceous, obscurely opaque- or pellucid-glandular, suborbicular or deltoid-orbicular, 4–7 mm. long, 4–8 mm. broad; petals 8–14 (rarely to 20), opaque-yellow-glandular or very sparsely so, 7–17 mm. long, 2–5 mm. broad; stamens 20–40(–50), the filaments 0.5–2.5 mm. long, the connective yellow-glandular (usually conspicuously so at apex, sometimes scarcely so); carpels 3–8(–13), the stigma conspicuous, on a stipe usually 0.2–0.5 mm. long, the ovules 6–12. (FIG. 3, g–j.)

DISTRIBUTION: Southeastern Brazil (Bahia to Paraná [and Rio Grande do Sul, according to Eichler]), adjacent Paraguay, and Misiones in northern Argentine, at altitudes between 800 and 1250 m. (according to collectors' incomplete data, but probably found both lower and higher); occurring in forests, woods, or campos, often on shores of streams; said to be fairly common in parts of Minas Geraes.

BRAZIL: Bahia: Rio de Contas, Bom Jesus, *Lützelburg 268* (NY); Minas Geraes: *St. Hilaire* (TYPE COLL. of *D. granadensis* var. *campestris*, NY), *St. Hilaire* (TYPE COLL. of *D. granadensis* var. *sylvatica*, NY), *Gardner 4402* (M, NY, US), *Claussen* (F, NY), *1064* (GH); Rio Tejuco, *Ackermann* [*Mart. Herb. Fl. Bras. 288*] (GH, M, NY), *Vauthier 489* (GH); Diamantina, Olaria, *Mexia 5791* (A, GH, M, NY, UC, US); Jacuba, Serra dos Crystaes, Mun. Diamantina, *Mello Barreto 10069* (F); Serra da Piedade, Mun. Caeté, *Mello Barreto 7451* (F), *Warming* (NY); Serra de Cipó, Mun. Santa Luzia, *Mello Barreto 7452* (F); Caldas, *Regnell 145* (US), *Mosén 331* (NY); Rio de Janeiro: Vargem, Organ Mts., *Miers 4606* (US); São Paulo: *Lund* (NY); Serra de Cubatão, *Burchell 3567* (GH, NY); Alto da Serra, *Hoehne 1205* (A, US); Butantan, *Hoehne 3839* (GH); Jardim Botanico, São Paulo, *Hoehne 28700* (F, NY); Paraná: Pinhaes, *Dusén 14504* (M); without definite locality: *Sellow* (M), *Burchell 4748* (GH), *Riedel* (A), *Collector?* (M).

PARAGUAY: Sierra de Amambay, *Rojas 9992* (A), *10586* (A).

ARGENTINE: Misiones: No specimens seen, but those cited by Hauman indicate the occurrence of the variety in Misiones.

NATIVE NAMES: *Casca d'Anta, cataia, curvillo* (in Brazil). St. Hilaire has discussed native uses of this plant, and his data are repeated by subsequent writers.

Collectors of the above-listed specimens note this plant as a shrub or tree, as low as 50 cm. high in open situations on campos and up to 13 m. high in the forests. Probably this difference in habit has been the principal reason why St. Hilaire and other writers have distinguished varieties within this entity, which, on the basis of the material I have seen, cannot satisfactorily be further divided.

The majority of the specimens which I refer to *D. brasiliensis* is characterized by having the lower surfaces of the leaf-blades distinctly papillate. Papillae are obviously present in the specimens of var. *retorta* and var. *roraimensis,* but they are lacking in the following specimens of var. *campestris: Lützelberg 268, Claussen 1064, Miers 4606, Burchell 3567, Hoehne 1205* and *28700,* and *Dusén 14504.* The remaining specimens of var. *campestris* have the lower leaf-surfaces clearly papillate. Whether the presence or absence of such papillae is a fundamental character cannot be stated at present, but quite possibly the population under discussion should be broken up into varieties on this basis. On the other hand, the papillate and the non-papillate specimens present no geographic pattern, nor is this character accompanied by any other. In leaf-size, number and size of floral parts, etc., there is considerable variation within var. *campestris,* but such variation in different organs is not correlated and therefore, in the present state of our knowledge, not usable for further subspecific division.

4b. **Drimys brasiliensis** var. **retorta** (Miers) comb. nov.

Drimys retorta Miers in Ann. Mag. Nat. Hist. III. **2:** 45. 1858, Contrib. Bot. **1:** 134. *pl. 26B.* 1861; Pilger in E. & P. Nat. Pfl. Nachtr. **2:** 108. 1906.
Drimys Winteri f. *revoluta* Eichl. in Mart. Fl. Bras. **13**(1): 136. *pl. 31, f. 2.* 1864.
Drimys ledifolia Eichl. in Mart. Fl. Bras. **13**(1): 136, as synonym. 1864.

Shrub to 3 m. high, the branchlets 1.5–4 mm. in diameter toward apices; leaves crowded on branchlets, especially distally; petioles 3–11 mm. long, 0.7–1.5 mm. in diameter; leaf-blades coriaceous, dark green above when dried, narrowly elliptic- or oblong-lanceolate, (2–)2.5–5.5 cm. long, (0.2–)0.3–1.5 cm. broad, usually conspicuously emarginate at apex, sometimes merely rounded, strongly revolute at margins (lower leaf-surface often completely obscured by revolute margins), the secondary nerves and veinlets completely immersed and obscure; inflorescences aggregated around growing points, appearing axillary, umbellate (or flowers sometimes single), the peduncle rugulose, inconspicuous, up to 15 mm. long or obsolete, the flowers (1–)2–6 per inflorescence, the pedicels slender, 15–33 mm. long; sepals papyraceous, opaque, obscurely glandular, suborbicular-ovate, 5–6 mm. long, 4–7 mm. broad; petals 8–11, conspicuously opaque-yellow-glandular, 6–12 mm. long, 2–5 mm. broad; torus cylindric, conspicuous; stamens 30–40, the filaments 1.5–2.5 mm. long, eglandular, the connective copiously and minutely yellow-glandular at apex; carpels 3–7, the stigma short-stipitate (stipe 0.3–0.7 mm. long), the ovules 6 or 7.

DISTRIBUTION: Minas Geraes, Brazil; probably restricted in area. Miers also cites a collection by Bowie from São Paulo. Eichler cites *Claussen 340* and *Sellow,* both from Minas Geraes.

BRAZIL: Minas Geraes: *Claussen s. n.* or *1503* (COTYPE COLL., F); Serra do

Itacolomy, Mun. Ouro Preto, *Mello Barreto 9083* (F) (shrub 3 m. high, common; flowers white).

A few of the specimens referred to the typical variety of *D. brasiliensis* (var. *campestris*) have unusually small and strongly revolute leaf-blades, thus indicating a transition between that variety and var. *retorta*. The existence of such specimens (e. g. *Mello Barreto 7452, 10069, Mexia 5791*) indicates that *D. retorta* can be accepted as no more than a variety, and probably not a very stable one.

4c. **Drimys brasiliensis** var. **angustifolia** (Miers) comb. nov.

Drimys angustifolia Miers in Ann. Mag. Nat. Hist. III. **2:** 46. 1858, Contrib. Bot. **1:** 135. *pl. 26A*. 1861; Pilger in E. & P. Nat. Pfl. Nachtr. **2:** 108. 1906.

Drimys Winteri f. *angustifolia* Eichl. in Mart. Fl. Bras. **13**(1): 136. *pl. 31, f. 3*. 1864.

Branchlets slender; leaves scattered along branchlets distally; petioles slender, narrowly winged, 8–10 mm. long; leaf-blades elongate- or linear-lanceolate, 4–10 cm. long, 0.5–0.6 cm. broad, obtuse or faintly emarginate at apex, slightly recurved at margin but essentially plane, the secondary nerves entirely immersed and obscure; inflorescences aggregated at apices of branchlets, the flowers single or rarely paired on short inconspicuous peduncles, the pedicels about 12 mm. long; sepals ovate; petals 9 or 10; stamens about 18; carpels about 5.

DISTRIBUTION: Known only from a single unnumbered collection of Sellow from southeastern Brazil, without detailed locality, cited by Miers and Eichler.

I have seen no material of this plant, the above notes being taken from the descriptions and illustrations of Miers and Eichler. It appears to be sufficiently distinct to be recognized as a variety of *D. brasiliensis*. Both Miers and Eichler discuss it as an even more extreme form than *D. retorta*.

4d. **Drimys brasiliensis** var. **roraimensis** var. nov.

Drimys granadensis sensu Oliver in Trans. Linn. Soc. II. Bot. **2:** 271. 1886; N. E. Br. in Trans. Linn. Soc. II. Bot. **6:** 8. 1901; non L. f.

Drimys Winteri sensu Ule in Bot. Jahrb. **52:** Beibl. 115: 49. 1914; Knuth in Rep. Sp. Nov. Beih. **43:** 331. 1927; non J. R. & G. Forst.

Arbor parva (?), ramulis apicem versus 2–4 mm. diametro; foliis apicem ramulorum versus confertis; petiolis 5–15 mm. longis, 0.7–2 mm. diametro; laminis subcoriaceis, supra in sicco fuscis vel fusco-viridibus, oblongo-ellipticis, 6–11 cm. longis, 2.5–5 cm. latis, apice obtusis vel rotundatis, margine obscure recurvatis, nervis secundariis utrinsecus 7–14 angulo 55–70° patentibus utrinque prominulis vel subplanis, venulis immersis vel utrinque leviter prominulis; inflorescentiis ut videtur axillaribus et solitariis, floribus singularibus vel pedunculo gracili circiter 35 mm. longo binis, pedicellis gracilibus 50–80 mm. longis; sepalis papyraceis ovato-deltoideis circiter 5 mm. longis et 6 mm. latis; petalis 10–12 obscure glandulosis, 10–16 mm. longis, 3–6 mm. latis; staminibus 35–50, filamentis sparse luteo-glandulosis 1.5–2 mm. longis, connectivo dense glanduloso in apiculum circiter 0.15 mm. longum dense et minute luteo-glandulosum producto; carpellis circiter 9, stigmate sessili subterminali, ovulis 10–12. (FIG. 3, k–m.)

DISTRIBUTION: Known only from Mt. Roraima, on the Venezuela-Brazil-British Guiana boundary.

VENEZUELA (or adjacent countries): Amazonas: Mt. Roraima, The Ledge, *im*

Thurn 242 (US, TYPE), 1884; Rondon Camp, upper slopes, alt. about 2100 m., *Tate 500* (NY) (in humid temperate forest).

The variety described above is quite distinct from other American material of *Drimys,* being characterized by the apiculate and very densely glandular connective of the stamens. The long pedicels are also noteworthy, as is the fact that the stigma is essentially sessile, whereas in other specimens from the northern part of the range of the genus the stigma is short-stipitate. As my description is based upon only two specimens (of which the Tate collection is sterile), the rigidity of these characters remains to be seen. The relationship of this Roraima plant seems to be with the Brazilian rather than the Andean-Mexican species, as evidenced by the papillate lower leaf-surface and the rounded or broadly obtuse leaf-apex. It seems conceivable that this Roraima form may prove to merit specific status when more ample material is available.

EXCLUDED SPECIES

DRIMYS VASCULARIS Parment. in Bull. Sci. Fr. & Belg. **27:** 229, 306. *pl. 11, f. 39, 40.* 1896.

In a footnote on page 229 of the above-cited publication, Parmentier states: "Etiquette: 'Drimys. — Brésil; Martins; cortex aromaticus.' (Unicum)." The description is detailed as far as anatomical details are concerned, but the habit-sketch (*f. 39*) cannot possibly be taken to represent a species of *Drimys.* On p. 229 we read: "N'ayant eu à ma disposition que des fleurs mal conservées, très petites, il m'a été impossible d'en reconnaître tous les caractères; j'ai néanmoins pu m'assurer que ce sont bien des fleurs de *Drimys,* surtout à cause de la forme de leur calice." In view of this uncertainty, Parmentier would have been wiser not to have proposed the species at all; in fact, had Parmentier's work in its entirety never been published, taxonomy would have benefited from the omission. Van Tieghem's remarks (**11:** 284, 285) in this connection are of interest.

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PLANTAE PAPUANAE ARCHBOLDIANAE, XI*

E. D. MERRILL AND L. M. PERRY

With seven text-figures

THIS paper, consisting of a consideration of the Ranunculaceae and the Begoniaceae, is a continuation of the series being published on the plants collected by the Archbold Expeditions in New Guinea; a few plants from the Solomon Islands are included in the discussion.

RANUNCULACEAE

Clematis Linnaeus

Clematis Gouriana Roxb. ex DC. var. **malaiana** Miq. Ann. Mus. Bot. Lugd.-Bat. **4**: 66. 1869.

Clematis Vitalba Linn. var. *javana* (DC.) O. Ktze. Verh. Bot. Ver. Prov. Brandenb. **26**: 100. 1885; K. Schum. & Hollr. Fl. Kais. Wilhelms Land 47. 1889; K. Schum. & Lauterb. Fl. Deutsch. Schutzg. Südsee 311. 1900.

Clematis Gouriana sensu Kaneh. & Hatus. Bot. Mag. Tokyo **52**: 354. 1938, non Roxb.

NETHERLANDS NEW GUINEA: Balim River, *Brass 11788,* December 1938, alt. 1600 m., climbing over stone walls in secondary forest. BRITISH NEW GUINEA: Rona, Laloki River, *Brass 3611,* April 1933, alt. 450 m., light rain-forests on valley slopes, climbing over small trees and bushes (branches corrugated; pale crinkled leaves).

In view of the consistent texture and lack of pubescence of the leaves in this species, as represented by a considerable number of collections from India and China, we believe it is more advantageous to maintain Miquel's variety for this material with leaves less coriaceous and obviously pubescent.

Clematis glycinoides DC. Reg. Veg. Syst. Nat. **1**: 145. 1817; Benth. Fl. Austr. **1**: 7. 1863; F. v. Muell. Pap. Pl. **2**: 40. 1886; F. M. Bail. Queensl. Fl. **1**: 5. 1899.

Clematis stenosepala DC. l. c. 147.

BRITISH NEW GUINEA: Wassi Kussa River, Tarara, *Brass 8423,* December 1936, scrambling in rain-forest second growths.

The leaves of the collection are thinly chartaceous and broader than in most Australian specimens examined, but the flowers of this staminate material agree very well with those of most collections so designated. The sepals have a distinct mucro 0.5–1 mm. long.

Clematis papuasica sp. nov.

Frutex scandens; ramis leviter sulcatis subteretibus; ramulis hornotinis parce pubescentibus vel glabratis; foliis 3-foliolatis glabris vel interdum pilis brevibus paucis conspersis chartaceis vel subcoriaceis, 10–17 cm. longis et 5–9 cm. latis; foliolis ellipticis vel ovato-ellipticis utrinque angustatis vel basi rotundato-cuneatis, apice acuminatis vel acutis, margine integris, 5-nervatis, nervis prominulis 2 interdum basim ± 7 mm. supra

*Botanical Results of the Richard Archbold Expeditions. See Jour. Arnold Arb. **23**: 383–416. 1942.

ortis, venis manifestis, reticulo inconspicuo; petiolulo 1.5–2.5 cm. longo parce pubescente vel glabro; petiolo 8–12 cm. longo; paniculis axillaribus 20–25 cm. longis, axi, ramulis et pedicellis subcrispe pubescentibus, pedicellis 1.5–2.5 cm. longis; floribus 1–3-fasciculatis; sepalis 4 patentibus lineari-oblongis, 7–8 mm. longis, 2 mm. latis, apice obtusiusculis apiculatis, extus dense minute pubescentibus; staminibus 3-seriatis, filamentis 3 mm. longis complanatis linearibus quam antheris angustioribus glabris, interioribus brevioribus, antheris anguste oblongis 1.4 mm. longis glabris, loculis marginalibus, connectivo rostrato-subclavato 2 mm. longo; achaeniis ± 16 in sicco pallide brunneis ovoideis, 5 mm. longis, 2–2.5 mm. latis, pubescentibus, in stylum persistentem pilis longis plumosum curvatum (3–) circiter 6 cm. longum attenuatis.

BRITISH NEW GUINEA: Ihu, Vailala River, *Brass 1010,* February 1926, climbing over rain-forest trees (large vine; leaves pale and shining); Buna District, *Lane-Poole 179.* SOLOMON ISLANDS: Bougainville: Koniguru, Buin, *Kajewski 2174,* August 1930, alt. 900 m., common in rain-forest (vine; sepals whitish green; stamens numerous); Malaita: Quoimonapu, *Kajewski 2379,* December 1930, alt. 200 m., common in rain-forest; Ysabel: Meringe, *Brass 3168* (TYPE), November 1932, coast to 300 m., rain-forest on limestone hills (scandent; leaves fleshy and very glossy; flowers white, faintly perfumed); same locality, *Brass 3411,* December 1932, alt. 200 m., rain-forest clearing, climbing over low bushes (leaves thick, pale, very glossy, with slightly recurved margins; fruit pale green).

This material has been passing for *Clematis Pickeringii* A. Gray. With several Fijian collections for comparison, including Gray's fragmentary type, we find ourselves unable to accept the Papuasian plant here cited as representing that species. The anther-appendages of *C. Pickeringii* are minute (less than 0.5 mm. long) in all the collections we have seen. In *C. papuasica* they are more like those of *C. aristata* DC. but very narrowly club-shaped towards the tip, while the leaves are larger and quite different from those of the Australian species. It should be noted that the plumose style is shorter in the Papuan material and the achenes are smaller; probably this is owing to a difference in stage of development.

Clematis phanerophlebia sp. nov.

Frutex scandens inflorescentia excepta glaber; ramulis leviter sulcatis; foliis coriaceis 3-foliolatis vel interdum simplicibus; foliolis lanceolato-oblongis vel anguste ellipticis, 5–13 cm. longis et 2–5.5 cm. latis; costa valida, nervis utrinque 2 subparallelis fere a basi laminae ortis plus minusve secus marginem decurrentibus, externo magis obscuro, interno praesertim trabeculis conspicuis 3–7 cum costa conjuncto, reticulo caeterum utrinque manifesto; petiolo 7–14 cm. longo, petiolulo terminali 0.7–2 cm. longo, laterali 0.5–1.5 cm. longo; inflorescentiis axillaribus paniculatis saepe quam foliis longioribus; sepalis 4 lineari-lanceolatis, 7 mm. longis, 1.5–2 mm. latis, apice angustatis mucronatis; staminodiis 4 circiter pistillum subaequantibus, filamentis complanatis quam antheris latioribus, connectivo aristato; ovario ovoideo complanato dense pubescente, stylo 6–7 mm. longo piloso, stigmate recurvo glabro; achaeniis circiter 14 ovoideis, 2 mm. longis, 1 mm. latis, pubescentibus, in stylum persistentem pilis longis plumosum curvatum ± 3 cm. longum attenuatis.

NETHERLANDS NEW GUINEA: 9 km. northeast of Lake Habbema, *Brass 10772,* October 1938, alt. 2700 m., scrambling in secondary forest; Bele River, 18 km. northeast of Lake Habbema, *Brass 11235* (TYPE), November 1938, alt. 2300 m., occasional in secondary forest.

These collections are unlike others we have examined in their definitely coriaceous leaves and the conspicuous venation. Not only are the primary veins prominent, but the horizontal veins are more obvious than usual. The staminodes do not have the long clavate appendage characteristic of *C. papuasica* but are more like those of *C. aristata* DC.

Clematis Archboldiana sp. nov.

Frutex scandens; ramulis novellis, petiolis, petiolulis, axi inflorescentiae, pedicellis fulvo-flocculoso-tomentosis; ramulis teretibus; foliis coriaceis 3-foliolatis, superioribus interdum simplicibus; foliolis ovatis obtusis basi rotundatis, 2.5–6 cm. longis et 1.2–3.7 cm. latis, supra glabratis (minute flocculosis), subtus dense ferrugineo-flocculoso-tomentosis; costa valida, nervis primariis utrinque 2, externo magis obscuro, interno trabeculis inconspicuis vel subobscuris 2–4 cum costa conjuncto; reticulo subobscuro; petiolo 1.5–5 cm. longo, petiolulo terminali 1–1.5 cm. longo, laterali 0.7–1 cm. longo; inflorescentiis paniculatis axillaribus terminalibus; pedicellis ± 1 cm. longis; sepalis ut videtur 4 lanceolatis acutiusculis, 5 mm. longis et 2 mm. latis, intus trinerviis, extus dense flocculoso-tomentosis; staminibus vel staminodiis(?) glabris circiter stylos aequantibus, filamentis compressis linearibus 5 mm. longis, antheris vix 1 mm. longis, loculis marginalibus 0.4 mm. infra apiculum obtusum positis; achaeniis numerosis (± 28), immaturis 2 mm. longis et 1 mm. latis, compressis, dense pilosis, apice in stylum persistentem plumosum vix 2 cm. longum attenuatis.

NETHERLANDS NEW GUINEA: Bele River, 18 km. northeast of Lake Habbema, *Brass 11366* (TYPE), November 1938, alt. 2200 m., common climber in young secondary rain-forest.

This collection of pistillate material is past the flowering stage and only by a careful search of the duplicates were we lucky enough to find a flower showing the few stamens still adhering. These appear to be sterile, but at least they give a clue to the type of stamens to be expected in the staminate plant. The general habit of the species is similar to that of the other species of the region belonging to the Section *Flammula* Prantl, but the crisp somewhat flocculose tomentum is unlike the type of pubescence in any of the species available for examination.

Ranunculus Linnaeus

Five species of *Ranunculus* Linn. have been reported from New Guinea. As usual, we have at hand little material for comparison, and again the original diagnoses sometimes lack definition of specific characters. We have been unable to apply the descriptions of *R. Muelleri* Benth. and *R. tridens* Ridl. to any of the collections before us. All the species represented have flowers borne on leafless scapes, petals with a yellow upper surface, and sepals spreading or ascending but not reflexed. The species are mostly of Australian alliance.

Ranunculus perpusillus sp. nov.

Planta pumila acaulis; caudice 1–2 cm. longo fibris vestito; foliis omnibus basalibus; petiolo 1.5 cm. longo (basi vaginante 5 mm. longa inclusa) patenti-piloso; lamina 5–6 mm. longa tripartita, segmentis integris linearibus vel anguste lanceolatis obtusiusculis interdum consperse pilosis; scapis 1–2, unifloris aphyllis patenti-pilosis folia subaequantibus vel in fructu quam foliis longioribus; sepalis 2.5–3 mm. longis, 1 mm. latis, concavis ± patentibus apicem versus parce pilosulis; petalis 5 mm. longis, 1–1.2 mm. latis, oblongo-linearibus, apice obtusis, basim versus paullo angustatis, basi squamula minuta nectarium tegente praeditis; staminibus 5, circiter 2.5 mm. longis; receptaculo brevi; achaeniis paucis ± 4, oblique ovatis compressis, stylo apice tantum leviter recurvo.

NETHERLANDS NEW GUINEA: 2 km. east of Wilhelmina-top, *Brass & Myer-Drees 10381* (TYPE), September 1938, alt. 3700 m., amongst short grasses (flowers yellow).

This species somewhat resembles *Ranunculus Millani* F. v. Muell., of the Australian mountains and Tasmania, but a comparison with authentic material of that species, in the Gray Herbarium, collected by von Mueller, shows a real contrast in floral characters. The peduncle of *R. Millani* is much shorter than the petioles, the petals are about as broad as long, and the plant as a whole is less pubescent.

Ranunculus bellus sp. nov.

Planta nana acaulis; rhizomate brevi; foliis dense rosulatis parvis; lamina oblonga vel late lanceolata, 5 mm. longa, 3 mm. lata, utrinque hirsuta, sensim in petiolum basi dilatatum 4 mm. longum et 2 mm. latum extus adpresse hirsutum confluente; flore sessili terminali; sepalis uninerviis 5 oblongis, 4 mm. longis, 1.2 mm. latis, extus praecipue apicem versus costa hirsutis; petalis 5 lineari-spathulatis, 5 mm. longis, 0.5 mm. latis, 3-nerviis, nectario parvo haud obvio ad medium laminae posito; staminibus 5, filamentis 3 mm. longis; achaeniis novellis 12–15, levibus, 1 mm. longis, in rostrum subaequilongum tenuem fere rectum angustatis, maturis semiellipticis, 2 mm. longis, 1 mm. latis, compressis, in rostrum leviter recurvatis; receptaculo hirsuto subplano.

NETHERLANDS NEW GUINEA: 7 km. northeast of Wilhelmina-top, *Brass & Myer-Drees 9867* (TYPE), September 1938, alt. 3560 m., gregarious in alpine bogs (flat rosettes 1.5–2 cm. diameter; flowers yellow).

This plant may be of the affinity of *Ranunculus recens* Kirk of New Zealand. Both are small plants, but that of New Guinea is smaller and densely covered with pubescence, the very small leaves are entire, the scape is apparently absent, and the achenes are cultriform. In this plant the petiole as such is practically lacking except for the broad sheathing base.

Ranunculus angustipetalus sp. nov.

Planta parva acaulis; caudice valde abbreviato; radicibus fibrosis; foliis omnibus basalibus; lamina crasse chartacea fere glabra, margine et subtus praecipue ad costam pilosa, oblonga, 1–1.5 cm. longa, 0.5 cm. lata, basi sensim in petiolum brevem (3–8 mm. longum) ± adpresse hirsutum angustata, basi vaginante 0.8–2 cm. longa extus dense adpresse hirsuta; scapis solitariis aphyllis unifloris circiter folia aequantibus parce adpresse hirtellis; sepalis 5–6 mm. longis, 2 mm. latis, margine membranaceis, ad apicem angustatum parce hirsutis; petalis anguste oblongis, 9–10 mm. longis, 2.5 mm. latis, 1 mm. supra basim squamula nectarium tegente praeditis;

staminibus 15–20 circiter 5 mm. longis; achaeniis ± 18, stylo apice leviter recurvo.

NETHERLANDS NEW GUINEA: 7 km. northeast of Wilhelmina-top, *Brass & Myer-Drees 9866A* (TYPE), September 1938, alt. 3560 m., few plants in alpine bog (petals long and narrow, underside red).

The fruit of this species is immature. The petioles and basal sheaths are densely appressed-hirsute, but the leaf-blades are almost glabrous. Another distinctive character is in the long narrow petals. The species obviously is of the same group to which *Ranunculus amerophyllus* F. v. Muell. belongs, but closer than that we cannot place it.

Ranunculus amerophyllus F. v. Muell. Trans. Roy. Soc. Vict. **1**(2): 1. 1889; Kew Bull. **1899:** 96. 1899; Ridl. Trans. Linn. Soc. Bot. II. **9:** 10. 1916.

NETHERLANDS NEW GUINEA: Lake Habbema, *Brass 9245,* August 1938, alt. 3225 m., forming small carpets on wet grassy shores of lake (lower side of petals purple-brown); 7 km. northeast of Wilhelmina-top, *Brass & Myer-Drees 9792,* September 1938, alt. 3560 m., in wet grassy valley; 11 km. northeast of Wilhelmina-top, *Brass & Myer-Drees 9709* (possibly also *9740,* same locality), September 1938, alt. 3400 m., in grass on moist western slope (corolla yellow within, the outer upper part dark). BRITISH NEW GUINEA: Mount Albert Edward, southwest slope, *Brass 4266,* June 1933, alt. 3680 m., sporadic on wet grasslands, common (leaves erect; petals bright yellow inside, reddish brown outside); Murray Pass, Wharton Range, *Brass 4647,* July 1933, alt. 2840 m., abundant on grasslands (petals reddish brown beneath).

The collections from British New Guinea were identified by Mr. C. T. White, who noted in his list that these were "a good match for the scrappy type-material received on loan from the National Herbarium, Melbourne." The leaves are 1–1.5 cm. long and 0.3 cm. broad, with petioles 2–3 cm. long. The collections cited from Netherlands New Guinea are plants 6–15 cm. tall, with leaves 1.5–2 cm. long and 0.6–0.8 cm. broad, and with petioles 3–9 cm. long. The flowers appear to agree well with those of the British New Guinea plants, and, although we have no mature achenes, we believe these all belong to the same species, with the possible exception of *Brass & Myer-Drees 9740,* a plant with leaves coarsely 3-dentate and in general more pubescent.

Ranunculus habbemensis sp. nov.

Caudex brevis; foliis omnibus basalibus petiolatis; petiolo 1.5–4 cm. longo strigoso; lamina chartacea supra consperse subtus ± dense strigosa, variabili, obovato-cuneata vel oblongo-cuneata, 2–3 cm. longa, 0.8–1.8 cm. lata, apice grosse dentata (dente medio 3–5 mm. × 3–7 mm., dentibus lateralibus ± 2 × 2–5 mm.) vel interdum 5-dentata, basi late breviter cuneata, margine integra; scapis 1–3 aphyllis unifloris 8–18 cm. longis parce strigosis; sepalis ovato-oblongis, 6.5 cm. longis, 2–2.5 cm. latis, extus strigillosis; petalis 12–14 mm. longis, 5–6 mm. latis, basi squamula oblonga nectarium tegente praeditis; staminibus ± 35, circiter 4 mm. longis, filamentis complanatis; achaeniis numerosis 2.5 mm. longis, oblique oblongis compressis, rostro 1 mm. longo apice leviter recurvato.

NETHERLANDS NEW GUINEA: Lake Habbema, *Brass 9589* (TYPE), August 1938, alt. 3225 m., plentiful on alpine grassland.

Possibly this species is close to *Ranunculus Muelleri* Benth., but the pubescence is of stiffish hairs, the sepals are half as long as the petals, and the achenes are recurved at the stigmatic tip of the beak.

Ranunculus perindutus sp. nov.

Planta acaulis; rhizomate descendente; foliis omnibus basalibus chartaceis saepe dense adpresse vel subpatenter villosulis; petiolo 2–5 cm. longo; lamina oblonga vel elliptica, basi obtusa, grosse 5–7-dentata, dente medio 5–6 mm. longo et 3–8 mm. lato, dentibus ceteris paullo minoribus; scapis unifloris aphyllis 3–7 cm. vel in fructu 10–14 cm. longis, adpresse hirsutis; sepalis patenti-adscendentibus late ovatis, 6 mm. longis, 3 mm. latis, margine membranaceis obtusiusculis, extus hirsutis, intus 3-nerviis; petalis oblongis, 8–9 mm. longis, 2.5–3 mm. latis, apice obtusis, basi leviter angustatis squamula nectarium tegente praeditis; staminibus 20–25 circiter 3–4 mm. longis; achaeniis numerosis immaturis oblique ovatis, stylo sensim recurvato.

NETHERLANDS NEW GUINEA: 11 km. northeast of Wilhelmina-top, *Brass & Myer-Drees 9727,* September 1938, alt. 3400 m., rather dry grassy valley (corolla yellowish within, the outer part reddish); 7 km. northeast of Wilhelmina-top, *Brass & Myer-Drees 10027* (TYPE), September 1938, alt. 3560 m., abundant on grassy slopes (petals brown beneath); 2 km. east of Wilhelmina-top, *Brass & Myer-Drees 10132,* September 1938, alt. 3800 m., common on grassy banks of stream.

This species differs from *Ranunculus habbemensis* in the finer and more profuse indument and somewhat in the leaves being more evenly incised-dentate along the margin, rather than having the dentations confined to the terminal part of the margin.

Brass 4354, Mount Albert Edward, alt. 3680 m., gregarious on alpine slopes (peduncles purple; flowers small, pale yellow striped underneath with purple-brown), is a plant with indument similar to the type, but with stout petioles, small flowers and achenes. We have been uncertain where to place the collection.

Ranunculus perindutus var. **papuanus** var. nov.

A forma typica recedit petiolo longiore, lamina suborbiculari trilobata (lobo terminali 6–12 mm. longo 5–7 mm. lato, lobis lateralibus inciso-lobatis vel dentatis) palmatim 3–5-nervata, supra fere glabra (conspersissime pilosa), subtus dense hirsuta, petiolo patenti-hirsuto, floribus et fructibus ut in typo.

BRITISH NEW GUINEA: Mount Albert Edward, *Brass 4353* (TYPE of var., New York Bot. Gard.), June 1936, alt. 3680 m., common along banks of small alpine stream (peduncles purple; petals reddish brown beneath).

Ranunculus Lowii Stapf in Hook. Ic. Pl. **23:** *pl. 2261.* 1893; Trans. Linn. Soc. Bot. II. **4:** 127. 1894; van Steenis, Bull. Jard. Bot. Buitenz. III. **13:** 239. 1934, vel. aff.

NETHERLANDS NEW GUINEA: 5 miles northeast of Wilhelmina-top, *Brass 9395,* August 1938, alt. 3400 m., gregarious along a grassland stream (small yellow flowers); 7 km. northeast of Wilhelmina-top, *Brass & Myer-Drees 10030,* September 1938, alt. 3560 m., common on wet grassy slopes; Bele River, 18 km. northeast of Lake Habbema, *Brass 11422,* alt. 2200 m., common on mossy rocks in river and on forest paths.

This material differs from the original description and the one Bornean specimen examined in having the leaves strigulose-hirsute on both surfaces and in its somewhat smaller flowers. The cited specimens are also close to *Ranunculus perindutus,* described above.

Ranunculus coacervatus sp. nov.

Planta acaulis; rhizomate crasso brevi; foliis omnibus basalibus subcoriaceis; petiolo ± 3 cm. longo patenti-villosulo, pilis luteis; lamina 1–1.3 cm. longa et 1.3–1.8 cm. lata, orbiculari-reniformi, 3–5-lobata, lobis grosse 2-vel 3-dentatis, utrinque ± villosula, margine copiose villosula, venis primariis palmatis; scapis unifloris 3–5 cm. longis patenti-villosulis; sepalis late ovatis leviter concavis, 3–3.5 mm. longis et 2 mm. latis, fere glabris, pilis paucis conspersis; petalis oblongis, 6–7 mm. longis et 3 mm. latis, obtusis, basi angustatis squamula nectarium tegente praeditis; staminibus ± 20 circiter 3 mm. longis; achaeniis numerosis oblique obovatis compressis, rostro brevi valde recurvo.

NETHERLANDS NEW GUINEA: 11 km. northeast of Wilhelmina-top, *Brass & Myer-Drees 9727A* (TYPE), September 1938, alt. 3400 m., rather dry grassy valley (corolla yellow within, the upper outer part reddish).

Amongst the New Guinean material, this species is perhaps closest to *Ranunculus perindutus,* but the leaves are broader than long and differently lobed, the flowers are smaller, the pubescence is distinctly yellow and widely spreading, and the achenes are broader toward the apex.

Ranunculus lappaceus var. **scapigerus** (Hook.) Benth. Fl. Austr. **1:** 12. 1863; Rodway Tasman. Fl. 3. 1903.

Ranunculus scapigerus Hook. Jour. Bot. **1:** 244. 1834; Hook. f. Fl. Tasman. **1:** 7. 1860.

NETHERLANDS NEW GUINEA: Lake Habbema, *Brass 9203,* August 1938, alt. 3225 m., in a mossy bog (small rosette herb; petals brown beneath). BRITISH NEW GUINEA: Mount Albert Edward, *Brass 4267,* June 1933, alt. 3680 m., rather rare grassland herb in wet soil (leaves flat-spreading; petals yellow inside, brown outside); same locality, *Brass 4355* (peduncles purplish; flowers deep yellow, shaded purple-brown beneath).

We have named these collections with some hesitancy. They differ from the original description in not having a reflexed calyx, and the petals are longer than the sepals. As far as we may judge from the diagnosis of Ridley's subvar. *papuanus,* these collections could not possibly belong to it.

Ranunculus lappaceus var. **multiscapus** Hook. f. Handb. N. Z. Fl. 7. 1864; Cheeseman, Man. N. Z. Fl. 448. 1925.

Ranunculus multiscapus Hook. f. Fl. N. Z. **1:** 9, *t. 5.* 1852.

NETHERLANDS NEW GUINEA: 9 km. northeast of Lake Habbema, *Brass 10546,* October 1938, alt. 2800 m., open bouldery bed of a forest-stream (petals brown beneath).

This variety or its affinity has been previously reported from British New Guinea, Kew Bull. **1899:** 96. 1899. This variety differs from the last, according to the specimens cited here, in that the former has leaves definitely 3-foliolate, somewhat thicker in texture, and almost sericeous-villous.

Ranunculus uncostigma sp. nov.

Planta acaulis stolonifera; foliis omnibus basalibus chartaceis, novellis dense maturis parce adpresso-pilosis, longe petiolatis; petiolo 8–15 cm. longo; lamina tripartita vel trifoliolata; foliolis petiolulatis; foliolo medio rotundato-cuneato grosse 3-dentato, foliolis lateralibus interdum bilobatis ac grosse dentatis; scapis ± 16 cm. longis parce et adpresse pilosis; alabastris sub anthesi: sepalis ovato-ellipticis 4 mm. longis obtusis concavis, margine late membranaceis, fere glabris; petalis 5 mm. longis, 4 mm. latis, rotundato-ellipticis, basi obtuse angustatis squamula nectarium tegente praeditis; staminibus ± 15 circiter 2 mm. longis; achaeniis numerosis, 2.5 mm. longis, vix 2 mm. latis, oblique obovatis compressis, rostro brevissimo retrorse uncinato.

NETHERLANDS NEW GUINEA: 9 km. northeast of Lake Habbema, *Brass 10748* (TYPE), October 1938, on a native clearing in the forest.

This species differs from *Ranunculus lappaceus* var. *multiscapus* Hook. f. in the obovate achenes with very short hooked beak. In this character it is more like *R. diffusus* DC., but the plants are all scapose.

BEGONIACEAE

Forty-three species of *Begonia* have been described from Papuasia. Nine of these are illustrated by partly diagrammatic sketches for the purpose of comparing modes of inflorescence, and five are represented by habit sketches. Thus, under present conditions, we find ourselves faced with the necessity of identifying most of our material from the original descriptions alone. To aid others in the interpretation of this difficult group, our species-descriptions are supplemented by text-figures. Some described from staminate material alone are assigned temporarily to the Section *Petermannia*. The first two species defined do not seem, in their combination of characters, to fall entirely within the limits of any Asiatic section given in the latest work on this family in the Pflanzenfamilien, but are perhaps nearest *Sphenanthera* and *Platycentrum*. Only one species of *Symbegonia* Warb. is represented in the material at hand.

Begonia Linnaeus

Begonia physandra sp. nov. Fig. 1, a–e.

Planta acaulis, foliis scapisque floriferis instructa; foliis membranaceis orbiculari-ovatis, 12–18 cm. longis et 9–16 cm. latis, apice acutis vel breviter acuminatis, basi vix aequalibus oblique cordatis, margine duplicato-serrato-denticulatis breviter setulosis interdum sinuato-sublobatis, supra conspersissime setulosis (setulis 1 mm. longis), subtus prope basim sparsim hirsutis, nervis basalibus 6 vel 7 bi-trifurcatis, lateralibus utrinsecus 3; petiolo 10–12 cm. longo fere glabro; stipulis ochraceis; scapo usque 30 cm. longo; inflorescentiis flores ♂ atque ♀ gerentibus; bracteis late ovatis 8–9 mm. longis membranaceis; floribus ♂: pedicello ± 1 cm. longo; tepalis 4, exterioribus ellipticis 1.5 cm. longis et 1.1 cm. latis, interioribus 1.3 cm. longis et 1.1 cm. latis obovatis retusis; staminibus 60 fasciculatim in columnam 1.5 mm. connatis; filamentis 1 mm. longis subaequalibus, connectivo 1 mm. longo apice evidenter inflato, thecis longitudinaliter dehiscentibus inter filamentum et connectivum inflatum positis; floribus ♀ ante anthesim: pedicello ± 1 cm. longo; tepalis 4 ut in floribus ♂; stylis 3 in columnam brevem connatis deinde in crura spiraliter papillosa partitis; capsula verisimiliter matura 1 cm. longa et lata, alis 3 aequalibus rotundatis 2 mm. medio latis.

BRITISH NEW GUINEA: Mafulu, *Brass 5199* (TYPE in NYBG), October 1933, alt. 1250 m., crevices in limestone rock faces, common (plant very fleshy; leaf-stalk and peduncle reddish pink, lamina pale green; flowers delicate pale pink).

In floral characters this species and *Begonia Archboldiana* very closely resemble each other, but they seem to be distinct in vegetative characters;

the former has not variegated leaves, the hairs on the upper surface of the leaf are shorter, stouter and much more scattered than in the latter, and the bracts of the inflorescence are almost three times as broad and probably white rather than ochraceous.

Begonia Archboldiana sp. nov. Fig. 1, f–k.

Planta acaulis, foliis scapisque floriferis instructa; foliis membranaceis variegatis orbiculari-ovatis, usque 12 cm. longis et 9.5 cm. latis, apice acutis vel breviter acuminatis, basi subinaequalibus leviter oblique cordatis, margine irregulariter subsinuatis vel interdum sinuato-sublobatis (lobis 5 parvis duplicato-serrato-dentatis setulosis), supra consperse setulosis (setulis 2–3 mm. longis interdum crispulis), subtus glabris vel costa nervisque prope basim setulosis; nervis basalibus circiter 6 bifurcatis, lateralibus utrinsecus 3; petiolo usque 18 cm. longo, glabro vel sparsissime hirtello; stipulis ochraceis lanceolatis 1 cm. longis apice longiuscule acuminatis; scapo 10–22 cm. longo glabro; inflorescentiis flores ♂ atque ♀ gerentibus; bracteis lanceolatis 6 mm. longis acuminatis; floribus ♂ : pedicello 1–2.5 cm. longo; tepalis 4 glabris, exterioribus ellipticis 1–1.5 cm. longis et 8 mm. latis, interioribus 1–1.2 cm. longis et 6–8 mm. latis obovatis retusis; staminibus 50 fasciculatim in columnam 1–2 mm. connatis; filamentis 1 mm. longis

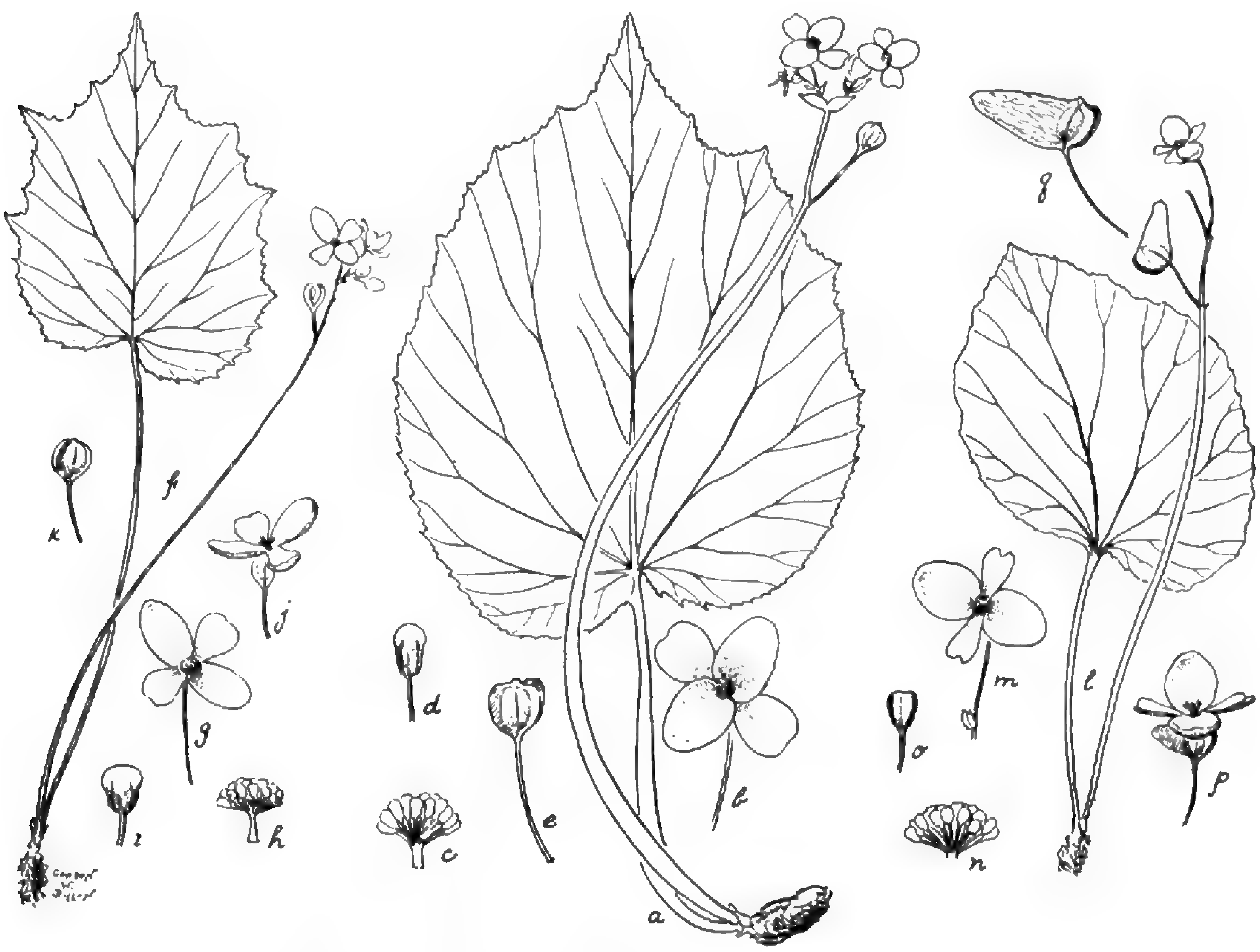

FIG. 1. *a–e. Begonia physandra* Merr. & Perry, drawn from the type in NYBG: *a.* habit, × ¼; *b.* ♂ flower, × ½; *c.* cluster of stamens, enlarged; *d.* single stamen, enlarged; *e.* capsule, × ½. *f–k. Begonia Archboldiana* Merr. & Perry, drawn from the type in NYBG: *f.* habit, × ¼; *g.* ♂ flower, × ½; *h.* cluster of stamens, enlarged; *i.* single stamen, enlarged; *j.* ♀ flower, × ½; *k.* capsule, × ½. *l–q. Begonia acaulis* Merr. & Perry, drawn from the type: *l.* habit, × ¼; *m.* ♂ flower, × ½; *n.* cluster of stamens, enlarged; *o.* single stamen, enlarged; *p.* ♀ flower, × ½; *q.* capsule, × ½.

subaequalibus, connectivo 1 mm. longo apice evidenter inflato, thecis longitudinaliter dehiscentibus inter filamentum et connectivum inflatum positis; floribus ♀ : pedicello ± 1 cm. longo; tepalis 4 ut in floribus ♂ ; stylis 3 circiter 3 mm. in toto longis, basi in columnam 1 mm. connatis subinde in crura 2 mm. longa spiraliter papillosa partitis; ovario 4.5–6 mm. longo et 4–5 mm. lato, alis 3 circiter 0.5 mm. latis; capsula immatura 7 mm. longa et lata subrotundata, alis inconspicuis.

BRITISH NEW GUINEA: Bella Vista, *Brass 5470* (TYPE in NYBG), November 1933, alt. 1450 m., wet banks of stream in forest (growing in small clump; leaves variegated green and brown; petiole and peduncle red; flowers white; seen only in one locality).

This species and *Begonia physandra* differ from the others we have examined in that the stamens are at the apex of a short column and the connective of the anthers is inflated at the apex; also the styles seem to be united almost to the point where the apex is divided into two parts. In the other species examined, although the three styles may be shortly connate at the base, they soon separate so that they appear free a short distance before the appearance of the stigmatic surface, which in most cases forms a band around the apical branches, these being spirally twisted.

Begonia acaulis sp. nov. § *Diploclinium*. Fig. 1, l–q.

Planta acaulis, foliis scapisque floriferis instructa; foliis membranaceis oblique orbiculari-ovatis, apice obtusiusculis, basi inaequalibus oblique cordatis, margine crenato-sinuatis et duplicato-dentatis ciliatis, supra consperse crispule albido-pilosulis, subtus costa nervisque consperse pilosulis, nervis basalibus 4–6 bi-tri-furcatis, lateralibus utrinsecus 3; petiolo 5–10 cm. longo consperse piloso; stipulis ochraceis; scapo usque 20 cm. longo in sicco complanato sparsim piloso; inflorescentiis flores ♂ atque ♀ gerentibus; bracteis ovato-oblongis 4 mm. longis, margine ciliatis; floribus ♂ : pedicello 1.5 cm. longo; tepalis 4 extus sparsim pilosulis, exterioribus late ellipticis 1.1 cm. longis, interioribus 9 mm. longis obovatis emarginatis; staminibus 50 liberis, filamentis 1.5 mm. longis, antheris 1 mm. longis rotundato-cuneatis; floribus ♀ : pedicello 1.5–2 cm. longo; tepalis ut in floribus ♂ ; stylis 3 vix 3 mm. longis basi connatis, apice in crura 2 circiter 1.5 mm. longa spiraliter papillosa fissis; ovario suborbiculari 0.5 mm. diametro consperse piloso alato; capsula 1 cm. longa et 2 cm. lata, alis 3 valde inaequalibus quarum 2 minoribus, basi atque apice ultra loculos 2 mm. productis; alis minoribus aequalibus, obtuse subtriangularibus, margine superiore 5–6 mm. longis, medio 3 mm. latis, una majore elongata, margine superiore 1.8 cm. longa, medio 1.2 cm. lata.

BRITISH NEW GUINEA: Rona, Laloki River, *Brass 3599* (TYPE), March 1933, alt. 450 m., common rock plant in light rain-forests (whole plant very fleshy; stem, peduncles, petioles and lower part of main leaf-nerves reddish; petals pink; fruit pinkish white).

This species undoubtedly belongs in the same group with *Begonia Sharpeana* F. v. Muell., but the latter is a much more pubescent species, the fruit of which is characterized by a large wing about twice as broad in proportion to its length as in our species.

Begonia Brassii sp. nov. § *Diploclinium*. Fig. 2, a–f.

Herba erecta gracilis; cauli simplice vel apicem versus pauci-ramoso et crispule hirtello deorsum glabro, nodis imis radicante; foliis tenuiter chartaceis fere membranaceis lanceolato-ellipticis, 3.5–9 cm. longis et 1–3.5 cm. latis, apice acutiusculis, basi valde obliquis, latere exteriore in lobum brevem (5 mm. longum) productis nervis basalibus plerumque 3, latere interiore cuneatis vel subobtusis nervis basalibus 1 vel 2, lateralibus 4 ascendentibus, margine irregulariter remotiuscule subduplicato-dentatis minute setulosis, supra glabris, subtus costa nervisque hirtellis; petiolo 1–3 cm. longo hirtello; stipulis ovatis 5 mm. longis, apice setulosis, glabris ochraceis; inflorescentiis terminalibus vel in axillibus superioribus 3–5 cm. longis racemosis flores ♂ atque ♀ gerentibus; bracteis albis late ovatis ± 8 mm. longis semiamplexicaulibus; floribus ♂ : pedicello circiter 8 mm. longo glabro; tepalis 4 oblongis exterioribus 8 mm. interioribus 4 mm. longis; staminibus 4, filamentis 2 mm. longis liberis, antheris 0.5 mm. longis ovatis vel subrotundatis; floribus ♀ : immaturis; pedicello 5 mm. longo; tepalis 3 vel 4 ellipticis, 8–9 mm. longis, 4.5 mm. latis, apice obtusis; stylis 3 erectis liberis quove 2 mm. supra basim partito, brachiis haud tortis stigmaticis subchartaceis complanatis 2 mm. longis, margine irregulariter erosis obscure papillosis; ovario 2–3 mm. longo glabro, alis inaequalibus; capsula cernua 6 mm. longa, alis 2 aequalibus ± rotundatis 3 mm. medio latis, una 1 cm. longa et 4 mm. lata chartacea viridescente.

NETHERLANDS NEW GUINEA: Bele River, 18 km. northeast of Lake Habbema, *Brass 11228* (TYPE), November 1938, alt. 2300 m., forest undergrowth, plentiful in moist gullies (flowers white).

The flowers, both staminate and pistillate, of *Begonia Brassii* and *B. oligandra* closely resemble each other in the very few stamens and the unequal wings of the capsule; two wings are alike and more or less follow the contour of the ovary, while the third is less developed towards the base of the ovary, but in the dried flower apparently lies projecting upward against the tepals, the margin being inconspicuously 2- or 3-dentate somewhat like the margin of a minute leaf. In fruit this wing stands straight out between the other two and is greenish, whereas the two smaller ones tend to be straw-colored in the dried specimens. The style-branches in all the flowers examined are flattened and not in any case twisted, as is usual in the other species of the genus.

Begonia oligandra sp. nov. § *Diploclinium*. Fig. 2, g–k.

Herba erecta gracilis ramosa; radice subcrassa; caule rufescente glabro nodis imis radicante; foliis breviter vel longiuscule petiolatis, petiolo 1–2.5(–4) cm. longo tenui; lamina glabra vel conspersissime setulosa, usque 4.5(–8) cm. longa et 2.5(–5) cm. lata, palmatim 4–6-partita, lobis pinnati-partitis vel bipinnatifidis, lobis ultimis integris vel apicem versus 1- vel 2-inciso-serratis; stipulis ochraceis ovatis ± 4 mm. longis caducis; inflorescentiis racemosis terminalibus et in axillis superioribus, 2–4 cm. longis, flores ♂ atque ♀ gerentibus; bracteis late ovatis vel fere orbicularibus circiter 1 cm. longis membranaceis albis; floribus ♂ : pedicello circiter 7 mm. longo glabro; tepalis 4 glabris, exterioribus 2 late ovatis 4 mm. longis latisque obtusiusculis, interioribus lanceolato-oblongis 3 mm. longis et 1.5 mm. latis; staminibus 6–8 basi 0.5 mm. connatis, filamentis 2.5 mm. longis, antheris suborbicularibus 0.5 mm. diametro; floribus ♀ : bracteis 6 mm. longis; pedicellis 5 mm. longis; tepalis 4, 2 majoribus ovatis obtusis 7 mm. longis, 2 minoribus lanceolatis 3–5 mm. longis; stylis 3 ad basim liberis, quove 2 mm. supra basim partito, brachiis circiter 2 mm. longis erectis subtortis papillosis; ovario 2 mm. longo; alis inaequalibus, 2 minoribus angustis 0.5 mm. latis rotundatis, una majore oblique desinente, margine superiore 4 mm. longa inferiore minute 2- vel 3-denticulata.

NETHERLANDS NEW GUINEA: 15 km. southwest of Bernhard Camp, Idenburg River, *Brass 12344* (TYPE), January 1939, alt. 1600 m., on mossy rocks in a rain-forest stream (flowers white); Valley of Bele River ± 20 km. north of Lake Habbema, *Brass 10829*, October 1938, alt. 2200 m., plentiful in forest shade on low banks of stream (flowers white).

FIG. 2. *a–f. Begonia Brassii* Merr. & Perry, drawn from the type: *a.* leaf, × ½; *b.* ♂ flower, × ½; *c.* cluster of stamens, enlarged; *d.* ♀ flower, × ½; *e.* one style, enlarged; *f.* capsule, × ½. *g–k. Begonia oligandra* Merr. & Perry, drawn from the type: *g.* leaf, × ½; *h.* ♂ flower, × ½; *i.* cluster of stamens, enlarged; *j.* ♀ flower, × ½; *k.* one style, enlarged. *l. Begonia otophora* Merr. & Perry, drawn from the type: habit, × ½. *m, n. Begonia diffusiflora* Merr. & Perry: *m.* habit, drawn from the type, × ½; *n.* capsule, drawn from *Brass 6713,* × ½.

Among the described Papuasian species, this suggests *B. Warburgii* Lauterb. & K. Schum. in the palmate-pinnatifid or bipinnatifid leaves; this character was so distinctive that Lauterbach & Schumann give only a brief description of the fruit: capsule broadly winged, red, 12–13 mm. long. However, if the wings had been conspicuously unlike in size they would surely have mentioned it. Unfortunately none of the plants belonging to the above cited numbers show mature or even partly mature fruits. The ovary has two wings more or less conforming to its contour and a third oblique and somewhat elongate wing projecting or directed upward against the larger tepals in the young flowers, its outer margin is uneven or minutely denticulate; the whole is very much like that found in *B. Brassii*. The immature flowers do not show papillose styles and sometimes they appear irregular in form, but at maturity they are similar to those of other species of *Begonia*.

Begonia otophora sp. nov. § *Petermannia*. Fig. 2, l.

Planta 50 cm. alta; ramulis crispe ferrugineo-hirtellis; foliis usque 8 cm. longis et 3.5 cm. latis, lanceolato-ellipticis, apice acutis, basi latere exteriore angustatis deinde in lobum orbicularem 1–1.5 cm. productis nervis basalibus 4 vel 5, interiore rotundatis vel obtusis nervis basalibus 1 vel 2, lateralibus utrinsecus 4 vel 5, margine duplicato-serrato-dentatis vel irregulariter breviter incisis, setulosis, supra conspersissime setulosis, subtus costa nervisque crispe hirtellis; petiolo ± 5 mm. longo hirtello; stipulis oblongo-lanceolatis 1 cm. longis, apice setosis, ochraceis, glabris; inflorescentiis ♂ tantum visis, terminalibus 3 cm. longis immaturis pauciramosis paucifloris; bracteis ut stipulis; pedicellis 0.8–1.5 cm. longis crispe hirtellis; tepalis 2 ± hirtellis ovatis obtusis 1.1 cm. longis; staminibus paucis circiter 8 basi connatis, antheris oblongis.

NETHERLANDS NEW GUINEA: 4 km. southwest of Bernhard Camp, Idenburg River, *Brass 13218* (TYPE), March 1939, alt. 850 m., rare in rain-forest flood-plain (ascending herb 50 cm. high; upper surface of leaves dark brownish green, the lower surface red; flowers white).

Begonia diffusiflora sp. nov. § *Petermannia*. Fig. 2, m, n.

Planta 50 cm. alta; ramulis ferrugineo-hirsutis, pilis ± 4 mm. longis; foliis ± 16 cm. longis et 7 cm. latis, ellipticis, utrinque angustatis, apice acuminatis, acumine ± 2 cm. longo, basi inaequalibus, in latere exteriore in lobum brevem 5 mm. longum rotundatum productis nervis basalibus 3, interiore cuneatis vel rotundato-cuneatis nervo basali uno, lateralibus utrinsecus 4 vel 5, margine subsinuatis remotiuscule denticulatis setulosis, supra conspersissime pilosis vel glabris, subtus costa nervisque sparsim hirsutis; petiolo circiter 1 cm. longo hirsuto; stipulis linearibus apice in setam longam productis, 1.2 cm. longis, hirtellis; inflorescentiis terminalibus flores ♂ aut ♀ gerentibus; inflorescentiis ♂ dichotomo-ramosis 8 cm. longis et 12 cm. latis ± 30-floris, ramulis sparsim hirtellis vel sursum fere glabris; floribus pedicellatis; tepalis 2 suborbicularibus 5–7 mm. diametro, extus basim versus sparsim pilosis; staminibus 25–30 basi breviter connatis, filamentis antheris subaequilongis, antheris 1 mm. longis oblongis emarginatis, rimis ½ antherae aequilongis; inflorescentiis ♀ bifloris; pedicellis 3 cm. longis sparsim pilosis; tepalis verisimiliter 5 (3 tantum visis) late ovatis 1 cm. longis; stylis 3 basi breviter connatis apice in crura 2 brevia patenti-erecta spiraliter papillosa fissis; ovario 1.5 cm. longo ellipsoideo; alis 3 inaequalibus ultra ovarium 3 mm. productis, una majore rotundata 7 mm. medio lata, 2 minoribus subtriangularibus 5 mm. medio latis.

BRITISH NEW GUINEA: Fly River, 528 mile Camp, *Brass 6713, 7010*, May 1936, alt. 80 m., heavily shaded gully in ridge-forest undergrowth, uncommon (30 cm. high; flowers pink); Palmer River, 2 miles below Black River Junction, *Brass 7318* (TYPE), July 1936, alt. 100 m., a rare species, epiphytic or terrestrial in ridge-forests (fleshy herb 50 cm. high; leaves of older plants reddish brown beneath; flowers pink).

In several characters this plant seems to agree with *Begonia filibracteosa* Irmsch., but the staminate inflorescence is distinctly dichotomously branched, the flowers have fewer stamens with longer lines of dehiscence, and the ♀ flowers are practically glabrous, although when younger they may have had a few scattered hairs.

Begonia calliantha sp. nov. § *Petermannia*. Fig. 3, a, b.

Planta suffruticosa circiter 2 m. alta; ramulis ± dense et crispule rufo-hirsutis; foliis 11–12.5 cm. longis et 4–5 cm. latis, oblongo-ellipticis vel ovato-ellipticis, apice acuminatis, acumine ± 1 cm. longo, basi inaequalibus, latere exteriore in lobum brevem (6 mm. longum) rotundatum productis, nervis basalibus 3 vel 4, interiore late cuneatis vel leviter rotundato-cuneatis nervis basalibus 2, lateralibus utrinsecus 4 valde ascendentibus, margine indistincte duplicato-serrato-dentatis setulosis, supra glabris vel consperse minuteque glanduloso-pubescentibus, subtus dense minute pustulatis, costa venisque crispe ± dense pilosis; petiolo 0.5–1 cm. longo dense crispe hirsuto; stipulis 2–2.5 cm. longis, 4–5 mm. latis, lineari-oblongis apice in setam 2–3 mm. longam sensim angustatis; inflorescentiis terminalibus circiter 7 cm. longis racemosis; floribus ♂ tantum visis; pedicellis 2 cm. longis crispe hirtellis, basi bracteis glabris 2.5–3 cm. longis et 1–1.2 cm. latis lanceolato-ellipticis apice setulosis; tepalis 2 glabris 3 cm. longis et 2.5 cm. latis, ovatis, basi retusis, apice obtusis; staminibus 50–60, filamentis basi 2 mm. connatis parte superiore liberis, exterioribus 0.5 mm. interioribus 1–1.5 mm. longis, antheris 2.5–3 mm. longis oblongis obtusis, rimis ⅔ antherae aequilongis.

BRITISH NEW GUINEA: Mount Tafa, Mavi, *Brass 4986* (TYPE in NYBG), September 1933, alt. 2225 m., bed of a small stream in forest (large fleshy shrub about 2 m. high; branches, petioles and peduncles with reddish brown hairs; flowering bracts suffused with red; petals carmine).

Begonia Randiana sp. nov. § *Petermannia*. Fig. 3, c, d.

Planta suffruticosa usque 1 m. alta, ramosa, ex toto ferrugineo-hirsuta; foliis oblongo-lanceolatis, 5–10 cm. longis et 1.5–3 cm. latis, apice acutis, basi latere exteriore in lobum brevem (5 mm. longum) cordatum productis nervis basalibus 2 vel 3, interiore rotundatis nervo basali uno, lateralibus utrinsecus 4 vel 5 ascendentibus, margine irregulariter duplicato-serrato-dentatis vel interdum inciso-lobatis; petiolo ± 5 mm. longo; stipulis lanceolatis 8 mm. longis, apice abrupte caudatis; inflorescentiis terminalibus flores ♂ atque ♀ gerentibus ± 5 cm. longis paucifloris; floribus ♂: pedicello 1–2 cm. longo; tepalis 2 ovatis late obtusis 1.5–2 cm. longis; staminibus 20–25 basi 2 mm. connatis, filamentis 1–1.5 mm. longis, antheris 1.6 mm. longis oblongis leviter obovatis obtusis, rimis ½ antherae aequalibus; floribus ♀: tepalis 5 oblongo-lanceolatis, 1.8 cm. longis et 6 mm. latis, obtusis; stylis 5 mm. longis 3, basi breviter connatis sursum liberis, apicem versus in crura 2 brevia (2 mm. longa) ascendentia spiraliter papillosa fissis; ovario late ellipsoideo 8 mm. longo, alis 3 subaequalibus, margine superiore horizontaliter truncatis, basi rotundatis, 4 mm. medio latis; capsula cernua 1.3 cm. longa, 1.5 cm. lata.

BRITISH NEW GUINEA: East Mount Tafa, *Brass 4136*, May 1933, alt. 2100 m., in a moist forest gully (compact small fleshy shrub ± 50 cm. high; branches purple-red and whole plant covered with long red hairs; petals pinkish white); Mount Tafa, *Brass 4989* (TYPE), September 1933, alt. 2400 m., plentiful in damp mountain-side hollow (densely foliaged fleshy shrub about 1 m. high; branchlets, petioles and peduncles red; flowers white); Mafulu, *Brass 5508*, November 1933, alt. 1100 m., floor plant in lower level forests, rare (low spreading shrub 50–70 cm. high; indumentum red; flowers pale pink).

The collection designated as the type differs from the other two chiefly in its leaf-margins being less deeply incised. In general habit the species seems to approach closely *Begonia fruticella* Ridl., but it is quickly distinguished from that species by having wings similar in size and shape. Dedicated to Dr. A. L. Rand, assistant leader of the Expedition.

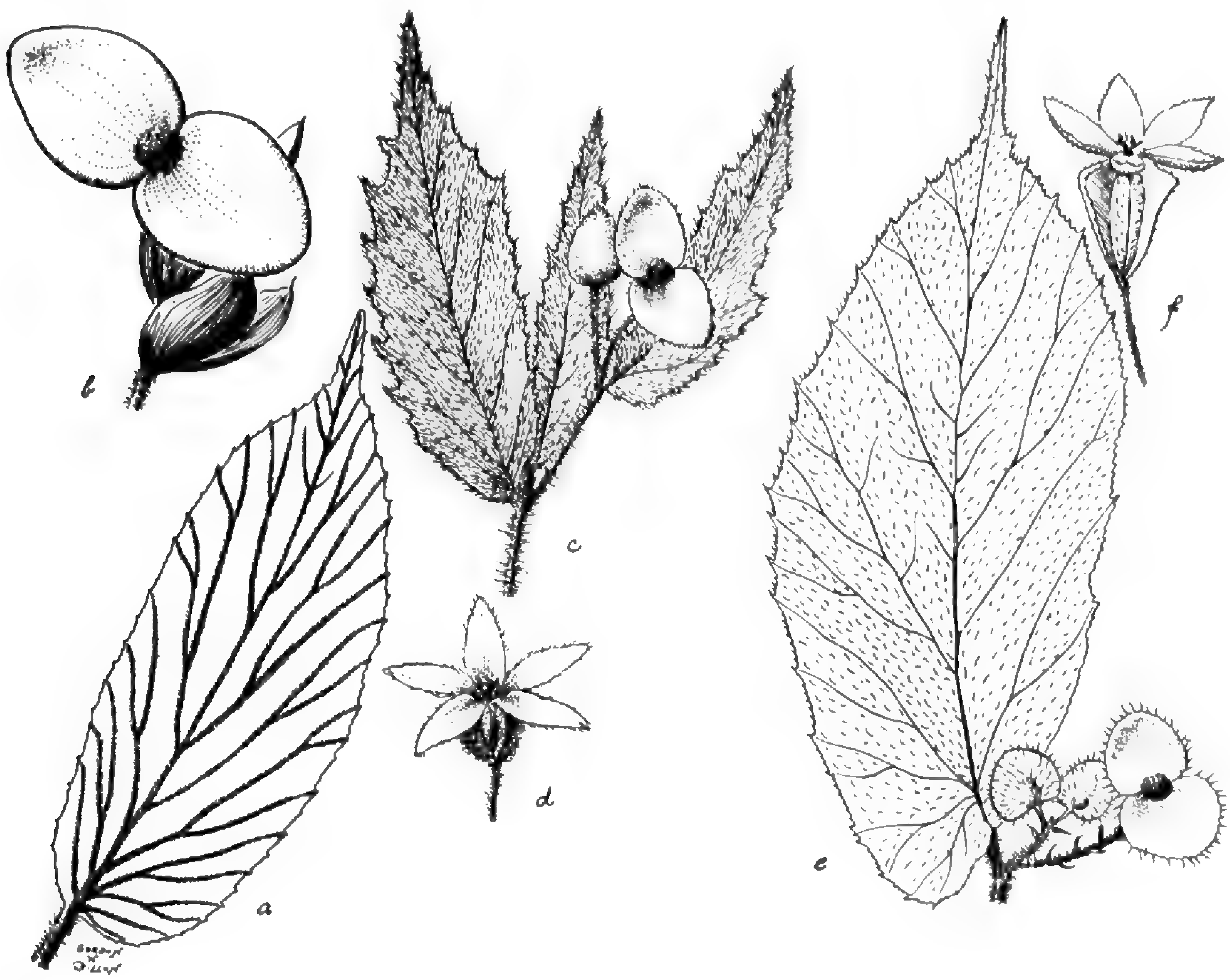

FIG. 3. *a, b. Begonia calliantha* Merr. & Perry, drawn from the type in NYBG: *a.* leaf, showing lower surface, × ½; *b.* portion of ♂ inflorescence, × ½. *c, d. Begonia Randiana* Merr. & Perry, drawn from the type: *c.* habit, showing ♂ inflorescence, × ½; *d.* ♀ flower, × ½. *e, f. Begonia Richardsoniana* Merr. & Perry, drawn from the type: *e.* habit, × ½; *f.* ♀ flower, × ½.

Begonia Richardsoniana sp. nov. § *Petermannia.* Fig. 3, e, f.

Planta erecta 60–70 cm. alta; ramulis dense ferrugineo-hirsutis; foliis 9–15 cm. longis et 4.5–6 cm. latis oblongo-ellipticis, apice subabrupte acuminatis, acumine ± 2.5 cm. longo, basi latere exteriore in lobum brevem rotundatum cordatum productis nervis basalibus 3 vel 4, interiore cuneatis vel rotundato-cuneatis nervis basalibus 1 vel 2, lateralibus circiter 5, utrinque consperse setulosis subtus costa nervisque hirtellis; margine minute duplicato-serrato-dentatis setulosis; petiolo 1–2 cm. longo hirsuto; stipulis hirtellis 1 cm. longis lanceolatis, apice 5 mm. caudatis; inflorescentiis axillaribus: ♂ ± 4 cm. longis racemosis; bracteis circiter 6 mm. longis stipulis similibus; pedicellis rufo-hirtellis; tepalis 2 late rotundatis, 1.5 cm. longis, 2 cm. latis, consperse hirtellis; staminibus 50–60, filamentis ± 1 mm. longis antheris subaequalibus, antheris oblongis emarginatis basi angustatis, rimis fere ½ antherae aequilongis; inflorescentiis ♀ : flore unico viso consperse setuloso; pedicello 2 cm. longo hirtello; tepalis 5 lanceolato-ellipticis 1.5 cm. longis ciliato-setulosis; stylis 3 circiter 5 mm. longis, basi connatis sursum liberis, apice in crura 2 brevia patentia spiraliter papillosa fissis; ovario 1.5 cm. longo et 0.6 cm. lato, oblongo; alis 3 subaequalibus subtriangularibus, margine superiore leviter oblique et horizontaliter truncatis vix 1 cm. longis, basi cuneatis, 3 mm. medio latis, margine setulosis.

NETHERLANDS NEW GUINEA: 4 km. southwest of Bernhard Camp, Idenburg River, *Brass 13423* (TYPE), March 1939, alt. 850 m., occasional on shady banks of rain-forest streams (erect to 60–70 cm.; all parts including petals sprinkled with red hairs; ♀ flowers pink; ♂ pink to white).

Dedicated to Mr. W. B. Richardson, mammologist of the Expedition.

Begonia oxyura sp. nov. § *Petermannia.* Fig. 4, a, b.

Planta ascendens ramosa; ramulis crispe ferrugineo-hirsutis; foliis chartaceis lanceolato-ellipticis, 9–16 cm. longis et 3–7 cm. latis, apice abrupte caudato-acuminatis, acumine 2–3 cm. longo, basi 7 mm. apicem versus 1 mm. lato, basi valde inaequalibus, uno latere rotundato-auriculatis, lobo 1.5–2.5 cm. longo, nervis basalibus 4 vel 5, altero rotundatis nervis basalibus 2, lateralibus utrinsecus 2 vel 3, margine sinuatis remote dentatis verisimiliter setulosis utrinque crispe subadpresse hirtellis, subtus costa venisque dense hirsutis; petiolo ± 1 cm. longo hirsuto; stipulis ovatis, 6 mm. longis, 4 mm. latis, hirsutis; inflorescentiis terminalibus ± 6 cm. longis, cymoso-paniculatis, paucifloris, flores ♂ atque ♀ gerentibus; pedunculo brevissimo usque 2 cm. longo et pedicellis usque 3 cm. longis dense hirtellis; floribus ♂ : tepalis 2 oblongo-ellipticis, 1.3–1.5 cm. longis, 6 mm. latis, hirtellis; staminibus ± 60 basi breviter connatis, filamentis 1 mm. vel ultra longis, antheris 1 mm. longis obovatis emarginatis; floribus ♀ totis hirtellis: tepalis 5 oblongo-lanceolatis, 1.3 cm. longis; stylis 3, basi breviter connatis sursum liberis, apice in crura 2 brevia patentia torte papillosa fissis; ovario ellipsoideo 1.2 cm. longo et 0.7 cm. lato, alis 3 subaequalibus; capsula 2.3 cm. longa cernua, alis rotundatis, apice deorsum leviter obliquis, 9 mm. medio latis.

NETHERLANDS NEW GUINEA: 4 km. southwest of Bernhard Camp, Idenburg River, *Brass 13217, 13457* (TYPE), March 1939, alt. 850 m., on banks of a rain-forest stream (*13217*: climbing to 3 m.; *13457*: herb 60 cm. high; flowers white).

These collections suggest *Begonia torricellensis* Warb., but they differ in having very distinctly acuminate leaves and fruits with very much narrower wings.

Begonia montis Bismarckii Warb. Fl. Deutsch. Schutzgeb. Südsee Nachtr. 322. 1905.

NETHERLANDS NEW GUINEA: 4 km. southwest of Bernhard Camp, Idenburg River, *Brass 13397,* March 1939, alt. 850 m., common in undergrowth of flood-plain rain-forest (herb 70–80 cm. high; flowers white or pale pink).

This collection seems to be a very good match for a fragmentary specimen collected by Schlechter from the Bismarck Mountains in Northeastern New Guinea.

Begonia suffrutescens sp. nov. § *Petermannia.* Fig. 4, c–e.

Planta suffruticosa usque 50 cm. alta ramosa; ramis ramulisque crispule hirsutis, pilis brunneis; foliis chartaceis, 1.5–4.5 cm. longis, 0.5–2 cm. latis, lanceolatis vel subovatis, apice acutis vel acuminatis interdum obtusiusculis, basi inaequaliter cuneatis vel rotundato-cuneatis, margine grosse serrato-dentatis vel erosis, dentibus setulosis, supra saepissime glabris, subtus costa adpresse hirtellis, nervis primariis in latere exteriore 4, interiore 3 ascendentibus; petiolo circiter 2 mm. longo hirtello; stipulis glabris ± 5 mm. longis lanceolatis obtusis, apice longiuscule setulosis; floribus ♂ ex axillibus superioribus solitariis vel binis, pedunculis vel pedicellis ± crispe hirtellis 2 cm. longis prope basim bracteis minimis ochraceis instructis; tepalis 2 ovatis 1.5–1.7 cm. longis glabris albis; staminibus 4–8, filamentis 1–1.5 mm. longis ± connatis, antheris ± 2 mm. longis apiculatis, rimis fere antherae aequalibus; floribus ♀ plerumque solitariis ex axillibus superiori-

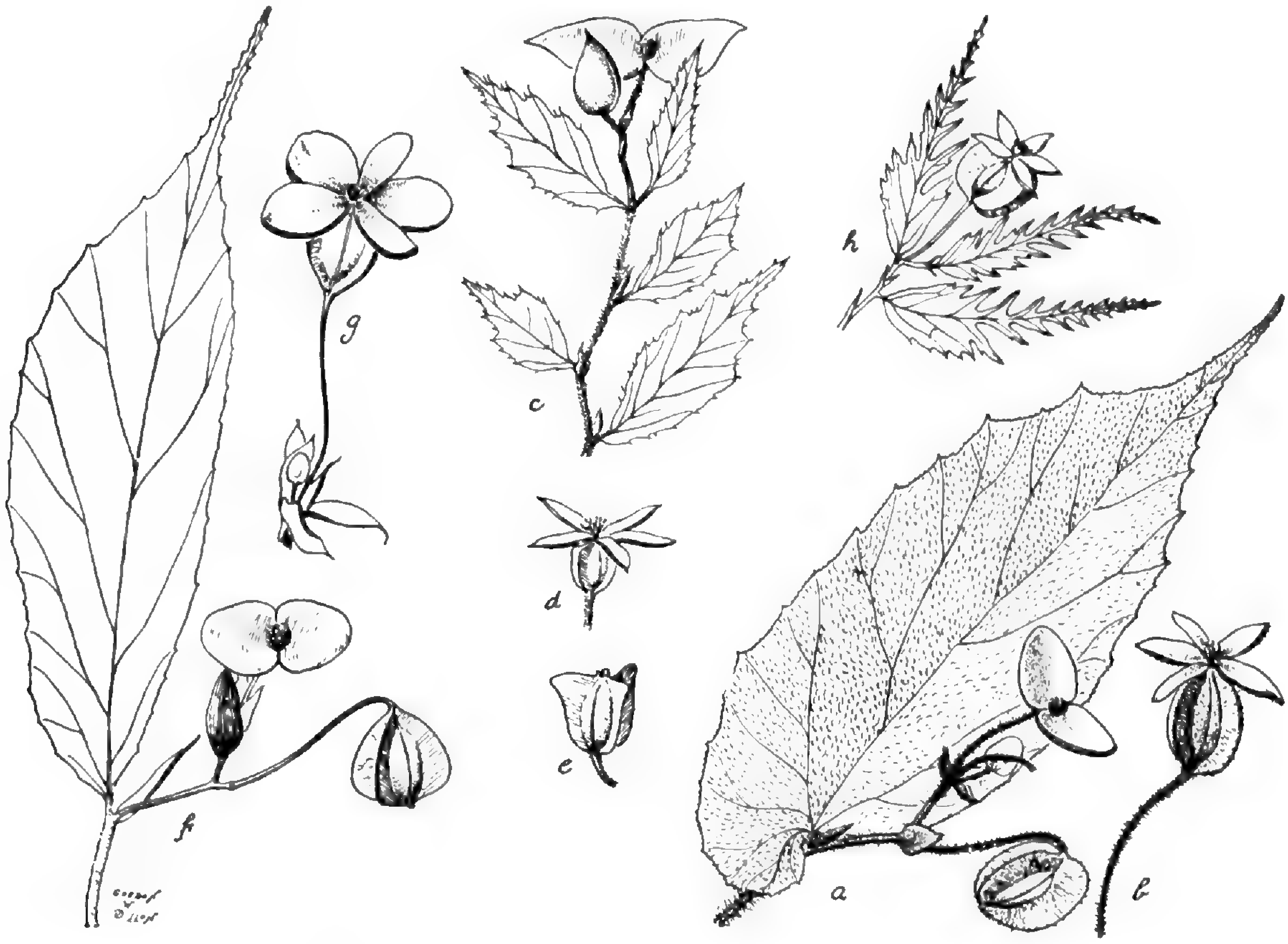

FIG. 4. *a, b. Begonia oxyura* Merr. & Perry: *a.* habit, drawn from *Brass 13217*, × ½; *b.* ♀ flower, drawn from the type, × ½. *c–e. Begonia suffrutescens* Merr. & Perry, drawn from the type: *c.* habit, × ½; *d.* ♀ flower, × ½; *e.* capsule, × ½. *f, g. Begonia serraticauda* Merr. & Perry, drawn from the type: *f.* habit, × ½; *g.* inflorescence, showing ♀ flower and immature ♂ flower at base, × ½. *h. Begonia pinnatifida* Merr. & Perry, drawn from the type: habit, × ½.

bus, pedunculo circiter 1.5 cm. longo crispe hirtello; tepalis 5 lanceolato-ovatis, 9–11 mm. longis, 3–4 mm. latis, glabris, albis; stylis 3 circiter 6 mm. longis, in parte inferiore 2 mm. connatis, apice in crura 2.5 mm. longa erecta in summo apice papillosa fissis; ovario ellipsoideo, 7 mm. longo, 4–4.5 mm. lato, pilis longiusculis sparsim obsito, alis 3 margine superiore truncatis basi rotundatis, sparsim pilosis, in fructu una ala latiore margine superiore 8 mm., ceteris 5 mm. longis; seminibus minute reticulatis.

NETHERLANDS NEW GUINEA: 15 km. southwest of Bernhard Camp, Idenburg River, *Brass 12030* (TYPE), January 1939, alt. 1750 m., rain-forest, common on banks of streams and slopes of ravines (30–50 cm. high; flowers white); 6 km. southwest of Bernhard Camp, Idenburg River, *Brass 12985,* February 1939, alt. 1050 m., on banks of a rain-forest stream (ascending to 20–30 cm.; flowers white).

Amongst the descriptions of Papuasian *Begonia,* this species most nearly approaches *B. monantha* Warb., but in that the stamens are many and the anthers ovate. We have found no formal description of the fruit of *B. monantha,* but Irmscher gives a sketch of it in his article on inflorescences, Bot. Jahrb. **50.** Suppl.: 573, *figs. 24 a–c.* 1914.

Begonia serraticauda sp. nov. § *Petermannia.* Fig. 4, f, g.

Planta glabra usque 1 m. alta ramosa; caule in sicco rufo-brunnescente, nodis incrassatis; foliis tenuiter chartaceis oblongis vel oblongo-ellipticis, 8–18 cm. longis, 2–7 cm. latis, basi cuneato-rotundatis leviter inaequalibus, in latere exteriore in lobum inconspicuum 2–4 mm. petiolo adnatum instructis, apice sensim caudato-acuminatis, acumine 3–4.5 cm. longo basi 4–6 mm. lato, margine indistincte (acuminis distincte) remotiuscule serratis, nervis primariis in latere exteriore 7–9, interiore 6–8 ascendentibus, venulis ultimis distincte elevatis; petiolo 5–7 mm. longo; stipulis oblongo-lanceolatis 1.8 cm. longis apice setulosis; inflorescentiis cymosis in axillibus superioribus paucifloris; floribus ♂: pedicello ± 1.5 cm. longo, tepalis 2 suborbicularibus basi cordatis 1.3 cm. diametro; staminibus 50–60, filamentis brevissimis basi connatis, antheris oblongis vel leviter clavatis 1.5 mm. longis extrorsis, rimis apice conniventibus ⅓ antherae aequilongis; floribus ♀: pedicello ± 3 cm. longo; tepalis 5 ellipticis utrinque leviter angustatis, 1.5–1.8 cm. longis, 1–1.2 cm. latis, obtusis; stylis 3 circiter 3 mm. longis, basi connatis, apicem versus latioribus et in crura brevia patenti-erecta spiraliter papillosa fissis; ovario ellipsoideo, 1.2 cm. longo, 0.8 cm. lato, alis 3 leviter inaequalibus, margine superiore paullo oblique truncatis, basi rotundatis; capsula cernua, 1.8 cm. longa, 2–2.3 cm. lata.

NETHERLANDS NEW GUINEA: 6 km. southwest of Bernhard Camp, Idenburg River, *Brass 12988,* February 1939, alt. 1050 m., bank of a rain-forest stream (1 m. high; leaf-nerves red; flowers pale pink); 4 km. southwest of Bernhard Camp, Idenburg River, *Brass 13685* (TYPE), *13712,* March 1939, alt. 850 m., flood-plain rain-forest (ascending herb 50–60 cm. high; flowers pink, white or pale pink streaked with darker pink).

In some characters this species suggests *Begonia strictinervis* Irmsch., but the acumen of the leaves is about twice as long as in the latter species, the base of the leaf is not sufficiently auricled to show three basal nerves on the larger side of the blade, the inflorescence is only very few-flowered (in the specimens cited not more than two were seen), the stamens are more than twice as many, and the wings do not extend beyond the apex of the capsule.

Begonia pinnatifida sp. nov. § *Petermannia.* Fig. 4, h.

Planta glabra ramosa nodis inferioribus radicans; ramis gracilibus in sicco ± striatis vel angulatis; foliis tenuiter chartaceis vel fere membranaceis, 4–5.5 cm. longis et 1–1.5 cm. latis, lanceolatis, parte tertia inferiore excepta pinnatifidis, laciniis integris vel 1- vel 2-dentatis setulosis, inferioribus circiter 7 mm. longis sursum decrescentibus, terminalibus linearibus; petiolo 1–1.5 mm. longo; stipulis 8 mm. longis linearibus longiuscule setulosis; inflorescentiis terminalibus; floribus ♂ non visis;

pedicello floris ♀ 1.3 cm. longo; tepalis 5 fere aequalibus late lanceolatis, circiter 9 mm. longis et 3 mm. latis, apice acutis breviter setulosis; stylis basi tantum connatis, 3 mm. longis, apicem versus latioribus, in crura 2 brevia patenti-erecta spiraliter papillosa fissis; ovario ellipsoideo 8 mm. longo utrinque angustato alis toto circumdato, alis 3 subaequalibus, 11 mm. longis ± 5 mm. medio latis; placentis bilamellatis.

BRITISH NEW GUINEA: Palmer River, 2 miles below Black River Junction, *Brass 7051* (TYPE), June 1936, alt. 100 m., gregarious in considerable communities in forest ground cover of the more elevated ridges (flowers pale pink; only one plant found in flower).

A striking species readily recognized by the rather small almost sessile lanceolate leaves pinnatifid in the upper two-thirds. The single specimen collected has only one ♀ flower, which is pale pink with translucent strongly veined wings, which project about 1.5 mm. beyond the base and the apex of the ovary.

Begonia stilandra sp. nov. § *Petermannia*. Fig. 5, a–d.

Planta usque 1 m. alta glabra; ramulis in sicco leviter striatis supra nodos angustatis; foliis 8–14 cm. longis, 3–5.5 cm. latis, oblongo-lanceolatis, apice acuminatis, acumine ± 1 cm. longo, basi valde inaequalibus, latere exteriore in lobum 1.5–2.5 cm. longum rotundato-cordatum productis nervis basalibus 5, interiore rotundatis nervis basalibus 2, lateralibus utrinsecus 2 vel 3, margine duplicato-serrato-dentatis breviter setulosis; petiolo 2–4.5 cm. longo; stipulis caducis haud visis; inflorescentiis terminalibus ± 9 cm. longis pauciramosis flores ♂ atque ♀ gerentibus; bracteis caducis; floribus ♂: pedicello ± 1 cm. longo; tepalis 2 ovatis vel ellipticis, 1.7 cm. longis, 1–1.3 cm. latis; staminibus 20–25 fasciculatim in columnam 1–2 mm. connatis, filamentis exterioribus 1 mm. interioribus 2 mm. longis, antheris 3 mm. longis oblongis emarginatis; floribus ♀: pedicello 2(–5) cm. longo; tepalis 5 lanceolato-ellipticis ± 2 cm. longis, apice acutis; stylis 3 circiter 7 mm. longis, basi 1.5 mm. connatis, apice in crura 2 erecta 3 mm. longa spiraliter papillosa fissis; ovario 1.1 cm. longo ellipsoideo; alis subaequalibus 3, basi rotundatis, ultra ovarium 3 mm. productis, apice horizontaliter truncatis rotundatis, 3 mm. et 4 mm. medio latis.

NETHERLANDS NEW GUINEA: 15 km. southwest of Bernhard Camp, Idenburg River, *Brass 12301* (TYPE), January 1939, alt. 1750 m., occasional in rain-forest gullies (up to 1 m. high; petioles, nerves and margins of leaves, peduncles and pedicels red; flowers pink, streaked with red); 18 km. southwest of Bernhard Camp, Idenburg River, *Brass 12499*, February 1939, alt. 2000 m., undergrowth of a gully (plant 1 m. high; flowers pink, streaked with red).

At a glance this species is scarcely to be distinguished from *Begonia simulans* Merr. & Perry, but a more careful examination shows the rather distinct character of the staminal column, the fewer and much longer anthers, and the less broadly winged fruit.

Begonia simulans sp. nov. § *Petermannia*. Fig. 5, e–i.

Planta ultra 35 cm. alta glabra; ramulis in sicco sulcatis ferrugineis; foliis 8.5–14 cm. longis, 3–6 cm. latis, apice acuminatis, basi inaequalibus, latere exteriore in lobum 1–2.5 cm. longum rotundatum productis nervis basalibus 4 vel 5, interiore rotundatis vel obtusis nervis basalibus 2 vel 3, lateralibus utrinsecus 3, margine duplicato-serrato-dentatis; costa et petiolo angulum ± 90° formantibus; petiolo 1.5–3 cm. longo; stipulis caducis; inflorescentiis terminalibus ± 7 cm. longis ramosis flores ♂ atque ♀ gerentibus; floribus ♂ : pedicello 1–2 cm. longo; tepalis 2 suborbicularibus, basi cordatis, ± 1 cm. longis latisque; staminibus 70, filamentis exterioribus ± 0.5 mm. interioribus 1.5 mm. longis, antheris 1.2 mm. longis obovatis obtusis; floribus ♀ : pedicello usque 5 cm. longo; tepalis 5 lanceolato-ovatis 1–1.2 cm. longis; stylis 3 circiter 6 mm. longis, basi 2 mm. connatis,

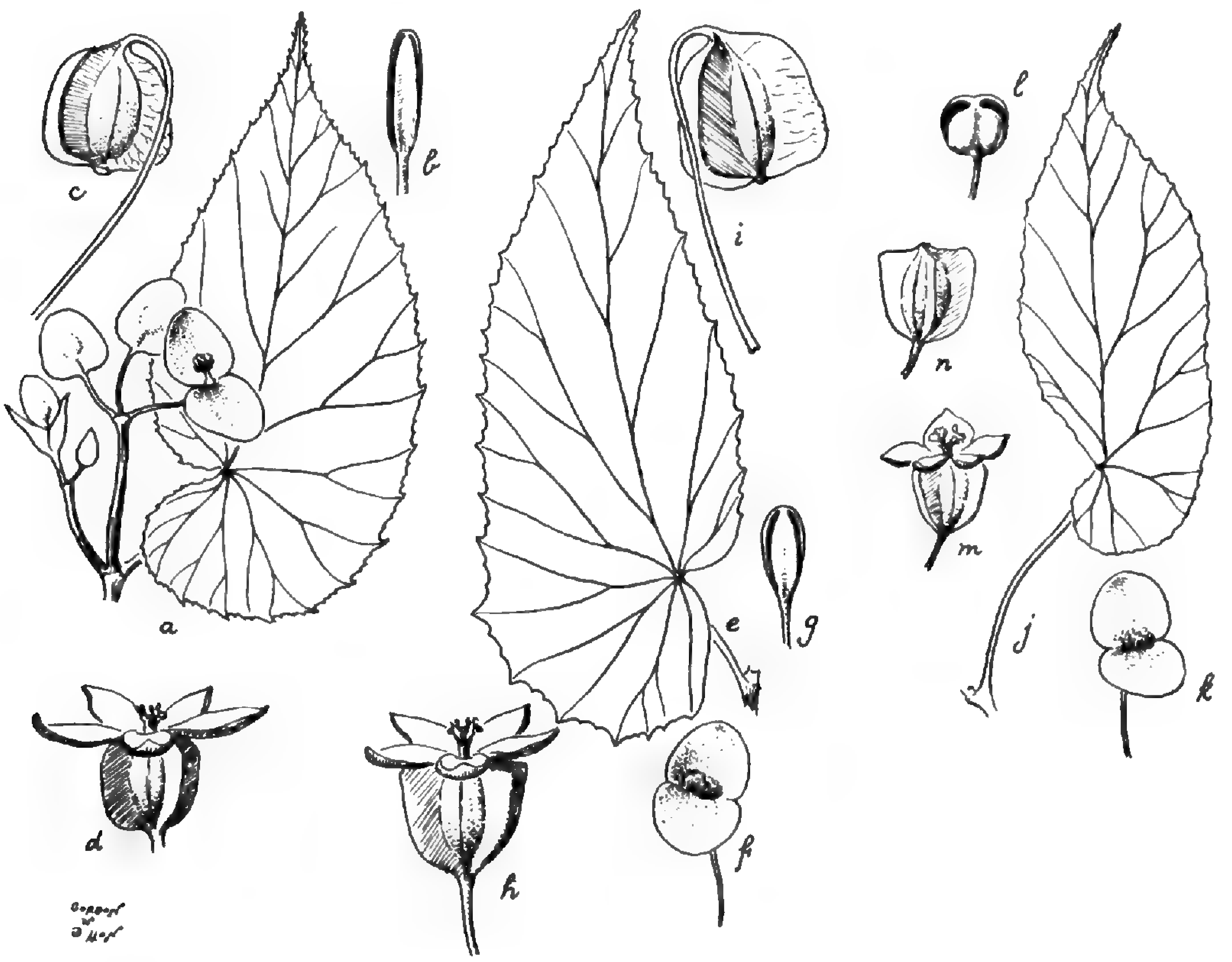

FIG. 5. *a–d. Begonia stilandra* Merr. & Perry, drawn from the type (except *d*): *a.* habit, × ½; *b.* one stamen, enlarged; *c.* capsule, × ½; *d.* ♀ flower, drawn from *Brass 12499,* × ½. *e–i. Begonia simulans* Merr. & Perry, drawn from the type: *e.* leaf, × ½; *f.* ♂ flower, × ½; *g.* single stamen, enlarged; *h.* ♀ flower, × ½; *i.* capsule, × ½. *j–n. Begonia pediophylla* Merr. & Perry, drawn from the type: *j.* leaf, × ½; *k.* ♂ flower, × ½; *l.* single stamen, enlarged; *m.* ♀ flower, × ½; *n.* capsule, × ½.

apice in crura 2 circiter 2 mm. longa spiraliter papillosa fissis; ovario 0.8–1.4 cm. longo ellipsoideo, alis 3, quarum 2 paullo minoribus, basi ultra ovarium ± 3 mm. productis, apice horizontaliter truncatis; capsula 2.5 cm. longa et lata, alis 2 minoribus 7 mm. medio latis, una majore 9 mm. medio lata.

NETHERLANDS NEW GUINEA: Balim River, *Brass 11835* (TYPE), December 1933, alt. 1800 m., a few plants in forest shade (branches, petioles and leaf-nerves beneath red; flowers pink).

The species is to be compared with *Begonia naumoniensis* Irmsch., with which it has many characters in common. It may be readily distinguished, however, by the smaller leaves with distinctly dentate margin and less cordate base, the more elongate anthers, and the larger ♀ flowers.

Begonia pediophylla sp. nov. § *Petermannia*. Fig. 5, j–n.

Planta parva glabra; foliis lanceolato-oblongis, 6–13 cm. longis, 2–4.5 cm. latis, apice abrupte acuminatis, acumine saepe angusto 0.5–1.5 cm. longo, basi inaequalibus, latere exteriore in lobum 1–2.3 cm. longum rotundatum productis nervis basalibus 3 vel 4, interiore rotundato-cuneatis vel obtusis nervis basalibus 1 vel 2, lateralibus utrinsecus 3 vel 4, margine indistincte serrato-denticulatis; petiolo 1–7.5 cm. longo; stipulis lanceolato-oblongis ± 7 mm. longis; inflorescentiis terminalibus et axillaribus pauci-floris ± 3 cm. longis, flores ♂ et ♀ gerentibus; bracteis 1 cm. longis ovato-oblongis; pedicellis 1–1.5 cm. longis; floribus ♂ : tepalis 2 late ovatis 1 cm. longis, basi leviter cordatis; staminibus ± 45 basi connatis, filamentis 2–4 mm. longis, antheris obovatis 1 mm. longis latisque, apice truncatis vix retusis, thecis inflatis, rimis antherae fere aequilongis; floribus ♀ : tepalis 5 ellipticis, 10 mm. longis, 6 mm. latis; stylis 3 circiter 6 mm. longis, basi 2 mm. connatis, apicem versus latioribus, apice in crura 2 brevia (2 mm. longa) patenti-erecta spiraliter papillosa fissis; ovario 1 cm. longo 5 mm. lato ellipsoideo, alis 3 subinaequalibus; capsula 1.4 cm. longa et lata, alis margine superiore subtruncatis rotundatis, basi rotundatis, 2 mm. atque 3 mm. medio latis.

BRITISH NEW GUINEA: Wharton Range, Murray Pass, *Brass 4577* (TYPE), July 1933, alt. 2840 m., forest shade (fleshy small shrub; branches, petioles, leaf-margins and nerves beneath red, also peduncles and pedicels; flowers very pale pink, marked with darker lines).

The shape of the anthers, with inflated sacs and gaping sutures, is very much like that pictured for *Begonia naumoniensis* Irmsch., as is also the indistinctly denticulate margin of the leaves. The new species differs in the smaller leaves, the number of stamens, and the much smaller fruits with narrower wings.

Begonia media sp. nov. § *Petermannia*. Fig. 6, a–c.

Planta circiter 1 m. alta; ramulis novellis parce crispe hirtellis cito glabris; foliis 12–24 cm. longis, 4.5–11.5 cm. latis, ovato-ellipticis vel lanceolato-ellipticis, apice acuminatis, acumine 2–2.5 cm. longo, basi valde inaequalibus, latere exteriore in lobum 1–4 cm. longum rotundatum productis nervis basalibus 4 vel 5, interiore obtusis vel paullo rotundatis nervis basalibus 1–3, lateralibus utrinsecus 3 vel 4, margine duplicato-serrato-dentatis, supra glabris, subtus costa nervisque sparsim hirtellis; petiolo 1–3 cm. longo sparsim crispe hirtello; stipulis oblongo-lanceolatis 1.3 cm. longis glabris; inflorescentiis terminalibus usque 12 cm. longis subracemosis; floribus ♂ : pedicello glabro ± 1 cm. longo; tepalis 2 suborbicularibus, 1–1.3 cm. longis, cordatis, glabris vel sparsim hirtellis; staminibus 70–80 basi breviter late connatis; filamentis 0.4–1 mm. longis, exterioribus quam interioribus brevioribus, antheris 1.6 mm. longis oblongis emarginatis; floribus ♀ non visis; pedicello 2 cm. longo; capsula cernua novella sparsim hirtella matura fere glabra, 1.5 cm. longa, 1.8 cm. lata; alis 3 subaequalibus basi rotundatis, ultra ovarium 2 mm. productis, margine superiore horizontaliter truncatis rotundatis, medio 5–6 mm. latis.

BRITISH NEW GUINEA: Mafulu, *Brass 5435* (TYPE in NYBG), November 1933, alt. 1250 m., undershrub in oak forest, rare (about 1 m. high; branches, peduncles, petioles and leaf-nerves beneath red; flowers pink).

Begonia tafaensis sp. nov. § *Petermannia*. Fig. 6, d–f.

Planta 1 m. alta glabra; ramulis in sicco striatis; foliis 11–21 cm. longis, 4.5–7 cm. latis, oblongo-ellipticis, apice acuminatis, acumine ± 2 cm. longo, basi valde inaequalibus, latere exteriore in lobum usque 3.5 cm. longum rotundatum productis nervis basalibus 5, interiore obtusis nervis basalibus 2, lateralibus utrinsecus 3 vel 4, margine minute denticulatis subsinuatis; petiolo 2–3 cm. longo; stipulis caducis haud visis; inflorescentiis terminalibus usque 10 cm. longis; floribus ♂: bracteis anguste oblongis; pedicello ± 1 cm. longo; tepalis 2 ovato-ellipticis, 2 cm. longis, 1.5 cm. latis, basi leviter cordatis; staminibus 45–55 basi connatis, filamentis 0.5–1.5 mm. longis, antheris 3.5 mm. longis clavatis emarginatis, rimis ½ antherae aequilongis; floribus ♀ non visis; pedicello 2 cm. longo; capsula cernua 1.5 cm. longa et lata, basi subangustata, alis subtriangularibus, margine superioribus ± 6 mm. longis, 4 mm. medio latis, valde venosis.

British New Guinea: Mount Tafa, *Brass 4017* (type in NYBG), May 1933, alt. 2100 m., fairly common in tall forest (fleshy plant 1 m. or more high; stems, petioles, peduncles and pedicels red; flowers pink); same locality, *Brass 5109*, September 1933, alt. 2400 m., damp places in valley forest, rare (erect fleshy sparsely branched shrub about 1 m. high; large pink flowers).

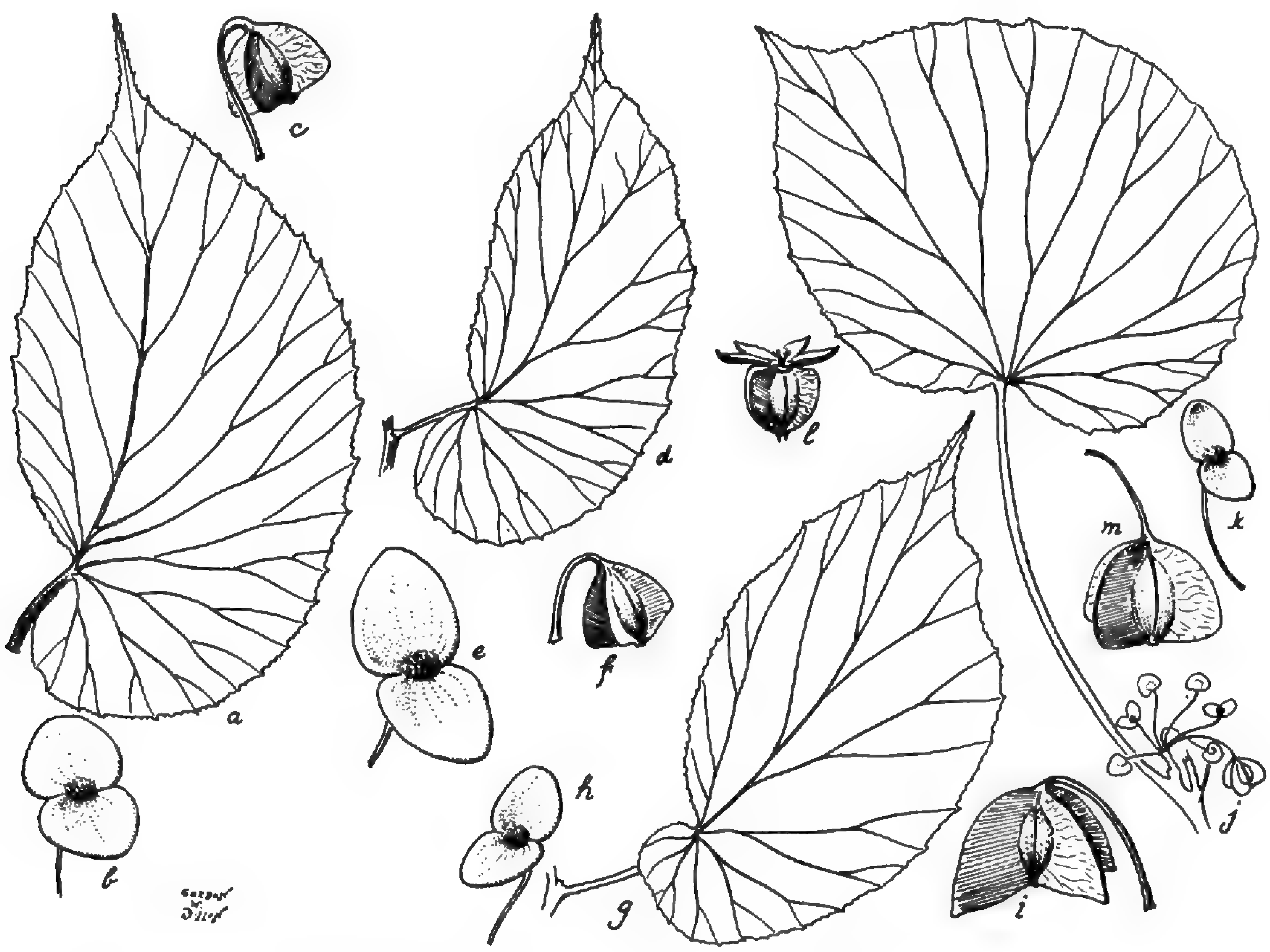

Fig. 6. *a–c. Begonia media* Merr. & Perry, drawn from the type: *a.* leaf, × ¼; *b.* ♂ flower, × ½; *c.* capsule, × ½. *d–f. Begonia tafaensis* Merr. & Perry, drawn from the type (except *d*): *d.* leaf, drawn from *Brass 5109*, × ¼; *e.* ♂ flower, × ½; *f.* capsule, × ½. *g–i. Begonia salomonensis* Merr. & Perry, drawn from the type: *g.* leaf, × ½; *h.* ♂ flower, × ½; *i.* capsule, × ½. *j–m. Begonia brachybotrys* Merr. & Perry, drawn from the type: *j.* habit, × ¼; *k.* ♂ flower, × ½; *l.* ♀ flower, × ½; *m.* capsule, × ½.

This species is fairly close to *Begonia media* Merr. & Perry, but it lacks the pubescence, the margin of the leaves more nearly approaches an entire condition, and the stamens are fewer. It may be near *B. Vandewateri* Ridl., but the plant is glabrous, although the leaf-veins on the lower surface are somewhat verruculose.

Begonia salomonensis sp. nov. § *Petermannia*. Fig. 6, g–i.

Planta 1–2 m. alta glabra; ramulis in sicco sulcatis; foliis 10–27 cm. longis, 5.5–11.5 cm. latis, ovato-ellipticis, apice subabrupte acuminatis vel acutis, basi latere exteriore in lobum 2–4 cm. longum rotundato-cordatum productis nervis basalibus 5, interiore rotundatis vel cuneatis nervis basalibus 2, lateralibus utrinsecus ± 3, margine inconspicue serrato-denticulatis interdum sinuatis; petiolo 1.5–4 cm. longo; stipulis haud visis, caducis; inflorescentia ♂ folio opposita, 8.5 cm. longa, subcymosa; floribus ♂ circiter 20; pedicello usque 1.5 cm. longo; tepalis 2 subrotundatis 1.2 cm. longis; staminibus ± 35 basi connatis, filamentis brevibus 0.6–0.8 mm. longis, antheris clavatis 1.6–1.8 mm. longis emarginatis, rimis circiter 0.4 mm. longis; inflorescentia ♀: axi 4 mm. longa; floribus ♀ non visis; pedicello 2.7 cm. longo; capsula 1.5–1.7 cm. longa, 2.5 cm. lata; alis 3 inaequalibus, basi rotundatis, ultra ovarium 3 mm. productis, in apicem sat acutum desinentibus, 2 brevioribus 7 mm. medio latis, margine superiore 1 cm. longis, una latiore 9 mm. medio lata, margine superiore 1.5 cm. longa.

SOLOMON ISLANDS: Ulawa: *Brass 2950* (TYPE), October 1932, swampy rain-forest, on coral limestones (fleshy shrub 1–2 m. high; flowers white; fruits red).

Begonia brachybotrys sp. nov. § *Petermannia*. Fig. 6, j–m.

Herba 80 cm. alta; caule glabro in sicco sulcato; foliis tenuiter chartaceis glabris, 10–20 cm. longis, 6–16 cm. latis, oblique ovato-ellipticis, apice abrupte breviter acuminatis, basi latere exteriore in lobum latum cordatum productis, interiore breviore cordato-rotundato, costa et petiolo angulum 130–140° formantibus, palmatim 7–9-nerviis, nervis a basi ⅓ longitudinis dichotomo-ramosis, margine subsinuatis ± serrato-denticulatis; petiolo glabro ± 15 cm. longo, folii laminae fere aequilongo; stipulis caducis probabiliter bracteis similibus; inflorescentiis axillaribus flores ♂ et ♀ gerentibus, axi 1–3 cm. longa, ramis brevissimis; bracteis novellis 1.5 cm. longis ovatis obtusis caducis; floribus ♂: pedicello usque 2 cm. longo; tepalis 2 glabris rotundatis 1 cm. longis latisque; staminibus 50–60, filamentis inaequalibus usque 1.5 mm. longis, antheris 0.8 mm. longis late ellipticis retusis, rimis antherae subaequilongis; floribus ♀: pedicello ± 2 cm. longo; tepalis 5 ellipticis 9 mm. longis, apice rotundatis; stylis 3 basi connatis sursum liberis 3 mm. longis, apice in crura 2 circiter 1 mm. longa patenti-erecta spiraliter papillosa fissis; ovario 6–7 mm. longo ellipsoideo, alis 3 subaequalibus; capsula 1.5 cm. longa, 1.6–1.8 cm. lata, alis apice horizontaliter truncatis obtusis, basi 3 mm. ultra loculos productis, 3–4 mm. medio latis.

NETHERLANDS NEW GUINEA: Bernhard Camp, Idenburg River, *Brass 14112* (TYPE), April 1939, alt. 55 m., bank of a small stream in rain-forest (herb 80 cm. high; flowers pink). BRITISH NEW GUINEA: Mafulu, *Brass 5429*, November 1933, alt. 1250 m., oak forest ground cover (about 50 cm. high; stems, petioles and peduncles red; leaves dark green; small pink flowers and red fruits).

This species should be compared with *Begonia strictiformis* Irmsch. from the North Celebes; the Papuasian material is glabrous with axillary inflorescences, fewer stamens, and leaves minutely denticulate.

Begonia novoguineensis sp. nov. § *Petermannia.* Fig. 7, a, b.

Planta 60 cm. alta; ramulis parce hirsutis dein glabratis; foliis ovato-ellipticis, 16–29 cm. longis, 10–15 cm. latis, apice breviter subabrupte acuminatis, acumine 2 cm. longo basi 1 cm. lato, basi latere exteriore in lobum 2–5 cm. longum rotundato-cordatum nervis basalibus 5, interiore rotundatis nervis basalibus 2, lateralibus utrinsecus circiter 5, margine sinuatis inconspicue serrato-denticulatis setulosis, supra glabris, subtus costa nervisque sparsim setulosis; petiolo 2–7 cm. longo parce hirsuto; stipulis ± 1 cm. longis anguste oblongis, apice setulosis caducis; inflorescentiis ♂ tantum visis usque 30 cm. longis, racemoso-paniculatis, axi ramisque sparsim hirtellis, ramulis pedicellisque minute glanduloso-pilosis, bracteis parvis stipulis similibus; pedicello 5–7 mm. longo; tepalis 2 late orbicularibus 5–7 mm. longis, minute hirtellis vel glabratis; staminibus circiter 60, filamentis quam antheris brevioribus, antheris 1 mm. longis oblongo-obovatis emarginatis, rimis ½ antherae aequilongis.

NETHERLANDS NEW GUINEA: Hollandia, *Brass 8841* (TYPE), June 1938, alt. 50 m., deep ravine (60 cm. high; leaves red beneath; flowers white).

Among the descriptions of Papuasian species of *Begonia,* perhaps this is to be compared to *B. brevirimosa* Irmsch., but it is a much less pubescent plant with about twice as many stamens; the young leaves are rather densely hirsute but very quickly become glabrate.

Begonia subelliptica sp. nov. § *Petermannia.* Fig. 7, c–e.

Planta 1 m. alta foliis novellis exceptis glabra; foliis novellis 5 cm. longis, subtus costa nervisque hirtellis, maturis late obovatis vel ellipticis, 20–25 cm. longis, 13–16 cm. latis, apice obtusis vel rotundatis, basi latere exteriore in lobum 5–6 cm. longum rotundato-auriculatum productis nervis basalibus 6, interiore rotundatis nervis basalibus 3 vel 4, lateralibus utrinsecus 4, margine subsinuatis integris; petiolo 5–7 cm. longo; stipulis oblongis ± 3 cm. longis, apice obtusis, breviter setosis; inflorescentiis 9–15 cm. longis flores ♂ atque ♀ gerentibus; floribus ♂ in ramis brevissimis fasciculatis; pedicello usque 2 cm. longo; tepalis 2 suborbicularibus 1.3–1.8 cm. diametro; staminibus 30–35 basi connatis, filamentis 1–1.5 mm. longis, antheris oblongis 1.5–2 mm. longis obtusis, rimis antherae fere aequilongis; floribus ♀ non visis; pedicello 4.5 cm. longo; capsula cernua 2.2 cm. longa et lata, alis 3 subaequalibus medio 6 mm. latis, basi atque apice angulis rotundatis.

NETHERLANDS NEW GUINEA: 4 km. southwest of Bernhard Camp, Idenburg River, *Brass 13396* (TYPE), March 1939, alt. 850 m., undergrowth of flood-plain rain-forest (single clump 1 m. high; leaf-veins red beneath; flowers white, veined with pink).

Begonia Somervillei Hemsl. Kew Bull. **1896**: 17. 1896.

SOLOMON ISLANDS: San Cristobal: Waimamura, *Brass 2644,* August 1932, steep rocky or gravelly slopes sheltered by rain-forest, very common (showy fleshy shrub growing often in dense masses; stems and petioles reddish; inflorescence pale pink).

Described from New Georgia and recorded only by the original description.

Begonia Augustae Irmsch. Bot. Jahrb. **50:** 350, *f. 2, A–G.* 1913.

British New Guinea: Oroville Camp, Fly River, *Brass 7392, 7417,* August 1936, plentiful on steep river bank of red clay (robust plant over 1 m. high; leaves dark green, very glossy above; flowers and fruit red in *7392,* flowers white in *7417*). North-eastern New Guinea.

This should also be compared with *Begonia sogerensis* Ridl.

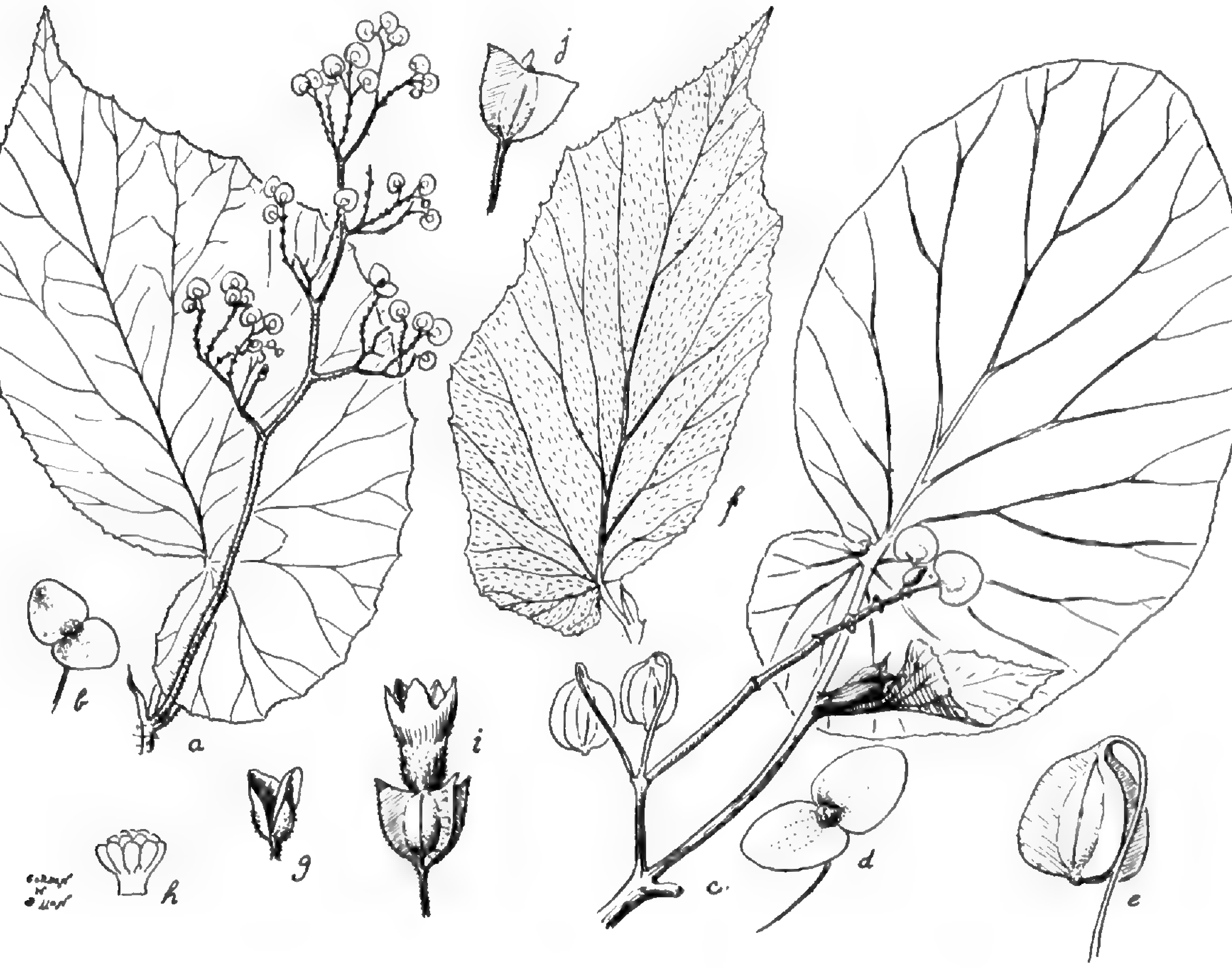

Fig. 7. *a, b. Begonia novoguineensis* Merr. & Perry, drawn from the type: *a.* habit, × ¼; *b.* ♂ flower, × ½. *c–e. Begonia subelliptica* Merr. & Perry, drawn from the type: *c.* habit, × ¼; *d.* ♂ flower, × ½; *e.* capsule, × ½. *f–j. Symbegonia papuana* Merr. & Perry, drawn from the type: *f.* leaf, × ½; *g.* ♂ flower, × ½; *h.* cluster of stamens, enlarged; *i.* ♀ flower, × ½; *j.* capsule, × ½.

Begonia spilotophylla F. v. Muell. Descr. Not. Pap. Pl. **4:** 67. 1876; D'Albertis, New Guin. **2:** 398. 1880; non sensu K. Schum. & Lauterb. (fide Irmscher, Bot. Jahrb. **50:** 345. 1913).

British New Guinea: Fly River, 528 mile Camp, *Brass 6702, 6730,* May 1936, alt. 80 m., occasional in forest undergrowth on ridges, gregarious and very abundant in semi-shade on steep slopes above river (very conspicuous fleshy herb 30–40 cm. high; leaves spotted with silver, the veins purple; flowers pink).

The ♀ flower: tepals 5, oblong, 1.3–1.4 cm. long; styles 3, separate, 4–5 mm. long, broadening at the apex into 2 short spreading spirally papillose lobes; otherwise as in the original description. These parts had apparently fallen before the original specimens were collected.

Symbegonia Warburg

Symbegonia papuana sp. nov. Fig. 7, f–j.

Planta 30–50 cm. alta; caule, ramulis, petiolis et axi inflorescentiae ± dense et crispule ferrugineo-hirtellis; foliis chartaceis inaequaliter oblongo-ovatis vel oblongo-obovatis, 9–12 cm. longis et 3.5–5 cm. latis, apice breviter obtusiuscule acuminatis, basi inaequalibus, latere exteriore in lobum 0.5–1.5 cm. longum rotundatum productis nervis basalibus 3, interiore rotundatis vel cuneatis nervis basalibus 1 vel 2, lateralibus utrinsecus 3 vel 4, margine remotiuscule denticulatis interdum repandis, supra consperse et crispule subhirtellis vel pilosis, subtus costa nervisque crispe hirtellis; petiolo 0.5–1.5 cm. longo; stipulis late oblongis 1 cm. longis, apice obtusis abrupte setulosis, costa minute pilosis; inflorescentiis terminalibus usque 7 cm. longis; bracteis glabris late ovatis membranaceis verisimiliter albis; floribus ♂ : pedicello brevi; tepalis 2 ovato-ellipticis, circiter 1 cm. longis, consperse et basim versus dense crispule hirtellis; staminibus ± 15, filamentis in columnam brevem connatis, antheris late oblongis obtusis 1 mm. longis; floribus ♀ : pedicello 0.5 (fructus 1–1.5) cm. longo; perianthio campanulato in sicco usque 1.5 cm. longo (lobis inclusis 5 mm. longis obtusis) et 0.8 cm. lato, extus consperse crispe pilosulo; stylis 3, basi 1 mm. connatis, deinde in crura 2 stricto-erecta 5 mm. longa torta partitis; ovario ellipsoideo 1 cm. longo, 0.6 cm. lato, sparsim piloso, alato; capsula 1.5 cm. longa et lata, alis subtriangularibus aequalibus, basi rotundatis, apice acutiuscule angulatis apiculatis, margine superiore 6–7 mm. longis, 3 mm. medio latis.

NETHERLANDS NEW GUINEA: 15 km. southwest of Bernhard Camp, Idenburg River, *Brass 12161* (TYPE), January 1939, alt. 1750 m., common in rain-forested gullies (plant 30–50 cm. high; leaf-nerves red beneath; flowers white).

This plant appears to be most like *Symbegonia strigosa* Warb., but it has a much shorter indument and larger and differently proportioned fruits.

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STUDIES IN THE THEACEAE, XIV
NOTES ON THE WEST INDIAN SPECIES OF TERNSTROEMIA

CLARENCE E. KOBUSKI

IN 1896, Urban (Bot. Jahrb. **21:** 521–544) presented an excellent and rather complete treatment of the West Indian species of *Ternstroemia.* The present contribution is hardly more than a review based upon Urban's work. As a result of study of the American species as a whole, I feel that Urban placed too much significance on the extent of connation in the petals and on other variable characters, using them extensively in his key to the species. Furthermore, the new species, which were described under the joint authorship of Krug and Urban, were often based on minor and variable characters. Nearly every number collected by C. Wright in Cuba was designated as a new species or variety. These species are not outstanding and in several instances have been reduced to synonymy in this paper.

In my presentation of the South American and the Mexican and Central American groups (Jour. Arnold Arb. **23:** 298–343, 464–478. 1942), complete description of all the species were offered, many of them for the first time. However, in the present paper, because of Urban's very carefully drawn descriptions, it is unnecessary to continue this practice, and instead only the salient characteristics, along with discussions of specific relationships and differences, are recorded. Here, for the first time, to my knowledge, is mentioned a pubescent species of *Ternstroemia, T. pubescens* from Santo Domingo.

KEY TO THE SPECIES

A. Pedicels, bracteoles, calyx-lobes, lower surface of leaves and current year's growth covered with a short villous pubescence (Santo Domingo) ......1. *T. pubescens.*
AA. Entire plant strictly glabrous.
  B. Ovary and fruit one- or three-celled.
    C. Ovary three-celled.
      D. Leaves membranaceous, not granular-punctate; stigma subcapitate, tri-crenate; each ovary cell single-seeded (Trinidad, French Guiana). ....2. *T. delicatula.*
      DD. Leaves heavy-coriaceous, densely granular-punctate on both surfaces; stigma three-parted, evolute; ovary cells more than one-seeded (Guadeloupe, Martinique, St. Kitts, Dominica)................3. *T. elliptica.*
    CC. Ovary one-celled ....4. *T. parviflora.*
  BB. Ovary two- or four-celled.
    C. Ovary four-celled (Tobago, Trinidad).................5. *T. oligostemon.*
    CC. Ovary two-celled.
      D. Pedicel with four bracteoles in two opposite pairs (Porto Rico)....... ....6. *T. heptasepala.*
      DD. Pedicel with two opposite bracteoles.
        E. Flowers and fruit sessile or subsessile (Jamaica)....7. *T. subsessilis.*
        EE. Flowers and fruit distinctly pedicellate.
          F. Calyx-lobes remarkably large, the smallest over 1 cm. long (1.2–1.7 cm.).

G. Calyx-lobes glandular-denticulate, up to 17 mm. long; bracteoles 7–9 mm. long, ovate, eglandular; pedicels 1.5–2.0 cm. long (Jamaica) . . . . 8. *T. calycina.*

GG. Calyx-lobes eglandular, 10–12(–14) mm. long; bracteoles minute, not over 3 mm. long, acuminate; pedicels 6–8 cm. long (Jamaica) . . . . 9. *T. rostrata.*

FF. Calyx-lobes under 1 cm. long.

G. Calyx-lobes and bracteoles eglandular.

H. Leaves elliptic-oblong, 2–3 times longer than broad, acute at apex, up to 12 cm. long (Porto Rico) . 10. *T. luquillensis.*

HH. Leaves broadly ovate-elliptic, suborbicular, rounded and lightly emarginate at apex, 3–4 cm. long, 3–4 cm. wide (Haiti) . . . . 11. *T. Barkeri.*

GG. Calyx-lobes and bracteoles glandular-denticulate.

H. Bracteoles long, conspicuous, linear, foliar, up to 6 mm. long (Haiti) . . . . 12. *T. Nashii.*

HH. Bracteoles seldom over 3 mm. long, not foliar and usually inconspicuous.

I. Largest leaves less than 3 cm. long.

J. Outer calyx-lobes very small, ca. 2.0–2.5 mm. long; bracteoles not over 1.5 mm. long, not keeled (Haiti) . . . . 13. *T. Selleana.*

JJ. Calyx-lobes 4–6 mm. long; bracteoles 2–4 mm. long, keeled.

K. Leaves rounded, spathulate, not revolute; bracteoles long-deltoid, ca. 3 mm. long (Haiti) . . . . 14. *T. gracilifolia.*

KK. Leaves thick-coriaceous, ovate or broadly ovate, revolute; bracteoles shortly triangular, acute, ca. 2 mm. long (Cuba) . . . . 15. *T. flavescens.*

II. Largest leaves well over 3 cm. long.

J. Pedicels less than 1.5 cm. long.

K. Pedicels very short, 0.5–0.9 cm. long, usually averaging 0.6 cm.

L. Leaves nearly orbicular (Cuba) . . . . 16. *T. baracoënsis.*

LL. Leaves elliptic-oblong, usually 2½–3 times longer than broad (Cuba) . . . . . 17. *T. cernua.*

KK. Pedicels 1.0–1.5 cm. long; calyx-lobes 3 mm. or less (Cuba) . . . . 18. *T. microcalyx.*

JJ. Pedicels longer than 1.5 cm., usually much longer, in some cases up to 8 cm.

K. Calyx-lobes distinctly sharp-pointed (Porto Rico) . . . . 19. *T. Stahlii.*

KK. Calyx-lobes usually rounded or obtuse.

L. Leaves with 12 or 13 pairs of veins, clearly visible on the lower surface (Jamaica) . . . . 20. *T. granulata.*

LL. Leaves with 5–8 pairs of veins, usually inconspicuous on the lower surface.

M. Leaves rounded or very obtuse at the base; petiole 6–12 mm. long; fruit semi-oval (Jamaica) . . . . 21. *T. Hartii.*

MM. Leaves attenuate at the base; petiole 3–7 mm. long; fruit conical (Cuba, Haiti, Santo Domingo, Porto Rico, St. Jan, St. Eustatius, Guadeloupe, Martinique) . . . . 22. *T. peduncularis.*

1. **Ternstroemia pubescens,** sp. nov.

Ramuli grisei, glabri, hornotinis brunnescentibus breviter villosis. Folia elliptica vel obovata, apice ramulorum congesta, coriacea vel subcoriacea, (2.5–) 5–6 cm. longa et 1.5–3.0 cm. lata, supra glabra opaca (ut videtur rubida), subtus breviter villosa, pallidiora, apice obtusa, basi in petiolum protracta, margine integerrima vel subrevoluta, costa supra impressa (in toto manifesta), venis 5 vel 6 paribus, supra obscuris, subtus pauce manifestis, petiolis 8–14 mm. longis, villosulis. Flores parvissimi, in foliorum axillis solitarii, pedicellis 8–14 mm. longis breviter villosis, bracteolis 2 oppositis vel suboppositis ca. 1 mm. minusve longis villosulis triangularibus vel subtriangularibus sparse glanduloso-denticulatis; sepala 5, imbricata, subaequalia, exterioribus villosulis ca. 2.5 mm. longis et 2.0 mm. latis pergamentaceis margine glanduloso-denticulatis, interioribus glabris sublongioribus (ca. 3 mm. longis et 2 mm. latis) margine scariosis et subfimbriatis (non glanduloso-denticulatis); petala 5, imbricata, obovata, basi leviter coalita, ca. 3.5 mm. longa, quam calyce pauce longiora; stamina ca. 30, filamentis antherisque ca. 1 mm. longis; ovarium parvum, 2-loculare, glabrum, basi 1.5–2.0 mm. diam., in stylum 1.5 mm. longum attenuatum, stigmatibus bipunctiformibus. Fructus ignotus.

DISTRIBUTION: Santo Domingo.

SANTO DOMINGO: Cordillera Central, Prov. Monte Cristi, Monción, Lagunas de Cenobi, common in forest, alt. 1100 m., *E. L. Ekman H-12879* (TYPE, US), June 17, 1929.

The astounding distinguishing feature of this species is the presence of a short villous pubescence on the lower surface of the leaves, the current year's growth of branchlets, the pedicels, bracteoles and calyx-lobes. This separates the species from all others in the genus. To my knowledge it is the first record of any kind of pubescence in *Ternstroemia*. Very closely related is *T. microcalyx* Krug & Urban. In the latter species the sepals are equally as small but are entire, lacking the distinct glandular denticulations on the margin as in *T. pubescens*. Also, the petals in *T. microcalyx* are 7 mm. long, twice as long as the petals in *T. pubescens*, which barely exceed the calyx-lobes in length. In *T. microcalyx* the petiole is considerably shorter (5–8 mm.) and the attenuation of the leaf-base into the petiole is more pronounced.

2. **Ternstroemia delicatula** Choisy in Mém. Soc. Phys. Hist. Nat. Genève, **14**: 106 (Mém. Ternstr. 18). 1855. — Wawra in Martius, Fl. Bras. **12**[1]: 273. 1886 (excl. spec. Weddell). — Krug & Urban in Bot. Jahrb. **21**: 536. 1896. — Melchior in Nat. Pflanzenfam. ed 2, **21**: 142. 1925. — R. O. Williams, Fl. Trinidad & Tobago, **1**: 70. 1929. — Kobuski in Jour. Arnold Arb. **23**: 308. 1942.

Mokofua delicatula (Choisy) O. Kuntze, Rev. Gen. Pl. **1**: 63. 1891.

Taonabo delicatula (Choisy) Szyszylowicz in Nat. Pflanzenfam. III. **6**: 118. 1893.

DISTRIBUTION: Trinidad, French Guiana.

TRINIDAD: Forests near Arima, alt. 600 m., *H. F. A. Eggers 1381* (NY, US). FRENCH GUIANA: Cayenne, *Martin s.n.* (ISOTYPE, FM; photos, FM, G).

This species is described as having membranaceous, obovate-elliptic leaves, narrowed at the base into a long petiole (6–15 mm. long), obtuse or very shortly acuminate at the apex, 5–9 cm. long and 2–4 cm. wide, quite distinctly crenulate in the upper half, and with lateral nerves prominulous on both surfaces. The flowers are fairly numerous, crowded on the branchlets. The peduncle is slender, 1–2 cm. long, recurved. The 5 sepals are more or less equal, 5–6 mm. long, obtuse at the apex, with eglandular entire margins. The ovary is globose-conical, 3-celled, contracted into a style ca. 4 mm. long which is topped by a subcapitate tri-crenate stigma. Each cell of the fruit is single-seeded.

The membranaceous leaves, the long petiole, the crowded flowers, the thin, recurved pedicels, the eglandular sepals, and the tri-crenate, subcapitate stigma are the distinguishing characters for identification. This is the only species which is found both in South America and the West Indies. However, its closest relationship is with *T. Browniana* Kobuski of British Guiana. Both have entire, scarious-margined, eglandular, small (5 mm. long) calyx-lobes, 3-celled ovaries and fruit with a single seed to each locule, and slender pedicels. *Ternstroemia Browniana* differs in having a punctiform rather than a subcapitate, tri-crenate stigma, and in the coriaceous, veinless leaves, shorter and rounded at the apex.

3. **Ternstroemia elliptica** Swartz, Prodr. 81. 1788; Fl. Ind. Occ. **2**: 929. 1800.— Vahl, Symb. **2**: 61. 1791.— De Candolle in Mém. Soc. Phys. Hist. Nat. Genève, **1**: 410 (Mém. Ternstr. 18). 1822; Prodr. **1**: 523. 1824.— Choisy in Mém. Soc. Phys. Hist. Nat. Genève, **14**: 129 (Mém. Ternstr. 15). 1855.— Urban in Bot. Jahrb. **21**: 535. 1893.— Melchior in Nat. Pflanzenfam. ed. 2, **21**: 142. 1925.

Mokofua elliptica (Swartz) O. Kuntze, Rev. Gen. Pl. **1**: 63. 1891.

Amphania integrifolia Solander Mss. ex DeCandolle in Mém. Soc. Phys. Hist. Nat. Genève, **1**: 410 (Mém. Ternstr. 18). 1822.

DISTRIBUTION: Guadeloupe, Martinique, St. Kitts, Dominica.

GUADELOUPE: Trois-Rivières, alt. 300–600 m., *Père Duss 2987* (FM, NY, US), 1893 (grand bel arbre, rare; feuillage très vert.; dans la haute région, comme à la Savane à Mulets, cet arbre reste à l'état d'arbrisseau rabougri).— Soufrière, somets volcaniques humides, alt. 1100 m., *H. Stehlé 322, 1023* (NY), Févr.-Sept. 1936 (2 m., arbrisseau rabougri à cette altitude).— Savane à Mulets forêt dense ventée, alt. 1100 m., *H. Stehlé 1524* (US), 8 Février 1937 (rabougrie). MARTINIQUE: Bois de Fonds Saint Denis, de Case Pilote et de la fontaine Absalon, alt. 300–600 m., *Père Duss 638* (NY, US), 1882–1883; *Père Duss 171* (FM, Mo, NY, US; not *Duss 171,* Berlin), 1887. ST. KITTS: Upper slopes of Mt. Misery, *N. L. Britton & J. F. Cowell 532* (NY, US). DOMINICA: *Dr. Imray 280* (G, sterile) (fide Urban).

This species is characterized by coriaceous leaves, 4.5–9.0 cm. long and 2–4 cm. wide, obovate to obovate-elliptic, granular-punctate on both surfaces, very obtuse at the apex, contracted at the base into a petiole 5–10 mm. long, the margin revolute, entire, the veins (ca. 7 pairs) obsolete or prominulous on the lower surface; peduncles 1–2 cm. long, the bracteoles ovate, the 5 sepals unequal, semiorbicular, 4–7 mm. long, ca. 5 mm. wide, the outer lobes glandular-denticulate, the petals 5, obovate, 8–10 mm. long, 6–8 mm. wide, the stamens numerous, 2–4-seriate, the filaments unequal, the inner filaments nearly 3 times longer than the anthers, the outer filaments about equal to anthers in length; ovary semiglobose or conical, 3-celled, tapering through the style to a 3-parted, evolute stigma which surpasses considerably the style in diameter; fruit three-celled, up to 18 mm. diam., the seeds few.

The characters significant in identification are: the three-celled ovary and fruit, the 3-parted evolute stigma, the long petiole, the granular punctations on both leaf-surfaces, the very numerous stamens in 2–4 series, and the eglandular sepals and bracteoles.

Cited above is *Duss 171* from various American herbaria. Evidently this specimen must differ from *Duss 171* as found in the herbarium at Berlin, since Urban (1893) cited the number as belonging to his new species *T. oligostemon,* which, in turn, is very different from the present species.

According to the labels and dates, Duss made frequent collections over a period of years, in different localities, assigning a single number to the massed collections.

4. **Ternstroemia parviflora** Krug & Urban in Bot. Jahrb. **21:** 523. 1896. — Melchior in Nat. Pflanzenfam. ed. 2, **21:** 142. 1925.

DISTRIBUTION: Cuba.

CUBA: Loma del Pinal Mayan, along road, *C. Wright 2110* (ISOTYPES, G, M), large bush, 10 ft.; flowers whitish rose, tinged with yellow at center. Prov. Santa Clara: Palm Barren, *N. L. Britton & J. F. Cowell 10178* (NY, US), March 1911. — Santa Clara to Loma Cruz, *N. L. Britton, E. G. Britton & J. F. Cowell 10220* (NY, US), March 23, 1911. — Palm Barren, *N. L. Britton, E. G. Britton & P. Wilson 6168* (NY, US), March 1910 (shrub 2 m.). Prov. Pinar del Rio: on top of Cajalbana, *Bros. Léon & Charles 4955* (NY), April 6, 1915 (shrub 4–5 ft.). — Hato Abajo, *J. T. Roig 3185* (G, NY, US), Apr. 7, 1924. Prov. Oriente: Along streamlets or edge of deciduous thickets, *J. A. Shafer 1282* (FM, NY, US), *1424* (FM, NY), *1691* (NY), *3189* (FM, NY, US), Apr.-Dec. 1909 (shrub 1–3 m.).

In his original description, Urban states that the ovary is one-celled, seven-ovulate. This character seems to hold for the type. However, such is not the case in all specimens. After dissecting several ovaries from each specimen, I find that *Shafer 1282* and *1691,* as well as *Britton, Britton and Cowell 10220,* possess single-celled ovaries. *Shafer 1424* and *3189, Bros. Léon and Charles 4955* and *Britton, Britton & Wilson 6168* have two-celled ovaries, while *Britton & Cowell 10178* have both single-celled and two-celled ovaries, with the larger number single-celled. The ovary is very minute (1 mm. or less long), conical in shape, and tapering into a style ca. 2 mm. long. Because of the surrounding subligneous calyx-lobes and the flatness of the ovary, dissections are very difficult.

The pedicels are very slender and are 2.5–3.0 cm. long. The bracteoles are ca. 2 mm. long, narrow and acute at the apex. Although not constantly so, there is a tendency for one of the bracteoles to be placed as much as 2 mm. below the sepals. Nearly every specimen shows this arrangement. The calyx-lobes are 3–5 cm. long and ovate, and the outer lobes are somewhat apiculate. The anthers also are long-apiculate (1 mm.).

Most closely allied to this species is *T. microcalyx* Kr. & Urb., which can be separated by the shorter stockier pedicel (1.0–1.5 cm. long), smaller calyx-lobes, and longer petals. The petals of *T. parviflora* scarcely exceed the calyx in length.

5. **Ternstroemia oligostemon** Krug & Urban in Bot. Jahrb. **21:** 534. 1896. — Melchior in Nat. Pflanzenfam. ed. 2, **21:** 142. 1925. — R. O. Williams, Fl. Trinidad & Tobago, **1:** 70. 1927. — Kobuski in Jour. Arnold Arb. **23:** 327. 1942.

DISTRIBUTION: Tobago, Trinidad.

Tobago: The Widow, *W. E. Broadway 4154* (FM, Mo, US), Sept. 29, 1910 (shrub with white, sweet-smelling flowers). — Easterfield, *W. E. Broadway 4369* (FM), Dec. 16, 1912 (bark of trunk rough and dark in color; leaves glossy-green). — Slopes of main ridge above Parlatuvier, relict forest bordering cultivations, *N. Y. Sandwith 1916* (NY), Oct. 24, 1937 (middle-sized tree with white flowers). — Exact locality missing, *F. A. "Durity" 12620* (NY), Jan. 21, 1932.

This species is characterized by obovate or narrowly obovate-elliptic leaves, 6–10(–14) cm. long and 2.5–5.0 cm. wide, shortly or obtusely acuminate at the apex, long-attenuately tapering at the base into a petiole 8–13 mm. long, the margin subrevolute, crenulate or occasionally entire, frequently glandular, the 10–15 pairs of rather straight veins conspicuous on the lower surface, sometimes obsolete above; the texture of the leaves is thick-chartaceous and the surface is free from granular punctations. The flowers are white with a sweet odor and the pedicels measure 1.0–2.5 cm. in length. The sepals are suborbicular, 5–6 mm. long and about 5 mm. wide and, like the narrowly ovate bracteoles, devoid of glandular denticulations. The petals are about 7 mm. long. The stamens (ca. 20) are about 5 mm. long, the filaments measuring only 1 mm. in length while the anthers are 4 mm. long, linear, and taper gradually to the apex. The ovary is conical, 4-celled, each cell having one or two ovules and tapering into the style, which is crowned by an entire stigma slightly exceeding the style in diameter. The fruit is globose, 12–20 mm. in diameter, 4-celled with one or two seeds in each cell, only one of which usually fully matures.

One of the types of this species, as cited by Krug and Urban, is *Père Duss 171* from Martinique. Before me are several specimens of this collection (supposed isotypes, FM, Mo, NY, US), which belong not to this species, but to *T. elliptica*. Perhaps there may be some confusion in the label of the Berlin specimen, since all seven sheets of *Duss 171* in American herbaria are true *T. elliptica*. On the label of two specimens in the New York and U. S. National herbaria are two numbers, *171* and *638*. There is no difference in the material, but *Duss 638* has been cited by Urban under *T. elliptica*. I doubt very much whether *T. oligostemon* actually grows in either Martinique or Guadeloupe, from which it has been cited. Williams cites material from Trinidad (none of which I have seen), and this, with that from Tobago, perhaps gives the correct geographical distribution for the species.

Krug & Urban's description is very complete. They state, however, that the ovary and fruit are 2-celled or incompletely 4-celled and that the number of ovules and seeds in either case is four. All material sectioned by me showed the ovary and fruit to be clearly 4-celled, with one or two ovules in each cell. In the first, eight seeds were found, four of which were fully mature, while the other four, although immature, were of considerable size. In other cases, a single seed was found in each cell.

The distinguishing characters of *T. oligostemon* are the four-celled ovary and fruit, the eglandular sepals and bracteoles, the entire stigma, and the 10–15 pairs of lateral veins of the thick-chartaceous leaves. Its closest ally is *T. delicatula* of Trinidad and French Guiana. This latter species can be distinguished by the 3-celled ovary, the tricrenate stigma, and the thin papery leaves with 7 or 8 pairs of lateral veins.

6. **Ternstroemia heptasepala** Krug & Urban in Bot. Jahrb. **21**: 530. 1896. — Urban, Fl. Ind. Occ. **4**: 411. 1910. — Melchior in Nat. Pflanzenfam. ed. 2, **21**: 142. 1925.

Taonabo heptasepala (Kr. & Urb.) Britton in Britton & Wilson, Sci. Surv. Porto Rico & Virgin Isl. **5**: 581. 1924.

DISTRIBUTION: Porto Rico.

PORTO RICO: Sierra de Luquillo, in planitie montis Jiminez, *P. Sintenis 1425* (ISOTYPES, FM, G, Mo, NY, US), June-July 1885. — Luquillo Mts., *P. Wilson 151* (FM, NY), July 1902. — Yunque, *W. E. Hess & F. L. Stevens 2949* (NY), Aug. 28, 1913.

According to the name and Urban's subsequent interpretation, this species is characterized by seven sepals and a single pair of bracteoles. However, to my mind, the more correct interpretation is to consider the flower as having the customary number of sepals (five) and two pairs of bracteoles. The outer pair of bracteoles are unequal, opposite, ovate or triangular, keeled, eglandular, and about 1 mm. long. The bracteoles of the second or inner pair alternate with those of the outer pair and are subrotund, measuring 2 mm. or less in length, being also eglandular. The sepals themselves are imbricate, eglandular, subrotund, varying from 3–5 mm. in length. The pedicels are curved, 10–18 mm. long.

Closely allied is *T. subsessilis,* which can be separated by the single pair of bracteoles, the two-parted style, and the subsessile flowers.

7. **Ternstroemia subsessilis** (Britton), comb. nov.

Taonabo subsessilis Britton in Britton & Wilson, Sci. Surv. Porto Rico & Virgin Isl. **5**: 581. 1924.

DISTRIBUTION: Porto Rico.

PORTO RICO: Luquillo Mts., rocky summit of Mt. Yunque, *N. L. Britton & E. M. Bruner 7627* (NY, TYPE), Feb. 1923 (shrub 1 m. high; petals white, 1 cm. long). — Sierra de Naguabo, Río Prieto and adjacent hills, thickets at top of peak, alt. 1000 m., *J. A. Shafer 3648* (NY, US), Aug. 1914 (small tree 1–2 m.).

This interesting species is characterized by sessile or subsessile flowers and fruit. This character, along with the two-parted style, is sufficient to separate *T. subsessilis* from all other species of the genus in the West Indies. The suborbicular eglandular calyx-lobes are very minute, the inner lobes not over 3 mm. and the outer lobes about 2 mm. long. The bracteoles resemble the calyx-lobes in shape but seldom measure over 1 mm. in length. Britton states that the calyx-lobes (inner) measure 5 mm. and the petals measure 10 mm. In the type specimen I could find no calyx-lobes measuring more than 3 mm. and the petals were lacking. The fruit is conical, tapering to a decided point. Because of the lack of material, no dissections have been made to determine the number of cells of the ovary and the number of ovules.

8. **Ternstroemia calycina** Fawcett & Rendle in Jour. Bot. **60**: 363. 1922. Fl. Jam. **5**: 184. 1926. — Melchior in Nat. Pflanzenfam. ed. 2, **21**: 142. 1925.

DISTRIBUTION: Jamaica.

JAMAICA: *W. Harris 10979, 11035* (ISOTYPES, NY).

Long ovate calyx-lobes (13–17 $\times$ 9–12 mm.) and bracteoles (7–9 mm. long) are the distinctive characteristics of this species. The calyx-lobes are glandular-denticulate, while the bracteoles are distinctly eglandular. The pedicels are rather short (1.5–2.0 cm. long), and the leaves are obovate-elliptic, rounded or very obtuse at the apex, sharply contracted at the base into a petiole 5–8 mm. long.

9. **Ternstroemia rostrata** Krug & Urban in Bot. Jahrb. **21**: 533. 1896. — Melchior in Nat. Pflanzenfam. ed. 2, **21**: 142. 1925. — Fawcett & Rendle, Fl. Jam. **5**: 184. 1926.

DISTRIBUTION: Jamaica.

JAMAICA: *W. Harris 10259* (FM, NY, US); *10317* (FM, NY, US); *N. L. Britton 2339* (NY); *N. L. Britton & A. Hollick 2168* (NY).

The fruit of this species is spheroidal or roundish-ovoid, rostrate at the apex. Krug & Urban record the pedicel as 3–5 cm. long. In all the specimens cited above, the pedicels are 6–8 cm. long, seldom less, and as much as 3 mm. diameter at the apex. The calyx-lobes are intermediate between those of *T. granulata* and *T. calycina* (10–12 [–14] × 7–10 mm.) in size and are eglandular. The bracteoles are comparatively minute, measuring not over 3 mm. in length, and acuminate. The leaves are obovate to obovate-elliptic, 7–12 cm. long, 3.0–5.5 cm. wide, obtuse, and occasionally emarginate at the apex, tapering at base into a petiole 5–7 mm. long.

10. **Ternstroemia luquillensis** Krug & Urban in Bot. Jahrb. **21**: 531. 1896. — Urban, Fl. Ind. Occ. **4**: 411. 1910. — Melchior in Nat. Pflanzenfam. ed. 2, **21**: 142. 1925.

Taonabo luquillensis (Kr. & Urb.) Britton in Britton & Wilson, Sci. Surv. Porto Rico & Virgin Isl. **5**: 580. 1924.

DISTRIBUTION: Porto Rico.

PORTO RICO: Sierra de Luquillo, in monte Jimenez, in silvis, *P. Sintensis 1523* (ISO-SYNTYPES, M, NY, US), *1331* (ISO-SYNTYPES, G, NY, US), July-Aug. 1885. — Sierra de Luquillo, in woods, alt. 600 m., *H. F. A. Eggers 1224* (US), May 1883.

Most species of *Ternstroemia* are characterized by obovate leaves. In this species the leaves are elliptic, up to 12 cm. long, usually 2.5–3.5 times longer than broad, acute at the apex rather than obtuse or rounded, with black punctate dots on the lower surface. The midrib above is impressed the whole length of the leaf. The margin is entire, flat or slightly recurved. The pedicels are slender, 3–9 cm. long, usually compressed. The bracteoles are ovate or suborbicular, 4–5 mm. long, 3–5 mm. wide, with a midrib evident near the apex and prolonged into a short apicule. The sepals are unequal, up to 9 mm. long and 11 mm. wide, and eglandular.

11. **Ternstroemia Barkeri** Ekman & Schmidt in Rep. Spec. Nov. **24**: 78. 1927.

DISTRIBUTION: Haiti.

HAITI: Massif de la Hotte, western group, Torbec, top of M. Formond, alt. 2225 m., *E. L. Ekman H-7483* (ISOTYPE, US), Jan. 1, 1927.

This species is characterized by broadly elliptic (or rarely broadly ovate-elliptic) nearly rotund leaves, 3–4 cm. long and 3–4 cm. wide, rounded and lightly emarginate at the apex, obtusely and abruptly contracted at the base into a petiole 3–5 mm. long, with the margin revolute, entire or nearly so, and the veins inconspicuous. The pedicels are 2–4 cm. long. The bracteoles are unequal, one subrotund, the other triangular, ca. 3 mm. long, 2–3 mm. wide, entire, not glandular-denticulate. The calyx-lobes are subequal, 8–9 mm. long, 7–8 mm. wide, broadly ovate, the margins scarious without glandular-denticulations. The petals are lanceolate, acuminate, 12–13 mm. long, connate at base. The stamens number ca. 50; filaments up to 8 mm. long; anthers ca. 4 mm. long. The ovary is semi-globose, bi-loculate.

The nearest relative is *T. baracoënsis* O. C. Schmidt, which can be separated from the present species by the glandular-denticulate bracteoles and calyx-lobes, the very short pedicels (5–6 mm.), and the conspicuous veins.

12. **Ternstroemia Nashii** Urban in Rep. Spec. Nov. **13:** 466. 1915, Fl. Ind. Occ. **8:** 436. 1920. — Melchior in Nat. Pflanzenfam. ed. 2, **21:** 142. 1925.

DISTRIBUTION: Haiti.

HAITI: Marmelade, Camp No. 4, pineland, alt. 850 m., *G. V. Nash & N. Taylor 1307* (ISOTYPE, NY), Aug. 1–2, 1905 (shrub 1–2 m.). — Massif du Nord, Marmelade, Jalousière, alt. 1000 m., *E. L. Ekman H-8254* (US), May 24, 1927.

The outstanding feature of this species is the presence of the long bracteoles (up to 6 mm.), by which it can be quickly separated from *T. peduncularis* DC., its nearest relative. The leaves of *T. Nashii* are coriaceous, obovate-elliptic to obovate, 4–7 cm. long and 1.5–3.0 cm. wide, rounded at the apex and tapering at the base into a petiole 2–3 mm. long, the margin revolute and glandular-punctate, the veins inconspicuous. The peduncles (3.5–5.0 cm.) immediately suggest *T. peduncularis,* but the linear, glandular-denticulate bracteoles mentioned above distinguish it. The calyx-lobes are unequal, apiculate, up to 10 mm. long and 7–9 mm. wide, glandular-denticulate. The ovary and fruit are globular, tapering into the style.

Urban suggests a relationship between this species and his *T. apleura.* The type specimen resembles the type specimen of *T. apleura.* However, subsequent collections show larger leaves with more conspicuous veining.

13. **Ternstroemia Selleana** Ekman & Schmidt in Rep. Spec. Nov. **24:** 79. 1927.

DISTRIBUTION: Haiti.

HAITI: Massif de la Selle, gr. Crete-au-Piquants, Port-au-Prince, top of M. Malanga, alt. 1475 m., *E. L. Ekman H-7391* (ISOTYPE, US), Dec. 16, 1926. — Massif de la Selle, Ganthice, along path Badeau to Saltrou, alt. 2000 m., *E. L. Ekman H-3101* (US), Jan. 27, 1925.

This species is characterized by small, broadly obovate or suborbicular leaves, usually 2–3 cm. long (rarely 3.5 cm.) and ca. 2 cm. wide, rounded (or nearly so) and lightly emarginate at the apex, attenuated at base into a petiole 4–5 mm. long, the margin revolute, slightly denticulate and plane toward the apex, the veins 4 or 5 pairs (inconspicuous in *Ekman H-3101*). In the type specimen the pedicels vary from 1.0–1.5 cm. in length; however, in *Ekman H-3101* the pedicels are considerably shorter (0.5–0.8 cm.). The bracteoles are unequal, 1.0–1.5 mm. long, scarious-margined and sparsely (if at all) glandular-denticulate. The calyx-lobes are unequal and suborbicular, the outer lobes smaller, ca. 2.5 mm. long, sparsely glandular-denticulate, the inner lobes 3.0–3.5 mm. long, the margin scarious. The young fruit is conical, up to 1 cm. long and only one-half as wide.

The nearest relative is *T. gracilifolia* O. C. Schmidt. This latter species can be separated by the longer pedicels and bracteoles, the larger, triangular calyx-lobes, and the semi-globose fruit.

14. **Ternstroemia gracilifolia** O. C. Schmidt in Rep. Spec. Nov. **22:** 95. 1925.

DISTRIBUTION: Haiti.

HAITI: Massif de la Selle, Pétionville, M. La Visite, alt. 2050 m., *E. L. Ekman H-1410* (ISOTYPE, US), Aug. 9, 1924.

This species is characterized by small, coriaceous, spathulate leaves, 1.5–3.0 cm. long and 1.5–2.2 cm. wide, rounded at the apex, narrowed at the base into a petiole 2–3 mm. long, the margin both revolute and glandular-denticulate along the entire length, the veins inconspicuous. The pedicels are 2.0–3.5 cm. long. The bracteoles are long-deltoid, ca. 3 mm. long, carinate, glandular-denticulate. The calyx-lobes are unequal, the outer lobes subcordate-triangular, ca. 6 mm. long and 5 mm. wide, strongly glandular-denticulate, the inner lobes slightly longer, somewhat apiculate at the apex, and scarious-margined. The immature fruit is globose.

Closely allied is *T. Selleana* Ekm. & Schmidt, which can be separated by the smaller, rounded bracteoles and calyx-lobes, only sparsely, if at all, glandular-denticulate, the shorter pedicels, the elongated fruit, and the leaf margin plane and denticulate only at the apex.

15. **Ternstroemia flavescens** Grisebach, Cat. Pl. Cuba, 35. 1866. — Sauvalle, Fl. Cub. 10. 1873. — Urban in Bot. Jahrb. **21:** 530. 1896. — Melchior in Nat. Pflanzenfam. ed. 2, **21:** 142. 1925.

Ternstroemia clusiifolia Grisebach, Pl. Wright. 166. 1860. — Non H.B.K.

Taonabo flavescens (Griseb.) Szyszylowicz in Nat. Pflanzenfam. III. **6:** 189. 1893.

DISTRIBUTION: Cuba.

CUBA: Near Mont Verde, *C. Wright 1124* (ISOTYPE, NY). — Prov. Oriente: Camp La Gloria, south of Sierra Moa, *J. A. Shafer 8200* (NY), Dec. 1910 (straggling shrub 1 m.).

The very small, thick-coriaceous, ovate to broadly ovate leaves (2.4 × 1.0–1.5 cm.) and the small flowers are the outstanding distinguishing characters of this species. The nearest relative is *T. baracoënsis* Schmidt, the leaves of which are considerably larger and subrotund.

16. **Ternstroemia baracoënsis** O. C. Schmidt in Rep. Spec. Nov. **22:** 95. 1925.

DISTRIBUTION: Cuba.

CUBA: Prov. Oriente: Lomas de Cuaba, near Baracoa, in pines, *E. L. Ekman 4230* (photo of isotype, NY), Jan. 13, 1925.

A photograph of the isotype (Stockholm) with a few leaves (NY) are the only available material for study. Close observation shows flowers to be present on the isotype. According to the description and the photograph, the outstanding characteristics are (1) the broadly elliptic or nearly rounded, coriaceous leaves, 3–5 cm. long and 1.8–3.0 cm. broad, rounded at the apex, obtusely contracted at the base into the petiole, the margin entire, slightly revolute, the midrib flat above, fading out toward the apex, raised below, the veins (5 or 6 pairs) tenuous and conspicuous below; (2) the pedicel short, 0.5–0.6 cm. long; (3) the bracteoles subcordate(?).

The nearly rounded leaves, the tenuous veins, and the very short pedicels are characters which clearly distinguish the species from its Cuban relatives. This species is probably the only Cuban species whose leaves are not twice as long as broad. Unfortunately, the description of the flowers was drawn only from buds and proved of little aid. Schmidt remarked that the bracteoles were subcordate; this seems very dubious.

The nearest relative of this species is *T. flavescens* Griseb. However, the latter species has much narrower leaves with inconspicuous veining and longer pedicels (1.0–2.5 cm.).

17. **Ternstroemia cernua** Grisebach, Cat. Pl. Cuba, 35. 1866. — Sauvalle, Fl. Cub. 10. 1873. — Urban in Bot. Jahrb. **21**: 529. 1896. — Melchior in Nat. Pflanzenfam. ed. 2, **21**: 142. 1925.

Taonabo cernua (Griseb.) Szyszylowicz in Nat. Pflanzenfam. III. **6**: 189. 1893.

DISTRIBUTION: Cuba.

CUBA: Prov. Pinar del Rio: near Retiro and Sumdero, *C. Wright 2112* (ISOTYPES, G, NY, US).

This species is characterized by obovate or elliptic-oblong, coriaceous leaves, nearly three times longer than broad (5–8 × 2–3 cm.), with 6–8 pairs of veins visible on the under surface. The petiole exceeds that of most species in length (5–10 mm.). The short, thick, recurved pedicels (0.4–1.0 cm. long and 1.5 mm. thick) also distinguish this species. The sharply pointed triangular bracteoles and the ovate, acuminate calyx-lobes are added features which separate this species from *T. peduncularis* DC.

18. **Ternstroemia microcalyx** Krug & Urban in Bot. Jahrb. **21**: 531. 1896. — O. C. Schmidt in Rep. Spec. Nov. **22**: 96. 1925. — Melchior in Nat. Pflanzenfam. ed. 2, **21**: 142. 1925. — Non Airy-Shaw, 1939.

Ternstroemia elliptica Grisebach, Pl. Wright. 166. 1860, Cat. Pl. Cuba, 35. 1866. — Non Swartz.

DISTRIBUTION: Cuba, Haiti.

CUBA: Oriente, near La Guinea, *C. Wright 1577* (ISOTYPES, G, NY), Dec. 17, 1859 (tall shrub). — Southern Oriente and Pico Turquino, *Fr. Leon 10737, 11073* (NY), July 1922. — Oriente, Sierra Maestra, alt. 1200 m., *J. Roig & Bucher 6901* (NY), July 1935. — Oriente, Sierra Maestra, *Bucher* (*244*) *5720* (NY), July 8, 1931. HAITI: Massif du Nord, Anse-i-Foleur, top of Mt. Colombos, alt. 900 m., *E. L. Ekman H-4342* (US), June 20, 1925. — Massif du Nord, Port-de-Paix, summit of Haut-Piton, alt. 1205 m., *E. L. Ekman H-4623* (US), Aug. 9, 1925.

The leaves of this species are thin-coriaceous, obovate-elliptic or elliptic-oblong, 4.5–7.5 cm. long and 1.5–3.0 cm. wide, obtuse or obtusely acuminate at the apex, narrowing at the base into a petiole 5–8 mm. long. The leaf-margin is plane and usually entire, with occasional slight evidences of serration near the apex. The midrib is narrowly and deeply sulcate the whole length of the leaf above, raised below with 3–5 pairs of obscure nerves evident on the lower surface. The pedicels are 1.0–1.5 cm. long and the small suborbicular bracteoles are less than 1 mm. long. The calyx-lobes are minute, measuring 3 mm. or less in length, rounded at the apex, with the margin of the outer lobes entire or occasionally obscurely glandular-denticulate. According to a subsequent observation by Urban, the petals far exceed the calyx in length, measuring 7 mm. long.

A close relative is *T. parviflora,* which can easily be distinguished by the usually single-celled ovary and fruit, the longer peduncle (2.5–3.0 cm. long), and the petals exceeding the calyx in length. Another closely related species is *T. pubescens.* The calyx-lobes, bracteoles, pedicels, lower surface of the leaves, and the young branchlets of this latter species are covered with a soft villous pubescence. Also, the petals measure only 3 mm. long, barely exceeding the calyx in length, and the bracteoles and outer calyx-lobes are sharply glandular-denticulate, with the inner lobes scarious and subfimbriate.

In 1939, Airy-Shaw (Kew Bull. 506) described *T. microcalyx* from Sarawak, apparently overlooking Krug & Urban's earlier species of the same name. No material of Airy-Shaw's species is available for my study, and since, as he states, his new species is so very closely allied to *T. Robinsonii* Merrill from Amboina, I merely wish to draw attention to this later homonym rather than suggest a new combination.

19. **Ternstroemia Stahlii** Krug & Urban in Bot. Jahrb. **21**: 527. 1896. — Urban, Fl. Ind. Occ. **4**: 410. 1910. — Melchior in Nat. Pflanzenfam. ed. 2, **21**: 142. 1925.

Ternstroemia pachyphylla Krug & Urban in Bot. Jahrb. **21**: 529. 1896. — Urban Fl. Ind. Occ. l. c. — Melchior, l. c. — Syn. nov.

Taonabo Stahlii (Krug & Urban) Britton in Britton & Wilson, Sci. Surv. Porto Rico & Virgin Isl. **5**: 581. 1924.

Taonabo pachyphylla (Krug & Urban) Britton, l. c.

DISTRIBUTION: Porto Rico.

PORTO RICO: *N. L. Britton & E. G. Britton 9512, 9636, 9923, 9924* (NY). — *N. L. Britton & J. F. Cowell 1556* (NY, US). — *N. L. Britton, F. L. Stevens & W. E. Hess 2445* (NY, US). — *E. G. Britton & D. W. Marble 722* (FM, NY, US). — *P. Sintenis 349* (G, ISOTYPE of *T. pachyphylla*). — *W. E. Hess 3863* (NY). — *A. A. Heller 4545* (AA, FM, G). — *J. A. Stevenson 2118* (NY, US). — *L. R. Holdridge 38* (NY).

The leaves are obovate, thick-coriaceous, 4–7 cm. long, rounded at the apex, tapering at the base into a stout petiole, 3–5 mm. long; the midrib is quite flat on the upper surface, fading out toward the apex, raised below; the surface is distinctly granular below; the margin is flat, occasionally remotely denticulate. The pedicels are stout, 5–12 mm. long. The bracteoles are long-triangular, 2.5–3.5 mm. long, 1.0–1.5 mm. wide at the base, glandular-denticulate. The calyx-lobes are ovate, distinctly acute, occasionally decidedly acuminate, the outer lobes being glandular-denticulate. The sharp apex of the calyx-lobes is an excellent diagnostic character.

Ternstroemia pachyphylla Krug & Urban is undoubtedly a synonym of this species. In the type specimen the petioles and pedicels are slightly shorter. However, in all other respects the two species are identical. *Heller 4545,* identified by Urban (1910) as *T. Stahlii,* is identical with the type of *T. pachyphylla.*

20. **Ternstroemia granulata** Krug & Urban in Bot. Jahrb. **21**: 534. 1896. — Melchior in Nat. Pflanzenfam. ed. 2, **21**: 142. 1925. — Fawcett & Rendle, Fl. Jam. **5**: 182. 1926.

DISTRIBUTION: Jamaica.

JAMAICA: *Purdie s.n.* (probable iso-syntype, G).

This species is characterized by obovate-elliptic leaves, 7–9 cm. long and

3–4 cm. wide, densely granular-punctate on both surfaces, obtuse at the apex, tapering quite abruptly at the base into a petiole 8–10 mm. long, with the midrib evident the entire leaf-length on both surfaces and 12 or 13 pairs of veins, clearly evident on the lower-surface; pedicels 3.5–4.5 cm. long, the bracteoles 2, suborbicular, 4–5 mm. long, 3–4 mm. wide, glandular-denticulate, not keeled (Purdie); sepals 5, subequal, somewhat orbicular, 8–9 mm. long, 8–11 mm. wide, glandular-denticulate (outer sepals); petals 5, 12–13 mm. long, 8–9 mm. wide.

Purdie s.n. (G) is probably an iso-syntype of *T. granulata,* as originally formulated by Krug & Urban. This specimen has densely granular-punctate leaves, from which the species derives its name. However, the description calls for bracteoles which are more or less carinate on the dorsal surface. On bracteoles of the specimen cited above there is no evidence of a keel. Later (1908), Urban determined questionably a specimen collected by Prior near Brownstown. This specimen lacks any vestige of granular punctation on the leaves, and here also there is no evidence of a keel on the bracteoles.

Fawcett & Rendle included both these entities under *T. granulata* in their treatment of the Ternstroemiaceae for the *Flora of Jamaica.* Besides the leaves, the larger flowers (both calyx and corolla) and the larger number (12 or 13 pairs) of clearly visible veins should clearly distinguish this species from *T. Hartii,* its nearest relative.

21. **Ternstroemia Hartii** Krug & Urban in Bot. Jahrb. **21:** 532. 1896. — Melchior in Nat. Pflanzenfam. ed. 2, **21:** 142. 1925. — Fawcett & Rendle, Fl. Jam. **5:** 182. 1926.

DISTRIBUTION: Jamaica.

JAMAICA: St. Georges, alt. 650 m., *W. Harris 5767* (ISO-SYNTYPE, FM, NY), June 14, 1895 (tree 8 m.). — Troy, alt. 600 m., *W. Harris 8786* (NY), Aug. 1904 (tree 10 m.). — Road to Holly Mount, alt. 600 m., *W. Harris 8987* (AA, FM, NY), Aug. 17, 1908 (small tree 6 m. with white fragrant flowers). — Ipswich, St. Elizabeth, alt. 270 m., *W. Harris 12369* (FM, Mo, NY, US), June 13, 1916 (tree 8 m.). — Summit of John Crow Peak, vicinity of Cinchona, *N. L. Britton 266* (FM, NY, US), Sept. 1906 (tree 8 m. with white flowers). — Grove Place, near Mile Gully, alt. 500 m., *W. Harris & N. L. Britton 10621* (FM, NY, US), Sept. 23, 1908 (tree 8 m.). — *J. Hart 529* (US). — Near Brownstown, *Prior s.n.* (NY).

This species is characterized by obovate or obovate-elliptic leaves, 6–11 cm. long, 3.0–5.5 cm. wide, opaque, obtuse or rounded at the apex, contracted abruptly or gradually at the base into a petiole 6–12 mm. long, with the surface free from granular punctations, the margin plane or slightly revolute and entire, and the veins obscure on both surfaces and, when visible, few in number; pedicels varying in length, 1.5–5.0 cm. long, usually somewhat carinate, the bracteoles 2, 3–5 mm. long, 2.5–3.5 mm. wide, ovate, the margin usually free from glandular denticulations; sepals 5, subequal, suborbicular, 6.0–7.5 mm. long and about as wide, the margins of the outer sepals sparsely glandular-denticulate, usually entire, scarious; petals barely exceeding the calyx in length (8 mm.).

Several of these numbers (*Prior s.n., W. Harris 8786, 8987* and *12369,* and *Harris & Britton 10621*) have been cited by Fawcett & Rendle (Fl.

Jam.) under *T. granulata*. *Prior s.n.* was determined questionably by Urban (1908) as *T. granulata*. *Ternstroemia granulata* can be separated from the present species by the dense granular punctations covering both leaf-surfaces, the highly revolute leaf-margin, and the copious (12 or 13 pairs) and clearly visible veins. The flowers are larger, especially as regards the corolla (12–13 mm.).

22. **Ternstroemia peduncularis** A. de Candolle in Mém. Soc. Phys. Hist. Nat. Genève, **1:** 409 (Mém. Ternstr. 17). 1822; Prodr. **1:** 523. 1824. — Krug & Urban in Bot. Jahrb. **21:** 526. 1896. — Boldingh, Fl. Dutch West Ind. Isl. **1:** 134. 1909, Fl. Ned. West-Ind. Eil. 285. 1913. — Urban, Fl. Ind. Occ. **4:** 410. 1910. — Melchior in Nat. Pflanzenfam. ed. 2, **21:** 142. 1925.

Ternstroemia meridionalis Swartz, Prodr. 81. 1788. — Non Mutis.

Ternstroemia obovalis A. Richard in Sagra, Hist. Phys. Pol. Nat. Cuba, 221, *t. 25.* 1845. — Walpers, Rep. **5:** 130. 1845. — Grisebach, Cat. Pl. Cuba, 36. 1866. — Sauvalle, Fl. Cub. 10. 1873. — Krug & Urban in Bot. Jahrb. **21:** 524. 1896. — Urban, Fl. Ind. Occ. **8:** 436. 1920. — Melchior in Nat. Pflanzenfam. ed. 2, **21:** 142. 1925. — Syn. nov.

Ternstroemia obovalis var. *excelsa* Grisebach, Cat. Pl. Cuba, 36. 1866.

Ternstroemia obovalis var. *ovulosa* Wright in Grisebach, Cat. Pl. Cuba, 36. 1866.

Mokofua obovalis (A. Rich.) O. Kuntze, Rev. Gen. Pl. **1:** 63. 1891.

Mokofua peduncularis (DC.) O. Kuntze, loc. cit.

Ternstroemia peduncularis DC. var. *stenophylla* Krug & Urban in Bot. Jahrb. **21:** 526. 1896. — Syn. nov.

Ternstroemia obovalis var. α. genuina Krug & Urban, loc. cit. **21:** 524. 1896. — Syn. nov.

Ternstroemia obovalis var. β. *Lindenii* Krug & Urban, loc. cit. **21:** 524. 1896. — Syn. nov.

Ternstroemia obovalis var. γ. *minor* Krug & Urban, loc. cit. **21:** 525. 1896. — Syn. nov.

Taonabo Leonis Britton & Wilson in Bull. Torrey Bot. Club, **50:** 42. 1923.

Taonabo monticola Britton & Wilson, loc. cit. **50:** 42. 1923.

Taonabo peduncularis (DC.) Britton in Mem. Brooklyn Bot. Gard. **1:** 70. 1918, in Britton & Wilson, Sci. Surv. Porto Rico & Virgin Isl. **5:** 581. 1924.

Ternstroemia apleura Krug & Urban in Bot. Jahrb. **21:** 523. 1896. — Melchior in Nat. Pflanzenfam. ed. 2, **21:** 142. 1925. — Syn. nov.

Ternstroemia potrerillensis O. C. Schmidt in Rep. Spec. Nov. **22:** 94. 1925. — Syn. nov.

Ternstroemia monticola (Britton & Wilson) Ekman ex Schmidt in Rep. Spec. Nov. **22:** 95. 1925. — Syn. nov.

Ternstroemia Ekmani Schmidt in Rep. Spec. Nov. **22:** 96. 1925. — Syn. nov.

Ternstroemia Leonis (Britton & Wilson) Ekman ex Schmidt in Rep. Spec. Nov. **22:** 96. 1925. — Syn. nov.

Ternstroemia rupicola Ekman ex Schmidt in Rep. Spec. Nov. **22:** 97. 1925. — Syn. nov.

DISTRIBUTION: Cuba, Haiti, Santo Domingo, Porto Rico, St. Jan, St. Eustatius, Guadeloupe, Martinique.

CUBA: Prov. Santa Clara: *Bro. Leon 782* (NY), *4642* (NY). — *Bros. Leon & Gustave 5291* (NY). — *Bro. Leon & M. Roco 8006, 8040, 8129* (NY). — *Bros. Leon & Clement 6700* (NY). — *Bro. Leon & J. Acuna 13040* (NY). — *E. L. Ekman 14016* (ISOTYPE of *T. potrerillensis*, NY). — *J. T. Roig & M. Cremata 2194, 2220* (US). — *A. Luna 552* (NY). — *N. L. Britton & J. F. Cowell 10263* (NY). — *L. B. Smith & A. R. Hodgdon 3205* (G). Prov. Pinar del Rio: *E. L. Ekman 16388* (ISOTYPE of *T. Ekmani*, NY). — *N. L. Britton, F. S. Earle & C. S. Gager 6909* (NY). Prov. Oriente: *Bro. Leon 10837* (NY), *10839* (TYPE of *T. monticola*, NY), *10910* (ISOTYPE of *T. Leonis*, NY), *11076* (NY), *11193* (NY). — *C. Wright 1125* (ISOTYPES of *T. obovalis* var. *minor*, FM, G, Mo, NY), *2111* (ISOTYPES of *T. apleura*, G, Mo, NY), *2114* (G, Mo, US). — *J. T. Roig & G. C. Bucher 6689* (NY). — *G. C. Bucher 88* (NY). Prov. Camaguey: *N. L. Britton & J. F. Cowell 13277* (FM, G, NY, US). Isle of Pines: *A. H. Curtiss 429* (FM, G, Mo, NY, US). — *Bro. Leon 5133* (NY). — *N. L. Britton & P. Wilson 15658* (FM, G, NY, US). HAITI: *E. C. Leonard 7146* (NY, US), *8849* (G, NY, US). — *E. C. & G. M. Leonard 13379* (NY, US), *15825* (G, US). — *E. L. Ekman H-1903* (US), *H-8330* (US). — *G. V. Nash 816* (NY). — *G. V. Nash & N. Taylor 1311* (FM, NY, US). — *O. F. Cook, C. S. Scofield & C. B. Doyle 92* (US). — *G. S. Miller 304* (US). SANTO DOMINGO: *E. L. Ekman H-13043* (US). — *M. Fuertes 1003* (NY), *1294* (FM, G, Mo). — *Eggers 2411* (US), *2519* (NY, US). — *W. L. Abbott 2226* (US). — *H. von Türckheim 3401* (FM, G, Mo, NY, US). — *E. J. Valeur 114* (US), *667* (FM, Mo, NY, US). — *C. Wright, C. C. Parry & H. Brummel 171* (US). PORTO RICO: *P. Sintenis 948* (FM, G, Mo, NY, US). — *N. L. Britton & J. A. Shafer 1565* (FM, Mo, NY, US). — *H. A. Gleason & M. T. Cook R-59* (NY). ST. JAN: *N. L. Britton & J. A. Shafer 532* (FM, NY, US). ST. EUSTATIUS: *J. Boldingh 323* (NY). GUADELOUPE: *Père Duss 3651* (FM, NY, US). MARTINIQUE: *Père Duss 1825* (FM, Mo, NY, US).

After long consideration, I find it expedient to combine under the name *T. peduncularis* DC. several formerly recognized species. The best known of these is *T. obovalis* Rich. Urban (Bot. Jahrb. **21:** 524–526. 1896) separates these two species on the granular-punctate surface of the leaves, the degree of prominence of the lateral veins, the plane or recurved margin of the leaves, the shape of the bracteoles, and the number of ovules in the ovary. None of these characters or any others listed by Urban consistently apply to either of the above mentioned entities. In the Haitian material, often on the same flower, bracteoles may be found, one of which is large and triangular-ovate, 4 mm. or more wide (far surpassing the pedicel in width), while the other is linear-acuminate, scarcely 1 mm. wide. In other specimens the larger bracteole may be subrotund. In the Santo Domingan material nearly all specimens have flowers with bracteoles equal or subequal, triangular, ca. 1.5 × 1.5 mm., while in the Cuban material the bracteoles vary from linear-lanceolate to subrotund.

The pedicel may vary from 2 to 8 cm. in length. Specimens with pedicels 8 cm. long certainly appear vastly different from specimens whose pedicels measure only 2–3 cm. Yet the gradation through a large series of specimens shows this character insufficient for specific delimitation.

Variation in veining, coupled with deciduous bracteoles, has been used as the basis of specific differentiation in *T. apleura*. Deciduous bracteoles would seem to be an excellent specific character. Still, on the isotype of *T. apleura* (*C. Wright 2111*) in the Missouri Botanical Garden all the bracteoles are present and there is also evidence of venation. In *T. peduncularis* itself, veining is often obscure, even to the extent found by Urban in *T. apleura*. On the other hand, some specimens have veins so pronounced that, influenced also by differences in leaf-shape, one would be inclined to describe another new species. Considerable variation in glandular denticulation on the bracteoles and outer calyx-lobes can be found on a single specimen. Often the age of a specimen may cause this variation. On fruiting calyx-lobes, the glandular denticulations of the slightly scarious margin are often worn off and the margins appear revolute or fimbriate.

The species *T. apleura* Krug & Urban, *T. Ekmani* O. C. Schmidt, *T. Leonis* (Britton & Wilson) Ekman, *T. monticola* (Britton & Wilson) Ekman, *T. potrerillensis* O. C. Schmidt, and *T. rupicola* O. C. Schmidt are separated on characters scarcely sufficient for specific delimitation. All these entities have obovate or obovate-elliptic leaves, rounded, obtuse, or obtusely acuminate at the apex, and tapering at the base into a petiole which averages 4–5 mm. long. The leaves of all are coriaceous or occasionally chartaceous-coriaceous, varying in thickness. The margin is usually entire, with occasional signs of serration, and flat or somewhat revolute. The pedicels in all the above listed entities (2–3 cm. long) vary little. The bracteoles (2–3 mm. long) likewise seldom vary more than a single millimeter either way. They are all triangular or deltoid and occasionally may be considered semi-ovate (*T. rupicola*). The calyx-lobes are always subequal and range from 4 to 7 mm. long. The outer calyx-lobes are always glandular-denticulate and the inner lobes eglandular. *Ternstroemia apleura, T. Leonis, T. monticola,* and *T. rupicola* were proposed without any description of corolla and stamens. In most cases, the corolla is approximately 6–8 mm. long. Urban (Bot. Jahrb. **21**: 521–551. 1896) based his key, to a considerable degree, on the coalescence of the petals at the base. The petals measure 6–8 mm. in length, and differentiation by means of the varying amount of coalescence of petals (as follows: 1/6, 1/4, 1/3, 2/5 or 1/2), is drawing too fine a line, considering the amount of known variation in the group and also the fact that in the majority of specimens the petals are lacking. The ovary and fruit characters show similar lines of variation.

DUBIOUS OR LITTLE KNOWN SPECIES

Ternstroemia buxifolia Ekman & Schmidt in Rep. Spec. Nov. **29**: 13. 1931.

DISTRIBUTION: Santo Domingo. No specimens studied.

According to the authors, this species is characterized by small coriaceous leaves (1.8–3.0 $\times$ 0.9–1.6 cm.), elliptic to obovate, rounded and lightly emarginate at the apex, narrowed at the base into a petiole 3–5 mm. long, with the margin recurved and the veins inconspicuous. The pedicel is short, 4–6 mm. long, and the bracteoles are semi-elliptic, $\pm$ 2 mm. long, membranaceous, fimbriate-serrulate. The sepals are unequal, the margin membranaceous-fimbriate, $\pm$ 5 mm. long and 4 mm. wide. The petals are obovate or subobovate-cordate, 5–6 mm. long, and up to 5.5 mm. wide, with the margin membranaceous and fimbriate. The stamens number about 25. The ovary is semi-ovate or subconical, ca. 1.5 mm. long, unilocular, 6-ovulate, attenuated at the apex into a style about 3.2 mm. long.

The authors of this species suggest a close relationship with the Cuban *T. parviflora* Krug & Urban, because of the single-celled ovary.

EXCLUDED SPECIES

Ternstroemia albo-punctata Grisebach, Cat. Pl. Cuba, 36. 1866 = **Cleyera albo-punctata** (Grisebach) Krug & Urban in Bot. Jahrb. **21:** 537. 1896.

Ternstroemia dentata Sprengel ex DeCandolle in Mém. Soc. Phys. Hist. Nat. Genève, **1:** 411 (Mém. Ternstr. 19). 1822 = **Freziera undulata** (Swartz) Swartz, Fl. Ind. Occ. **2:** 974. 1800.

Ternstroemia salicifolia DeCandolle in Mém. Soc. Phys. Hist. Nat. Genève, **1:** 411 (Mém. Ternstr. 19). 1822 = **Freziera undulata** (Swartz) Swartz, Fl. Ind. Occ. **2:** 974. 1800.

Ternstroemia crenata Macfadyen, Fl. Jam. **1:** 114. 1837 = **Symplocos octopetala** Swartz, Prodr. Veg. Ind. Occ. 110. 1788.

ARNOLD ARBORETUM,
HARVARD UNIVERSITY.

PAPUAN GRASSES COLLECTED BY L. J. BRASS, III*

AGNES CHASE

With four text-figures

THE grasses here enumerated were collected in 1938–39, in Papua and in Netherlands New Guinea. Part I of Papuan Grasses collected by Mr. Brass, by A. S. Hitchcock, was published in Brittonia **2:** 107–130. 1936, Part II, by Agnes Chase, in the Journal of the Arnold Arboretum **20:** 304–316. 1939. The types of the species here described are deposited in the Gray Herbarium, with isotypes in the United States National Herbarium. Species previously collected by Mr. Brass in Papua are not included in the present paper, except when collected in Netherlands New Guinea. A few collections by J. and M. S. Clemens or by Mrs. Clemens are included when they represent species not before collected in New Guinea.

Oreiostachys producta Pilger, Bot. Jahrb. Engler **62:** 460. 1929.

NETHERLANDS NEW GUINEA: Bele River, 18 kilometers northeast of Lake Habbema, alt. 2300 m., *Brass 11072;* abundant in forest margins, downfall openings, etc., scrambling and tangled; flowering specimen. Eighteen kilometers southwest of Bernhard Camp, Idenburg River, alt. 2150 m., *Brass 12662;* scrambling to 5–6 m. in mossy forest, frequent at 1800 m., and on the highest point of the ridge at 2200 m., forming a high dense undergrowth, practically excluding the usual undergrowth and substage trees; sterile specimen.

These collections agree well throughout with Pilger's description. The palea is 2-keeled and sulcate toward the summit, the rachilla segment is prolonged and bears a rudimentary floret, the rachilla and rudiment reaching the apex of the palea. Henrard (Blumea **2:** 71. 1936), in reestablishing the genus *Chloothamnus* Buse, reducing *Oreiostachys* Gamble to it as a synonym, states that because of the prolonged rachilla segment and rudimentary floret he hesitated to place *O. producta* in the genus *Chloothamnus*. Endemic.

Chloothamnus sp.

NETHERLANDS NEW GUINEA: Six kilometers southwest of Bernhard Camp, Idenburg River, alt. 1450 m., *Brass 13020;* "upper limits of rain-forests; occasional open clumps of few stout stems up to ± 4 cm. diam. at base, 7–8 m. long, upper part weak, resting on substage trees; internodes up to ± 45 cm. long; leaves glaucous below; spikelets glaucous."

The specimen, which consists of an internode and two nodes of a stout culm and four flowering twigs, agrees with the generic description of *Chloothamnus* but differs from any known species in the open panicles, the stiff branches having pronounced pulvini at their base.

An over mature specimen collected in "Lower regions of British New Guinea" in 1894 by MacGregor, no. *49,* is apparently the same species.

*Botanical Results of the third Archbold Expedition.

Dendrocalamus latifolius Lauterb. & K. Schum. in K. Schum. & Lauterb. Fl. Deutsch. Schutzgeb. Südsee 188. 1901.

NETHERLANDS NEW GUINEA: Hollandia and vicinity, alt. 10 m., *Brass 8894;* shrub about 1 m. tall, plentiful on dry gravel beds in river.

The specimen consists of a single branch of inflorescence which agrees with *Brass 7908, 8518* and *8660* from Papua, excellent specimens of *D. latifolius,* but the detached leafy shoot of *Brass 8894* has blades only 15–20 mm. wide. Endemic.

Dendrocalamus sp.

NETHERLANDS NEW GUINEA: Four to six kilometers southwest of Bernhard Camp, Idenburg River, alt. 850–1200 m., *Brass 12825, 13070, 13327;* rain-forest, in flood plain and characteristic in rather open rain-forest, scrambling 2–20 m.

Schizostachyum lima (Blanco) Merr. Amer. Journ. Bot. **3:** 62. 1916.

Bambusa lima Blanco, Fl. Filip. ed. 1. 271. 1837.

PAPUA: Middle Fly River, Lake Daviumbu, *Brass 7913* (listed as *Schizostachyum* sp. by Chase, Jour. Arnold Arb. **20:** 305. 1939). Philippines.

?Schizostachyum sp.

NETHERLANDS NEW GUINEA: Four kilometers southwest to Bernhard Camp, Idenburg River, alt. 900 m., *Brass 13743;* "scrambling to 4–6 m. in mossy forest; clumps of several stems about 2 cm. diameter at base."

Sterile specimen, the culm thin-walled and roughish as in *Schizostachyum,* the overlapping slightly carinate sheaths with conspicuous slender spreading fragile fimbriae from the shoulder, the fimbriae arising from thick tuberculate bases, and with a row of stiff hairs back of the very short ligule; blades somewhat plicate.

Bromus scopulorum sp. nov.

Perennis; culmi 50–125 cm. alti, tenues; vaginae sparse retrorse-pilosae; ligula minuta; laminae planae, 15–20 cm. longae, 2–4 mm. latae; panicula subsimplex, 12–18 cm. longa, angusta, laxa, ramis tenuibus brevibus; spiculae 2–3 cm. longae, 5–7-florae; glumae 7–9.5 mm. longae, 1–3- vel 5-nervia, ad marginem sparse pilosae; lemmata 10–13 mm. longa, 5-nervia, ad marginem dense hirsuta, arista 5–7 mm. longa.

Perennial, loosely tufted with lax-leaved innovations, purplish at base; culms ascending, 50–125 cm. tall, slender, glabrous; sheaths shorter than the internodes, thin, the lower sparsely to rather densely retrorsely pilose, becoming shredded, the upper loosely pilose; ligule minute; blades flat, thin, lax, 15–20 cm. long, 2–4 mm. wide, delicately pilose toward the base, acuminate; panicle purplish brown, nearly simple, 12–18 cm. long, narrow, lax, nodding, the short slender branches scaberulous; spikelets 2–3 cm. long, loosely 5–7-flowered, the slender rachilla segments 2.5–3 mm. long, pubescent; glumes 7 and 9.5 mm. long, narrow, acuminate, the first 1-nerved (short lateral nerves developed in some), sparsely pilose along the margin near the base, the second 3–5-nerved, pilose along the margin nearly to the summit; lemmas 10–13 mm. long, excluding the awn, 7-nerved, hirsute on the margin to the summit and at the very base, the back otherwise glabrous, the nerves scabrous toward the summit, the awn erect, slender, scaberulous, 5–7 mm. long.

TYPE: *Brass & Myer-Drees 9825,* collected in September 1938, on dry ledges of a limestone cliff, 7 kilometers northeast of top of Mt. Wilhelmina, alt. 3560 m. Netherlands New Guinea.

Bromus sp.

NETHERLANDS NEW GUINEA: Lake Habbema, alt. 3225 m., *Brass 9127;* common in forest glades and other sheltered places.

Tall slender perennial with nodding panicle.

Brachypodium pubifolium Hitchc. Brittonia **2:** 108. 1936.

NETHERLANDS NEW GUINEA: Lake Habbema, 3225 m. camp, *Brass 9310;* forest glade. Bele River, 18 kilometers, northeast of Lake Habbema, 2200 m. camp, *Brass 11426;* on wet marshy rocks in river. Mt. Wilhelmina, 7–11 kilometers northeast of top, alt. 3400–3560 m., *Brass & Myer-Drees 9714, 9827;* rather wet grassy valley and on dry ledge under limestone cliff. Endemic.

Festuca nubigena Jungh. Nat. Geneesk. Arch. Neerl. Ind. **2:** 51. 1845.

NETHERLANDS NEW GUINEA: Lake Habbema, alt. 3225 m., *Brass 9325, 9547;* sandy banks of streamlet and scattered over wet peaty flat; erect slender tufts 40–80 cm. high. Mt. Wilhelmina, 11 kilometers northeast of top, alt. 3400 m., *Brass & Myer-Drees 9747;* rather wet grassy valley. Same, 7 kilometers northeast of top, alt. 3560 m., *Brass & Myer-Drees 9823;* plentiful on dry ledges under limestone cliffs, 50–80 cm. high, panicles bluish. Same, 4 kilometers northeast of top, alt. 3660 m., *Brass & Myer-Drees 9976;* alpine grassland, covering marshy hollows, 70–90 cm. high. Same, northern slopes, alt. 4050 m., *Brass & Myer-Drees 10066;* wet shallow soil of old screes, 30 cm. high. Java, New Guinea.

Festuca nubila Jungh. ex Steud. Syn. Pl. Glum. **1:** 315. 1854.

NETHERLANDS NEW GUINEA: Lake Habbema, 3225 m. camp, *Brass 9128;* common in moist forest glades. Mt. Wilhelmina, 4–11 kilometers northeast of top, alt. 3400–3560 m., *Brass & Myer-Drees 9715, 9824, 9845;* wet grassy valley and forest glades, tufts up to 1 m. high, inflorescence purple. Same, northern slopes, alt. 4050 m., *Brass & Myer-Drees 10061, 10071;* very common on upper slopes, about 80 cm. high. Same, alt. 4050 m., *Brass & Myer-Drees 10070;* common in grass cover of old screes, panicle greenish purple. Java, New Guinea.

This species is closely related to *F. nubigena,* but has taller culms, much longer leaves, larger lax panicles and larger spikelets with hispidulous glumes and lemmas.

Monostachya oreoboloides (F. Muell.) Hitchc. Brittonia **2:** 107. 1936.

Festuca oreoboloides F. Muell. Trans. Roy. Soc. Vict. **1**(2): 38. 1889.

NETHERLANDS NEW GUINEA: Lake Habbema, 3225 m. camp, *Brass 9184.* Mt. Wilhelmina, 7–11 kilometers northeast of summit, alt. 3400–3900 m., *Brass & Myer-Drees 9818, 9941;* large bright green cushions among taller grasses of open summit. Same, northern slope, alt. 4100 m., *Brass & Myer-Drees 10159.* Philippines (Luzon), New Guinea.

Poa saruwagetica Pilger, Bot. Jahrb. Engler **62:** 459. 1929.

NETHERLANDS NEW GUINEA: Mt. Wilhelmina, 7 kilometers northeast of top, alt. 3560 m., *Brass & Myer-Drees 9844.* Endemic.

Poa egregia sp. nov. FIG. 1.

Perennis; culmi 18–40 cm. alti; vaginae imbricatae; ligula 6–8 mm. longa; laminae 10–16 cm. longae, involutae vel planae, 2–3 mm. latae, subpungentes; panicula laxa, nutans, 9–12 cm. longa, axi ramisque subcapillaribus; pedicellis 2–3 mm. longis; spiculae 6–7 mm. longae, 2-florae (rarius 3-florae); glumae aequales, 5.5–6 mm. longae, scaberrimae, mucronatae; lemmata 5.5–6.5 mm. longa, lata, scaberrima, apice dentata vel minute lobata, mucronata, basi sparse lanata; palea lemmate brevior, carinis excurrentibus.

Tufted perennial; culms 18–40 cm. tall, scabrous below the panicle, leafy at the base; sheaths overlapping, strongly nerved, keeled, smooth, those toward the base crowded, thin, papery, loose, pale, finally somewhat shredded, the upper sheaths reaching nearly to the base of the panicle; ligule 6–8 mm. long, hyaline, lacerate, often split; blades 10–16 cm. long, the lower sometimes loosely involute, the others mostly flat, 2–3 mm. wide, scaberulous on the upper surface, smooth beneath, the apex acuminately boat-shaped, tipped with a fine stiff point; panicles lax, drooping, 9 to 12 cm. long, the axis and branches subcapillary, flexuous, scabrous, the branches mostly in pairs, the pairs rather distant, the ultimate branchlets and pedicels angled, scabrous, 2–3 mm. long, the spikelets approximate; spikelets 6–7 mm. long, 2-flowered (rarely 3-flowered), broadly ovate to V-shaped; glumes equal, 5.5–6 mm. long, very scabrous, the apex dentate

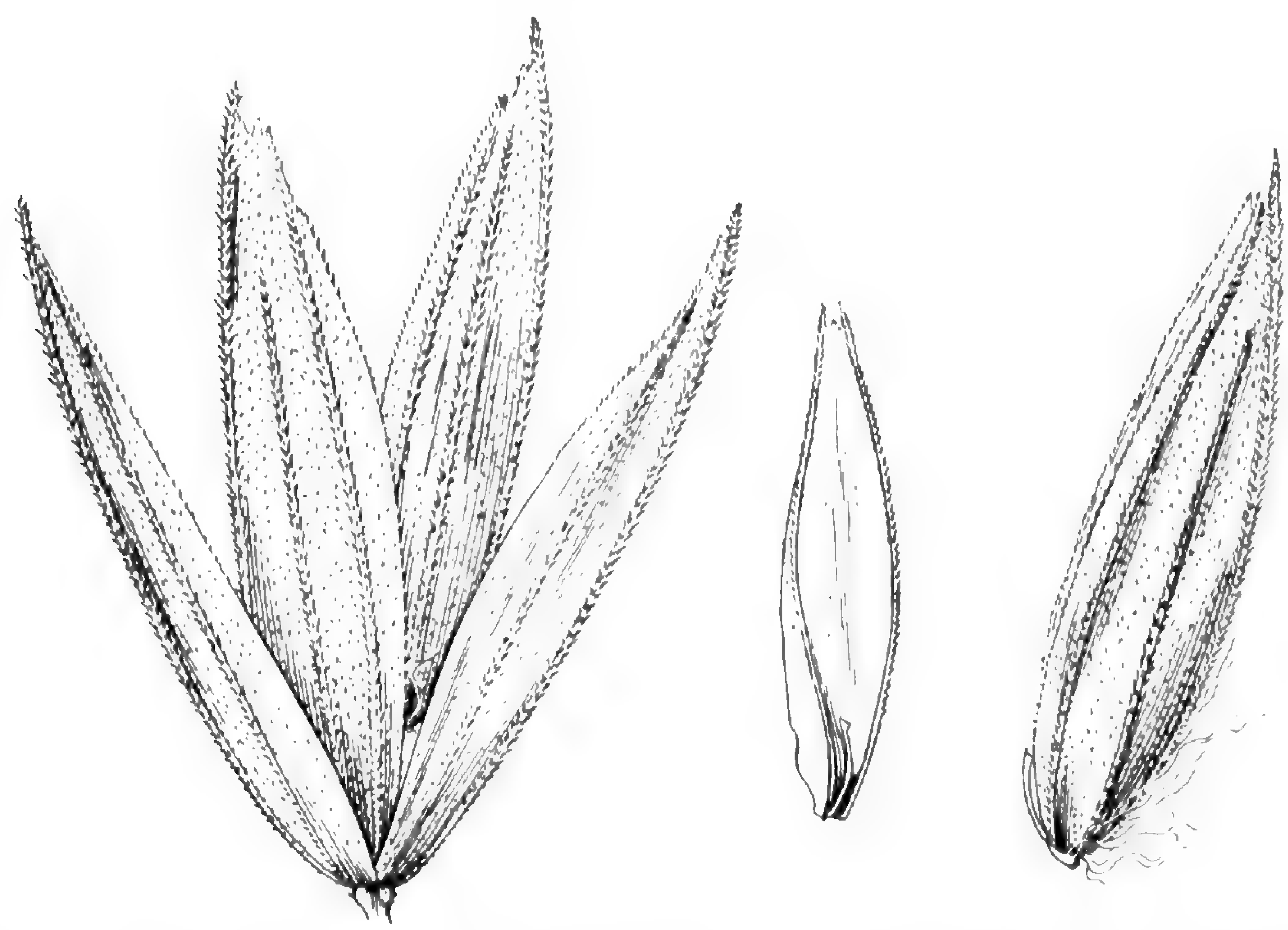

FIG. 1. *Poa egregia;* spikelet, palea, and floret, × 10; from *Brass & Myer-Drees 10206.*

or minutely lobed, the midnerve excurrent as a short mucro; rachilla segments slender, smooth; lemmas 5.5–6.5 mm. long, broad, very scabrous, strongly nerved, the apex notched, lobed or dentate, the midnerve excurrent as a mucro, the base with sparse white cottony hairs 1–2 mm. long; palea shorter than the lemma, the scabrous keels excurrent as short mucros, the internerve toothed at apex, scaberulous on the back.

TYPE: *Brass & Myer-Drees 10206,* collected in September 1938, in "alpine grassland; gregarious under shelter of rocks, 4150 m. alt., northern slope of Mt. Wilhelmina," Netherlands New Guinea.

There are two other collections of this species from the same region, *Brass & Myer-Drees 10040, 10068,* altitudes 4050 m. and 4100 m. respectively, plentiful in wet grassy spots and under rocks on tussock-grass slopes. In no. *10068* a piece of the buried culm with old shredded sheaths is attached at base, giving the appearance of a rhizomatous plant. Nearly mature caryopses were found with anthers about 1 mm. long, crushed with the stigmas at the summit, indicating closed fertilization.

Poa lunata sp. nov. FIG. 2.

Perennis, caespitosa; culmi 25–35 cm. alti, erecti; vaginae imbricatae; ligula 2–4 mm. longa; laminae 8–15 cm. longae, conduplicatae vel involutae; panicula densiuscula, erecta, 6–8 cm. longa, circa 1–1.5 cm. lata, axi ramisque scabris, pedicellis 2–3 mm. longis; spiculae 5 mm. longae, circa 1.6 mm. latae, 2-florae; glumae 3.5 et 4.3 mm. longae, sublunatae, carina ad apicem scaberula; lemmata 3.5–4 mm. longa, sublunata, acuta, glabra; palea lemma aequans, hyalina.

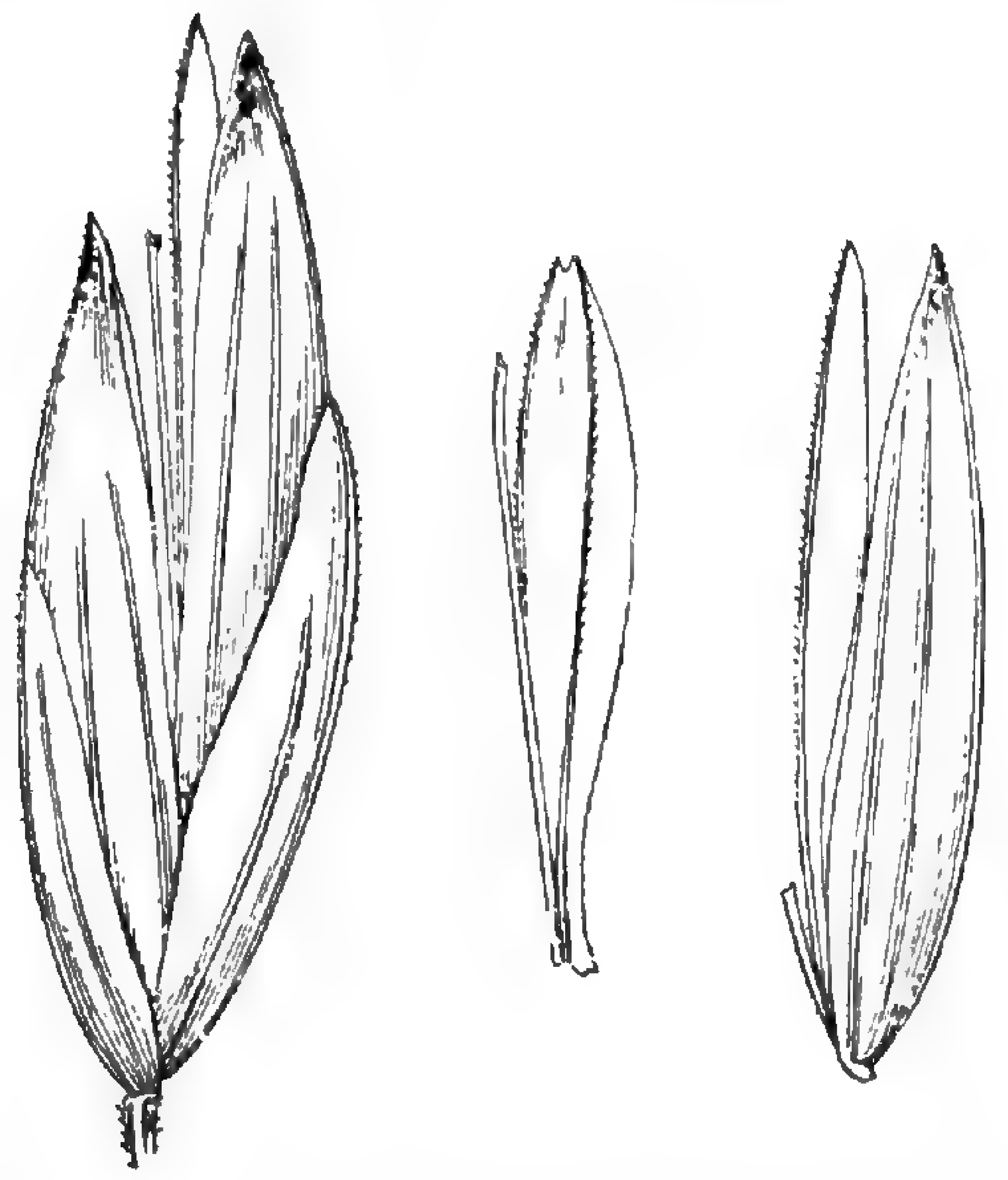

FIG. 2 (left). *Poa lunata;* spikelet, palea, and floret, × 10; from *Brass & Myer-Drees 10067.*

FIG. 3 (right). *Poa multinodis;* spikelet, palea, and floret, × 10; from *Brass 9584.*

Tufted perennial; culms 25–35 cm. tall, erect, scaberulous below the panicle; leaves crowded toward the base; sheaths overlapping, rather strongly nerved, keeled, the lower rather papery, loose, pale; ligule 2–4 mm. long, hyaline, acute; blades ascending, 8–15 cm. long (uppermost shorter), folded or loosely involute, slender, smooth, the apex acuminately boat-shaped; panicle erect, narrow, rather densely flowered, the axis, branches, and pedicels scabrous, the branches erect or ascending, naked at base, the pedicels 2–3 mm. long; spikelets 5 mm. long, about 1.6 mm. wide, elliptic in outline, 2-flowered; glumes 3.5 and 4.3 mm. long, almost lunate, the keel scaberulous toward the apex; rachilla segments slender, smooth; lemmas 3.5–4 mm. long, somewhat lunate, especially at maturity, acute, scaberulous on the keel toward the apex, otherwise glabrous; palea as long as the lemma, hyaline, the keels scabrous, terminal rachilla segment nearly as long as the palea.

TYPE: *Brass & Myer-Drees 10067,* collected in September 1938; "common in small clumps under rocks of old screes, 3950 m. alt., northern slopes of Mt. Wilhelmina," Netherlands New Guinea.

Poa multinodis sp. nov. FIG. 3.

Perennis, e rhizomatibus tenuibus; culmi graciles, basi decumbentes, multinodes, vaginae inferiores imbricatae; ligula 1 mm. longa, decurrens;

laminae planae vel conduplicatae, 2.5–8 cm. longae, 1–1.6 mm. latae; panicula erecta, 6–7 cm. longa, patens, ramis 5–25 mm. longis, pedicellis 0.5–1 mm. longis; spiculae 3 mm. longae, circa 1.3 mm. latae, 2-florae; glumae 3 et 3.7 mm. longae; lemmata 2.1–2.4 mm. longa, latiuscula, firma, acuta; palea lemma aequans, membranacea.

Perennial with slender rhizomes; culms slender, decumbent at base, the lower part with numerous nodes 5–15 mm. apart, the upper 3 nodes distant, scaberulous below the panicle; lower sheaths overlapping, thin, smooth, the upper about as long as the internodes or shorter; ligule 1 mm. long, hyaline, decurrent; blades lax, flat or folded, 2.5–9 cm. long, 1–1.7 mm. wide, minutely scaberulous toward the apex; panicle erect, 6–8 cm. long, open, the axis and branches filiform, scabrous, the branches 5–25 mm. long, finally stiffly spreading or reflexed, the pedicels 0.5–1 mm. long, spreading; spikelets 3 mm. long, about 1.3 mm. wide, leaden-purplish at maturity, 2-flowered; glumes 3 and 3.7 mm. long, the keels convex, scaberulous toward the apex; rachilla segments slender, smooth; lemmas 2.1–2.4 mm. long, rather broad, firm, acute, scaberulous on the keels toward the apex, otherwise glabrous, the intermediate nerves often obscure; palea as long as the lemma, thin-membranaceous, the internerve sulcate toward the summit, the keels scaberulous.

TYPE: *Brass 9584,* collected in August 1938, "in wet forest glade, Lake Habbema, 3225 m. camp," Netherlands New Guinea.

Poa erectifolia Hitchc. Brittonia **2:** 111. 1936.

NETHERLANDS NEW GUINEA: Mt. Wilhelmina, 7 kilometers northeast of top, alt. 3720 m., *Brass & Myer-Drees 9945,* often the dominant grass on rather wet open summits, erect in very stiff small clumps, 30–40 cm. high. Endemic.

This specimen differs from *Brass 4326* (the type) and *Brass 4420* in having glabrous, coarser, longer blades (8–15 cm. long) and a panicle with longer branches. The decurrent ligule and the spikelets agree with those of the earlier collections.

Poa crassicaulis Pilger, Bot. Jahrb. Engler **62:** 458. 1929.

NETHERLANDS NEW GUINEA: Northern slopes of Mt. Wilhelmina, alt. 3900 m., *Brass & Myer-Drees 10079;* gregarious on edges of earth screes. Lake Habbema, 3225 m. camp, *Brass 9338;* alpine grassland, several plants on sandy bed of stream. Endemic.

Brass & Myer-Drees 10079 consists of dwarf plants like the type, *Keysser 4* from Sarawaket Mountains, Northeastern New Guinea, and *Brass 4469,* previously reported from Papua. *Brass 9338,* from a lower altitude, is a well developed plant, the lower sheaths closely imbricate as in the dwarf plants but the blades 5–7 cm. long. The culms are compressed, 12 and 14 cm. long, and the panicles are narrow, rather dense, and 8 cm. long.

Poa pilata sp. nov.

Perennis, caespitosa, 3–4 cm. alta; folia numerosissima; vaginae imbricatae; ligula nulla; laminae squarrosae, conduplicatae, 10–20 mm. longae, (plicatae) 0.5–0.8 mm. latae; panicula parva; spiculae 1–4, glabrae, 3.5 mm. longae, circa 1.2 mm. latae, 2–3-florae; glumae 1.6 et 2 mm. longae, latae, 3-nerviae, acutae; lemmata acuta, 2–2.3 mm. longa, nervis intermediis inconspicuis; palea lemmaque aequalia; segmentum superius rachillae productum.

Perennial in dense tufts, branching at base, glabrous as a whole; culms 3–4 cm. high above the surface of the bog, with old buried culms 1–4 cm. long extending downward from the base; leaves very numerous, about 18–20 to a centimeter; sheaths closely imbricate, thin below and adhering to the culm; ligule obsolete; blades firm, squarrose, conduplicate, 10–20 mm. long, 0.5–0.8 mm. wide as folded, the midnerve thick, the apex acute, boat-shaped; panicle not more than 10 mm. long, of 1 to 4 erect spikelets, the rather stiff peduncle exserted 3–10 mm., the peduncle, axis, and pedicels compressed, scabrous; spikelets 3.5 mm. long, about 1.2 mm. wide, 2–3-flowered, glabrous, the rachilla segments rather thick; glumes 1.6 and 2 mm. long, firm, broad, 3-nerved, acute, the second somewhat boat-shaped at apex; lemmas acute, the intermediate nerves obscure, the lower lemma 2.3 mm. long, the upper about 2 mm.; palea about as long as the lemma; upper rachilla segment prolonged back of the palea.

TYPE: *Brass & Myer-Drees 10153,* collected in September 1938, in "alpine grassland, abundant on boggy ground, alt. 4100 m., northern slopes of Mt. Wilhelmina," Netherlands New Guinea. Also collected at Lake Habbema, 3225 m. camp, *Brass 9554, 9580,* very abundant and one of the characteristic plants of open alpine peat bogs. In these two collections the spikelets are defective, either partly eaten away or affected by fungus. *Brass 9942,* "tufted on barren seepage-wet slopes of sandstone, alt. 3850 m., 7 kilometers northeast of the Wilhelmina top," consisting of tufts 1.5–3 cm. high, the lemmas all fallen, and *Brass & Myer-Drees 10205,* "forming loose clumps under rocks on alpine grassland, common but mostly sterile, alt. 4150 m., northern slope of Mt. Wilhelmina," with long under-surface culms clothed with remnants of sheaths, and with blades 2–4 cm. long, are doubtfully referred here.

This species is apparently related to *Poa crassicaulis* Pilger, but is much more delicate, the blades much finer, acute, the ligule obsolete.

Poa spp.

NETHERLANDS NEW GUINEA: Mt. Wilhelmina, northeast of top, alt. 3720 m., *Brass & Myer-Drees 9929,* scattered on bare peaty ground on edges of dying forest; alt. 3850 m., *Brass & Myer-Drees 10347,* on limestone near waterfall.

Both are tufted perennials, with small open panicles with 2-flowered purple spikelets; the lemmas of no. *9929* are glabrous, those of no. *10347* with very scanty cottony hairs at base.

Deschampsia Klossii Ridley, Kew Bull. **1913:** 268. 1913.

NETHERLANDS NEW GUINEA: Lake Habbema, 3225 m. camp, *Brass 9048, 9312;* marshy flats, sandy pools and open shore of lake. Nine kilometers northeast of Lake Habbema, 2800 m. camp, *Brass 10555,* open beds of streams and on landslips. Mt. Wilhelmina: Two to three kilometers east of top, alt. 3620–3800 m., *Brass 9425, Brass & Myer-Drees 10311;* dominant tussock grass of sheltered hollows, and glade in subalpine forest. Seven kilometers northeast of top, alt. 3560 m., *Brass & Myer-Drees 9846, 9848;* tussock grassland. Northern slopes, alt. 4000–4250 m., *Brass & Myer-Drees 10060, 10063, 10065, 10162;* alpine grassland, old screes, and marshy lake margin. Endemic.

Trisetum flavescens (L.) Beauv. var. **papillosum** Hack. Bull. Herb. Boiss. **7:** 702. 1899.

NETHERLANDS NEW GUINEA: Lake Habbema, 3225 m. camp, *Brass 9118;* a few erect tufts in an old native camp. Japan.

Differs from the species in the strongly papillose-scabrous lemmas.

Agrostis Reinwardtii Van Hall; Miquel, Fl. Ind. Bat. **3:** 750. 1855.

NETHERLANDS NEW GUINEA: Lake Habbema, alt. 3225 m., *Brass 9050, 9576;* common tussock grass in alpine grassland. Mt. Wilhelmina, alt. 3400–4080 m., *Brass & Myer-Drees 9674, 9717, 9864, 9928, 10064, 10069,* wet valleys and forest glades on north and northeast slopes of mountain. Java.

Agrostis avenacea Gmel. Syst. Nat. **2:** 171. 1791.

Avena filiformis G. Forst. Fl. Ins. Austr. Prodr. 9. 1786. Not *Agrostis filiformis* Vill. Hist. Pl. Dauph. **2:** 78. 1787.

Agrostis retrofracta Willd. Enum. Pl. **1:** 94. 1809.

NETHERLANDS NEW GUINEA: Mt. Wilhelmina, 2–7 kilometers northeast of top, alt. 3650–3700 m., *Brass & Myer-Drees 9821, 9969, 10116;* along native path and under native rock shelters. Nine kilometers northeast of Lake Habbema, alt. 2800 m., *Brass 10726;* native clearing. Australia, Polynesia; introduced in America.

Aulacolepis epileuca (Stapf) Hitchc. Brittonia **2:** 117. 1936.

Deyeuxia epileuca Stapf, Trans. Linn. Soc. Bot. II. **4:** 247. 1894.

Poa papuana Stapf, Hook. Ic. Pl. **27:** *pl. 2607.* 1899.

Poa epileuca Stapf, Hook. Ic. Pl. **27:** *pl. 2607,* in obs. 1899.

NETHERLANDS NEW GUINEA: Lake Habbema, alt. 3225 m., *Brass 9125, 9581;* grassland and forest glades. Mt. Wilhelmina, alt. 3400–3900 m., *Brass & Myer-Drees 9816, 10074;* alpine grassland, 11 kilometers northeast of top. Borneo, New Guinea.

Garnotia Mezii Janowski in Mez, Repert. Sp. Nov. Fedde **17:** 86. 1921; **18:** 27. 1922.

NETHERLANDS NEW GUINEA: Four kilometers southwest of Bernhard Camp, Idenburg River, alt. 850 m., *Brass 13216;* rain-forest, common on banks of river. PAPUA: Central Division: Diene, Ononge Road, alt. 50 m., *Brass 3818* (listed as *G. stricta* Brongn. by Hitchcock, Brittonia **2:** 118. 1936). Endemic.

Dichelachne novoguineensis (Pilger) Pilger, Bot. Jahrb. Engler **69:** 254. 1938.

Muhlenbergia novoguineensis Pilger, Bot. Jahrb. Engler **62:** 457. 1929.

PAPUA: Central Division: Mt. Albert Edward, alt. 3680 m., *Brass 4406* (doubtfully listed by Hitchcock, Brittonia **2:** 117. 1936 as *D. sciurea* (R. Br.) Hook. f.). NETHERLANDS NEW GUINEA: Nine kilometers northeast of Lake Habbema, alt. 2800 m., *Brass 10742;* native clearing in forest. Mt. Wilhelmina, alt. 3400 m., *Brass & Myer-Drees 9802;* sandy banks of stream 11 kilometers northeast of top. Endemic.

Aristida Cumingiana Trin. & Rupr. Mém. Acad. St. Pétersb. VI. Sci. Nat. **5**[1]**:** 141. 1842.

NETHERLANDS NEW GUINEA: Balim River, alt. 1600 m., *Brass 11741;* common along paths on sandy long-deforested slopes. Southwestern Asia, Philippines, New Guinea.

Cynodon Barberi Rang. & Tad. Jour. Bombay Nat. Hist. Soc. **24:** 846. 1916.

NORTHEASTERN NEW GUINEA: Morobe District: Kajabit Mission, *Clemens 10473 bis.* India; new to New Guinea.

Hierochloë redolens (Vahl) Roem. & Schult. Syst. Veg. **2:** 514. 1817.

Holcus redolens Vahl, Symb. Bot. **2:** 102. 1791.

NETHERLANDS NEW GUINEA: Lake Habbema, 3225 m. camp, *Brass 9461;* abundant among tussock grasses in a limestone sinkhole. Mt. Wilhelmina, 7–11 kilometers northeast of top, alt. 3400–3560 m., *Brass & Myer-Drees 9712, 9830;* alpine grassland, common among tussocks in moist situations. Northern slopes of Mt. Wilhelmina, alt. 4000 m., *Brass & Myer-Drees 10062;* common in wet situations.

Hierochloë Horsfieldii (Kunth) Maxim. Bull. Acad. Sci. St. Petersb. **32:** 627. 1888.

Ataxia Horsfieldii Kunth, Rev. Gram. **1:** 22. 1829, name only; Enum. Pl. **1:** 39. 1833, name only; Kunth ex Horsfield in Bennett, Pl. Jav. **8:** *pl. 3.* 1838–1852.

Hierochloë angusta Hitchc. Brittonia **2:** 118. 1936.

NETHERLANDS NEW GUINEA: Lake Habbema, 3225 m. camp, *Brass 9049, 9117, 9577;* forest margins, glades and lake shore. NORTHEASTERN NEW GUINEA: Sarawaket, *Clemens 7261;* bank of rivulet, alpine meadow. Java.

The type of *Hierochloë angusta, Brass 4412,* Mt. Albert Edward, Papua, is a slender specimen with glabrous foliage, narrow blades, and narrow panicle only 6–7 cm. long. The plate of *Ataxia Horsfieldii* shows a much larger plant with wider blades and looser panicle. The later New Guinea collections and additional specimens from Java show that the species is variable, ranging from narrow-leaved plants like *Brass 4412, 9577,* and *Clemens 7261,* to tall, broad-leaved plants like *Brass 9049* and most of the Java specimens. The panicles range from small and almost spikelike, as in *Brass 4412, Clemens 7261,* and two Java specimens, to as much as 20 cm. long with branches to 8 cm. long, as in *Brass 9049.* The foliage in the type of *H. angusta* is glabrous and that of *Ataxia Horsfieldii* is described as glabrous, but some of the specimens from both Java and New Guinea are retrorsely pubescent on the sheaths and spreading-pubescent on the upper surface of the blades. This is the type species of the Section *Ataxia* (R. Br.) Hack., in which the lower floret is staminate or neuter and the second neuter and usually without a palea. In *Hierochloë* proper the lower florets are staminate.

Arundinella furva sp. nov. FIG. 4.

Perennis; culmi ascendentes vel erecti, 75–95 cm. alti; nodi strigosi; vaginae apice et margine hirsutae; ligula 0.5 mm. longa, longe ciliata; laminae planae, 5.5–10.5 cm. longae, 5–10 mm. latae; panicula erecta, 10–16 cm. longa, 1–1.5 cm. lata, fusca, axi ramisque scabris, pedicellis 1–3 mm. longis; spiculae 5–6 mm. longae; glumae acuminatae, primo 3-nervio, secundo paulo longiore, 5-nervio; lemma sterile acuminatum, 3-nervium; fructus 3 mm. longus, 0.6 mm. latus, fuscus, callo piloso, lemmate bidentato, aristato, arista 3–4 mm. longa, prope basim geniculata.

Perennial with extravaginal innovations, sometimes rooting at the lower nodes; culms ascending to erect, 75–95 cm. tall, terete, firm, smooth; nodes strigose; sheaths hirsute on the collar and on the margin toward the summit, otherwise glabrous, the lower overlapping; ligule a firm membrane 0.5 mm. long, ciliate with white hairs 3–5 mm. long, the hairs brittle and broken off in old sheaths; blades ascending, firm, flat or the margins involute toward the apex, 5.5–10.5 cm. long, 5–10 mm. wide, slightly rounded at base, acuminate, the margins scabrous and sparsely stiffly ciliate toward the base, the hairs mostly broken off; panicle long-exserted, erect, 10–16 cm. long, 1–1.5 cm. wide, dusky purplish brown, the axis and branches erect, angled, scabrous, the branches slender, the lower distant, naked at base; pedicels 1–3 mm. long, angled, scabrous; spikelets 5–6 mm. long; glumes firm, acuminate, the first 3-nerved, the nerves scabrous, the second about 1 mm. longer than the first, 5-nerved, the nerves glabrous; sterile lemma slightly exceeding the first glume, acuminate, 3-nerved, its palea shorter, empty; fruit 3 mm. long, 0.6 mm. wide, dark purplish brown, minutely papillose-roughened, the callus pilose, the hairs white, 0.5–1 mm. long, the lemma bidentate, the awn 3–4 mm. long, twisted at base, geniculate just above the base.

TYPE: *Clemens 5826a,* collected in March 1937, at 2600 m. alt., Sarawaket, Morobe District, Northeastern New Guinea. A second collection from the same region is *Clemens 5250,* from "open place, Basu Tamanac, Sarawaket," alt. 2300 m., Jan. 31, 1937.

This species belongs in *Arundinella* proper as limited by Keng (Nat. Cent. Univ. Science Reports, Biology **2:** 20. 1936). It somewhat resembles *A. fuscata* Nees, but is taller and nearly glabrous, with longer spikelets and much larger fruit. It differs from all the species known in the very short twisted column of the awn, the geniculum being scarcely 1 mm. above the base of the awn.

FIG. 4. *Arundinella furva;* spikelet, first glume, second glume, sterile floret, and fruit, × 10; from *Clemens 5826a.*

Digitaria violascens Link, Hort. Berol. **1:** 229. 1827.

Paspalum chinensis Nees in Hook. & Arn. Bot. Beechey Voy. 231. 1836.

Paspalum minutiflorum Steud. Syn. Pl. Glum. **1:** 17. 1854; not *P. minutiflorum* Desv. 1831.

Digitaria chinensis A. Camus, Not. Syst. Lecomte **4:** 48. 1923; not *D. chinensis* Hornem. 1819.

NETHERLANDS NEW GUINEA: Balim River, alt. 1600 m., *Brass 11822;* sandy soil on deforested slopes, not common. NORTHEASTERN NEW GUINEA: Morobe District: Ogao, alt. 2000 m., *Clemens 10359.* Eastern and southern Asia, East Indies, Philippines; introduced in American tropics and subtropics.

Panicum auritum Presl, Rel. Haenk. **1:** 305. 1830.

NETHERLANDS NEW GUINEA: Bernhard Camp, Idenburg River, alt. 50 m., *Brass 13942;* common in swamp forests of river silt plains, ascending to 2 m. East Indies, southeastern Asia to Philippines.

Panicum zizanioides H.B.K. Nov. Gen. & Sp. **1:** 100. 1815.

NETHERLANDS NEW GUINEA: Bernhard Camp, Idenburg River, alt. 50 m., *Brass 13946;* abundant in semi-open swampy forest of river flood plain; massed and ascending to 1 m. Tropical America and Africa, India, New Guinea.

Ichnanthus vicinus (F. M. Bailey) Merr. Enum. Phil. Fl. Pl. **1:** 70. 1922.

Panicum vicinum F. M. Bailey, Syn. Queensl. Fl. Suppl. **3:** 82. 1890.

NETHERLANDS NEW GUINEA: Hollandia and vicinity, alt. 50 m., *Brass 8909;*

abundant on shaded sandy banks in moist ravine. Four kilometers southwest of Bernhard Camp, Idenburg River, alt. 850 m., *Brass 13210;* occasional on flooded rocky banks of river. Southern Asia, East Indies, northern Australia.

Sacciolepis contracta (Wight & Arn.) Hitchc. Mem. Bishop Mus. **8:** 199. *f. 90.* 1922.

Panicum contractum Wight & Arn. Linnaea **10:** Litt. 117. 1836.

NETHERLANDS NEW GUINEA: Nine kilometers northeast of Lake Habbema, alt. 2800 m., *Brass 10736;* suberect tufts about 80 cm. tall, native clearing in forest. Bele River, 18 kilometers northeast of Lake Habbema, alt. 2200 m., *Brass 11524;* plentiful on old garden lands, weak ascending tufts to about 50 cm. tall. Balim River, alt. 1600 m., *Brass 11824;* plentiful on sandy long-deforested slopes, erect tufts 40 cm. tall. Southern Asia, Japan, East Indies, Philippines.

Isachne albens Trin. Icon. Gram. *pl. 85.* 1827.

NETHERLANDS NEW GUINEA: Bele River, 18 kilometers northeast of Lake Habbema, alt. 2200 m., *Brass 11559;* common in open secondary forest, scrambling or in suberect clumps 1–1.5 m. tall. Southern Asia and East Indies.

Isachne Brassii Hitchc. Proc. Linn. Soc. N. S. Wales **54:** 146. 1929.

NETHERLANDS NEW GUINEA: Bernhard Camp, Idenburg River, *Brass 14055* [no data on this label, other than printed locality]. Endemic.

Plant larger than previous collections, the culms to 50 cm. long, blades to 7 cm. long and 7 mm. wide, the panicle 7 cm. long.

Isachne Brassii Hitchc. var. **villosa** Hitchc. Brittonia **2:** 123. 1936.

NETHERLANDS NEW GUINEA: Fifteen kilometers southwest of Bernhard Camp, Idenburg River, alt. 1500 m., *Brass 12370;* rain-forest, on sand in bed of small stream. Eighteen kilometers southwest of same, alt. 2150 m., *Brass 12475;* one small clump on open rock slide; more densely villous than usual. Endemic.

Isachne globosa (Thunb.) Kuntze, Rev. Gen. Pl. **2:** 778. 1891.

Milium globosum Thunb. Fl. Japon. 49. 1784.

Isachne australis R. Br. Prod. Fl. Nov. Holl. 196. 1810.

NETHERLANDS NEW GUINEA: Nine kilometers northeast of Lake Habbema, alt. 2800 m., *Brass 10743;* abundant on native clearing in forest. Bele River, 18 kilometers northeast of Lake Habbema, alt. 2200 m., *Brass 11542;* plentiful on sandy river banks and in old gardens. Balim River, alt. 1600 m., *Brass 11823;* plentiful on deforested slopes. China to Philippines and East Indies, New Guinea and Australia.

Isachne grisea K. Schum. in Schum. & Lauterb. Nachtr. Fl. Deutsch. Schutzgeb. Südsee 57. 1905.

PAPUA: Central Division: Murray Pass, *Brass 4642* (listed by Hitchcock, Brittonia **2:** 123. 1936, under *I. pauciflora* Hack.). NORTHEASTERN NEW GUINEA: Morobe District: Sattelberg, *J. & M. S. Clemens 312;* forest, Sarawaket, *J. & M. S. Clemens 6097.* Endemic.

Isachne micrantha Merr. Philip. Jour. Sci. Bot. **5:** 168. 1910.

NETHERLANDS NEW GUINEA: Lake Habbema, alt. 3225 m., *Brass 9556;* locally plentiful on open boggy ground, prostrate. Nine kilometers northeast of Lake Habbema, alt. 2800 m., *Brass 10740;* plentiful in native clearing in forest. Eighteen kilometers northeast of Lake Habbema, alt. 2200 m., *Brass 11583;* abundant in native gardens. Four kilometers southwest of Bernhard Camp, Idenburg River, alt. 850 m., *Brass 13201;* matted on flood-washed rocks on river bank. NORTHEASTERN NEW GUINEA: Morobe District: Yunzaing, *Clemens,* Sept. 1936; wet trails. Philippines, New Guinea.

Isachne scabrosa Hook. f. Fl. Brit. Ind. **7:** 23. 1896.

PAPUA: Central Division: Mt. Tafa, alt. 2400 m., *Brass 4871;* plentiful on open banks of small stream flowing over landslide debris. NORTHEASTERN NEW GUINEA: Morobe District: Ogeramnang, alt. 1800 m., *J. & M. S. Clemens 6958a;* wet open forest trail. India, New Guinea.

Isachne stricta Elmer, Leaflets Philip. Bot. **2:** 463. 1908.

NORTHEASTERN NEW GUINEA: Morobe District: Yunzaing, alt. 1360 m., *J. & M. S. Clemens 4105;* in seepage over rock slope, rare. Ogeramnang, alt. 1700 m., *Clemens 5402.* Samanzing, alt. 1500–1800 m., *Clemens 9208, 9239;* bank of mountain rivulet. Philippines, New Guinea.

The only collection previously known (the type), from Dumaguete (Cuernos Mts.), Island of Negros, Philippines, is very immature and has longer blades than the overmature Clemens specimens, but on the whole they agree very closely.

Echinochloa crusgalli (L.) Beauv. Ess. Agrost. 53, 161, 169. 1812.

Panicum crusgalli L. Sp. Pl. 56. 1753.

NETHERLANDS NEW GUINEA: Balim River, alt. 1600 m., *Brass 11793, 11803;* common in ditches, erect, 1 m. tall. Nearly awnless form. Warm regions of both hemispheres.

Imperata cylindrica (L.) Beauv. Ess. Agrost. 165, 177. 1812.

Lagurus cylindricus L. Syst. Nat. ed. 10. **2:** 878. 1759.

Imperata arundinacea Cyrillo, Pl. Rar. Neap. **2:** 27. 1792.

NETHERLANDS NEW GUINEA: Northern slopes of Mt. Wilhelmina, alt. 3200 m., *Brass & Myer-Drees 10235;* covering beaches of gravel and sand, Wamena River. Nine kilometers northeast of Lake Habbema, alt. 2600 m., *Brass 10902;* on old landslip in forest. Bele River, 18 kilometers northeast of Lake Habbema, alt. 2200 m., *Brass 11491;* dominant grass on old garden lands. Warm regions of the eastern hemisphere.

Saccharum spontaneum L. Mant. Pl. **2:** 183. 1771.

NETHERLANDS NEW GUINEA: Eighteen kilometers northeast of Lake Habbema, alt. 2200 m., *Brass 11374;* very abundant in tall thickets on abandoned garden land, 2.5–3 m. high, Bele River. Balim River, alt. 1600 m., *Brass 11778;* abundant on alluvial soil of river banks. Four kilometers southwest of Bernhard Camp, Idenburg River, alt. 850 m., *Brass 13264;* colonizing sand and gravel beaches. Bernhard Camp, Idenburg River, alt. 50 m., *Brass 13791;* in dense pure stands, 7–8 m. high, on recent silt deposits of river banks. Warm regions of Asia, the East Indies, Philippines.

Saccharum spontaneum var. **klagha** (Jungh.) Hack. in DC. Monogr. Phan. **6:** 116. 1889.

Saccharum klagha Jungh. ex Steud. Syn. Pl. Glum. **1:** 405. 1854.

NETHERLANDS NEW GUINEA: Hollandia and vicinity, *Brass 8920.* Java.

Differs from the species in the slightly larger spikelets with shorter less silky hairs.

Eulalia leptostachys (Pilger) comb. nov.

Pollinia leptostachys Pilger, Bot. Jahrb. Engler **52:** 170. 1914.

NETHERLANDS NEW GUINEA: Nine kilometers northeast of Lake Habbema, alt. 2600 m., *Brass 10901;* a few tufts on dry open landslip in forest. Bele River, 18 kilometers northeast of Lake Habbema, alt. 2200 m., *Brass 11363;* covering high, gravelly, formerly forested banks of river, ascending and tangled. Balim River, alt. 1600 m., *Brass 11825;* locally abundant on long-deforested slopes. Endemic.

Microstegium gratum (Hack.) A. Camus, Ann. Soc. Linn. Lyon **68:** 201. 1921.

Pollinia grata Hack. in DC. Monogr. Phan. **6:** 175. 1889.

Eulalia grata Kuntze, Rev. Gen. Pl. **2:** 775. 1891.

NETHERLANDS NEW GUINEA: Four kilometers southwest of Bernhard Camp, Idenburg River, alt. 850 m., *Brass 13720;* occasional in young seral rain-forest on sandy flood banks. Southern China to India and East Indies.

Andropogon intermedius R. Br. Prodr. Fl. Nov. Holl. 202. 1810.

NETHERLANDS NEW GUINEA: Balim River, alt. 1600 m., *Brass 11616, 11805, 11845,* common on deforested slopes. China to India, East Indies, Philippines and Australia.

U. S. NATIONAL HERBARIUM,
WASHINGTON, D. C.

NEW PHANEROGAMS FROM MEXICO, V

IVAN M. JOHNSTON

Milla Bryani, sp. nov.

Planta 3–9 dm. alta erecta; foliis linearibus revolutis canaliculatis laevibus 2–4 dm. longis; scapo apice 1–3-floro saepe infra medium aspero; bracteis subulatis 5–8 mm. longis; floribus albis lineis viridibus 5 notatis 16–18 cm. longis 1–5 (saepe ca. 2) cm. longe pedicellatis, tubo gracili basim versus 1.5 mm. crasso summum ad apicem sub anthesi 5–6 mm. crasso, lobis patentibus subaequalibus 14–18 mm. longis 4.5–6.6 mm. latis medium versus vel paulo supra medium latioribus utrinque contractis; staminibus exsertis aequalibus ad faucem affixis; antheris oblongis in sicco ca. 3 mm. longis (sub aqua ad 7 mm. longis) extus vesciculari-rugulosis; filamentis ca. 5 mm. longis evidenter exsertis cuneatis, in sicco ca. 0.8 mm. longe (sub aqua ad 2 mm. longe) supra basim antheris dorsaliter affixis, basi imo ca. 1.6 mm. latis paululo supra basim ca. 1 mm. lata deinde apicem versus gradatim attenuatis; filamentis lamellas 2 (vel 3) in faucem corollae decurrentes gerentibus.

COAHUILA: Western base of Picacho del Fuste, on mountain side, *Johnston 8364;* head of Cañon del Cuervo Chico, rocky slopes and crests, *Johnston 8529* (TYPE, Gray Herb.); Corte Blanco fork of Charretarras Canyon, Sierra Madera, grassy rocky flat forming in oak-thickets, *Johnston 9123;* ridge of Sierra de la Fragua north of Puerto Colorado, rocky soil in openings among brush and pines, *Johnston 8777;* Canyon del Agua, Sierra Madera, *Muller 3203.*

Differing decisively from the widely ranging *Milla biflora* Cav. in its well developed exserted filaments and more slender and elongate flower. The filaments bear two plates of tissue on their inner surface. These plates narrow as they extend upward toward the base of the anther. The summit of the immature ovary bears three lines of minute conic trichomes. These are more prominent than those frequently present on the ovary of *M. biflora.* The pale green lines down the middle of each perianth-segment of *M. biflora* are usually evidently three-nerved. In the proposed species these nerves are very inconspicuous. *Milla biflora* has been collected in various parts of Chihuahua, but the only station in Coahuila known to me is in the Sierra de Hechiceros on the Chihuahua border. The species here proposed ranges well to the east of the known range of *M. biflora* and appears to be endemic to the limestone mountains of north-central Coahuila.

I have associated with this species the name of my companion during much of my field work in Coahuila in 1941, Prof. Kirk Bryan of the Department of Geology and Geography of Harvard University. His stimulating companionship and his geologist's pick, frequently used for botanical purposes, contributed greatly to the pleasure and botanical success of the weeks we travelled together. It is a pleasure to associate his name with one of the plants he helped me collect.

Nolina texana Wats., var. **compacta** (Trel.), comb. nov.

N. erumpens compacta Trel. Proc. Amer. Philos. Soc. **50:** 418. 1911.

N. affinis Trel. l.c. 417.
N. caudata Trel. l.c. 417.

Differing from typical *N. texana,* of the eastern portions of the Edwards Plateau, in its more robust habit and in the more elongate, much larger, and more densely and abundantly branched female inflorescences. The ascending branches of the inflorescence are much more rigid and much more abundantly and stiffly short-branched. Except for Thompson's collection from Marathon (which is typical *N. erumpens*), all of the material of the var. *compacta* originally cited by Trelease belongs to the present plant. Trelease's *N. affinis* is a mixture of the present variety and *N. micrantha.* The actual type-sheet of *N. affinis,* at St. Louis, however, entirely represents the present variety. The var. *compacta* ranges from the western parts of the Edwards Plateau, in Texas, west to southern Arizona and south into northern Chihuahua.

Nolina micrantha, sp. nov.

Planta acaulis 6–10 dm. alta; foliis linearibus numerosis duris 5–13 dm. longis supra basim 2.5–4 mm. latis, supra planis, subtus convexis, margine laevibus vel scabris; panicula 4–6 dm. longa 10–15 cm. diametro; ramis rigidis numerosis laevibus gracilibus ascendentibus vel stricte ascendentibus, superioribus saepe simplicibus ad 15 cm. longis, inferioribus saepe 10–15 cm. longis ramosis (ramulis 2–12 gracilibus ascendentibus 3–7 cm. longis), bracteis 1–3 dm. longis basi scariosis dilatis ad 1 cm. latis alibi filiformibus; floribus ex axillis bractearum secundariarum minutarum scariosarum erosarum 1–2 vel rariter 3 mm. longarum erumpentibus; perianthii lobis 2–2.5 mm. longis oblongis apice rotundis, masculi ochroleucis, feminei costa rosea mediali notatis; capsula purpurascenti 3–4 mm. alta 5–6 mm. lata, pedicello 2.5–4 mm. longo ca. 2 mm. infra perianthum articulato; seminibus globosis ca. 3 mm. diametro capsulas chartaceas inflatas dirumpentibus.

Chihuahua: Vicinity of Santa Eulalia, 1908, *Palmer 139;* rocky hills, Bachimba Canyon south of Chihuahua, *Pringle 2* in pt. (G); Organos, base of grassy hills with large oaks, *Stewart & Johnston 2072;* Sierra Hechiceros, Rancho Encampanada, sunny hillside, *Stewart 193.* Coahuila: Sierra Hechiceros, vicinity of Rancho El Tule, rocky slopes and flats, *Stewart 490* and *Johnston & Muller 1326* (type, Gray Herb.).

A well marked species, probably most closely related to *N. texana,* from which it differs in its distinctly smaller flowers, looser larger inflorescence with less rigid, less twiggy, more slender and elongate branches, purpurascent capsules, and minute less lacerate bractlets.

Trelease's original publication of *N. affinis* is based upon specimens representing both the present species and *Nolina texana* var. *compacta.* The material at St. Louis, which Trelease designated as the type of his *N. affinis,* is representative of *N. texana* var. *compacta.* It is a composite sheet of *Pringle 1* and *2.* At the Gray Herbarium the sheet of *Pringle 2* is half fruiting material of *N. texana* and half the present plant. The Gray Herbarium sheet of *Pringle 1* is entirely male flowering material of *N. texana.* According to Pringle's field notes his two sheets, nos. *1* and *2,* were collected April 2 and May 22, 1885, in Bachimba Canyon, which is about 35 km. southeast of Chihuahua City.

Dasylirion heteracanthum, sp. nov.

Planta robusta *D. leiophyllo* affinis; foliis 8–11 dm. longis supra basim ampliatam 2–3 cm. latis plus minusve opacis viridibus, margine spinis plerumque divaricatis rectis vel antrorse arcuatis munitis, spinis gracilibus 2–4 mm. longis 5–15 mm. distantibus saepe lutescentibus rariter apicem versus brunnescentibus; fructu obovato-elliptico 6–7 mm. longo 4–5 mm. lato, sinibus apicalibus latis haud profundis.

COAHUILA: Western base of Picacho del Fuste, trunk up to 3 ft. tall, scape 10–15 ft. tall, frequent on rocky slopes and flats, *Johnston 8428* (TYPE, Gray Herb.). TEXAS: Persimon Gap area, Brewster Co., July 30, 1938, *Sperry 1321;* Chisos Mts., July 5, 1931, *Mueller 7958.*

In Texas this plant occupies the area between *D. texanum* Scheele, of the Edwards Plateau, and *D. leiophyllum* Trel., of western trans-Pecos Texas. It has the fruit of *D. texanum* but much longer and broader non-glossy leaves, of which the marginal thorns are distinctly divergent and straight or weakly curved, rather than ascending, stout, and strongly up-curved. The proposed species differs from *D. leiophyllum* in its somewhat broader non-lustrous leaves and in the absence of abundant stout strongly curved retrorse marginal thorns. Its fruit may be similar to those of *D. texanum* and *D. leiophyllum* or narrower with a deep apical notch.

Dasylirion Stewartii, sp. nov.

Planta robusta; foliis metralibus supra basim 2–3 cm. lata viridibus vix lucentibus margine spinis validis brunnescentibus conspicue retrorseque curvatis armatis; fructibus 6–7 mm. longis 4–5 mm. latis obovatis apice profunde et anguste emarginatis, alis 1–2 mm. latis.

COAHUILA: Vicinity of Santa Elena, eastern foothills of the Sierra de las Cruces, 1941, *Stewart 823* (TYPE, Gray Herb.) and *841;* 7 km. north of Santa Elena, *Johnston & Muller 331.*

There is only one described species of *Dasylirion* with retrorse thorns on the leaf-margins, *D. leiophyllum,* of western trans-Pecos Texas and Chihuahua. From that species, *D. Stewartii* differs conspicuously in its larger size, its very much coarser and more strongly armed non-lustrous leaves, its more deeply notched fruit, and its detached more south-easterly range. The plants of the Sierra de las Cruces, where it abounds on the limestone foothills, have a trunk becoming a meter tall and a large head of light green non-lustrous leaves. The flowering stalk becomes several meters tall. There is a vinata at San José, at the southeastern base of the Sierra de las Cruces, where for many years *D. Stewartii* has been used for the preparation of the alcoholic liquor "Sotol."

To a botanist who has not observed and lived with *Dasylirion* in the field, the fact that various species differ in the direction of their leaf-thorns may seem of minor importance. To those living with these plants the differences are very real indeed. In areas having species with antrorsely armed leaves, horsemen and cattle brush these plants with impunity. One may even grasp a handful of their leaves to help one up a steep slope. The collecting of the stem-crown for sotol-making or the gathering of the flowering stems ("garochas") for their many uses (from corks to building material) is a simple task. About the Sierra de las Cruces, however, where *D.*

Stewartii is the only species, all this is very different, for the thousands of cats-claws on the leaves of that species rake savagely the flanks of any animal brushing this plant. Any rider, unprotected by heavy leather chaps, has his legs and thighs unmercifully clawed and perhaps his clothes torn, if he is brushed, while on some narrow trail, against one of the massive clusters of viciously armed leaves. One who collects this plant, either for the herbarium or for the making of sotol, unless he is very cautious and deliberate, bears some scratches after his encounter with the plant. Because of its retrorse leaf-thorns, the plant has won the same respect that is accorded to such cacti as *Opuntia*. Direction of leaf-thorns do make a difference!

With this handsome plant I have associated the name of my good friend, Mr. Robert M. Stewart, of Santa Elena. Through his effort the area about Santa Elena has now become botanically the best explored in all of northern Coahuila. It is a pleasure to associate his name with one of the most common and conspicuous plants in that area.

Dasylirion Stewartii, var. **glaucum,** var. nov.

A forma typica differt foliis pallidis conspicue glaucis.

Coahuila: 3 m. northwest of El Oro, on road to Esmeralda, 1939, *White 1970*. Chihuahua: Mouth of Cañon del Rayo, Sierra Diablo, 1941, *Stewart 957* (type, Gray Herb.).

The above cited collections have the same fruit as the plant about Santa Elena, but their leaves are very glaucous rather than pale green. Perhaps also the thorns may be less coarse and the leaf-margin between them more denticulate. This glaucous plant is so strikingly different that I believe it merits a name.

Phorodendron flavum, sp. nov.

Planta dioica fulvescens, partibus junioribus omnino velutinis pilis stellatis minutis mollibus fulvis dense obtectis, partibus vetustioribus tarde subglabrescentibus pilis sparsis pallidioribus donatis; caulibus lignosis rigidis saltem ad 3 dm. longis ascendenter ramosis, internodiis 1–3 cm. longis inferioribus 4–7 mm. crassis; foliis oblongo- vel ovato-ellipticis quam internodiis saepe longioribus, majoribus 3.5–3.8 cm. longis 1.3–1.5 cm. latis, 1.5–2.3 mm. longe et 3–4 mm. late petiolatis; lamina crasse coriacea fulve fusco-viridescenti, medium versus vel paulo infra medium latiore, basi rotundata vel angulata in petiolum abrupte contracta, apice rotunda vel non raro plus minusve acuta, subtus (in sicco) plus minusve prominenter costata; spicis femineis (masculis non visis) ad axillas solitariis vel pluribus, ad anthesim 10–14 mm. longis, fructiferis ca. 2 cm. longis, 3- vel raro 5- vel 6-articulatis; floribus in series 2 vel 3 dispositis 8–12 pro articulo; baccis subglobosis ca. 4 mm. diametro glabris laevibus perianthio clauso basi ciliato coronatis.

Durango: Vicinity of Durango, on *Quercus*, Nov. 1896, *Palmer 777* (type, Gray Herb.). Coahuila: Sierra Negras, 9 km. south of Parras, on *Quercus, Stanford, Retherford & Northcraft 210;* hills 11 km. northeast of Jimulco, on *Quercus, Stanford, Retherford & Northcraft 71.*

This species belongs to the *Boreales-Pluriseriales-Flavescentes* of Trelease. The type-collection is cited and illustrated by Trelease, Monogr.

Phor. 42, *tab. 41b* (1916), as an aberrant form of *P. tomentosum* (DC.) Engelm. I do not believe that the species proposed here is very closely related to *P. tomentosum*. That species, based upon material collected near Catorce, S.L.P., "supra Mimoseas," is the common parasite on Leguminosae in the intermontane desert valleys of northern Mexico. It is a grayish green plant with proportionately broader leaves and a thinner grayish indument. The present species is a montane plant, growing on oaks, and apparently reaching southwestern Coahuila from the highlands of Durango. Its very dark green herbage, its more coriaceous, more elongate leaves, and its abundant softer tawny velvety indument set it off conspicuously from *P. tomentosum*. The three specimens cited form a very uniform series.

Gilia Stewartii, sp. nov.

Planta erecta 1–3 dm. alta, ut videtur biennis, stricte ascendenter ramosa minute inconspicueque glandulifera basim versus fruticulosa; foliis numerosis firmulis pinnatipartitis; foliis radicalibus congestis sub anthesi saepe delapsis 2–5 cm. longis saepe bipinnatisectis, lobis distantibus saepe 1 mm. latis raro latioribus; foliis caulinis saepe pinnatifidis sursum reductis, infra medium caulis 3–5 cm. longis, lobis saepe linearibus 3- vel 4-jugatis 5–20 cm. longis ca. 1 mm. latis; floribus numerosis laxe paniculatis; pedicellis 1–3 cm. longis ascendentibus rigidulis glandulis minutis dense obsitis; calyce fere ad basim partito 4–5 mm. longo, lobis cuneatis strictis margine membranaceis partibus mediis viridibus trinervatis saepe glanduliferis; corolla lilacina vel violacea usque ad basim fere partita quam calyce plus duplo longiore, lobis 7–12 mm. longis 2–5 mm. latis elongatis medium versus latioribus, apice acutis vel late acutis, basi subito in unguem angustatis; filamentis exsertis filiformibus quam antheris oblongis valde longioribus; ovario glabro; capsula ellipsoideo-ovoidea apicem lobis calycis attingente vel paulo superante; seminibus numerosis minutis sub aqua mucilaginosis.

TEXAS: 6 mi. north of Hot Springs, Brewster Co., *Innes & Warnock 546;* stony hills near Quitman Canyon, Hudspeth Co., *Chas. Wright.* CHIHUAHUA: Hills near Chihuahua, Aug. 11, 1885, *Pringle 530;* 12 mi. south of Camargo, *White 2196;* 1 km. north of Victoria, *Stewart & Johnston 2004;* Cañon del Rayo, Sierra Diablo, *Stewart 904* and *950.* DURANGO: Cerro de San Ignacio, July 1910, *Purpus 4595.* COAHUILA: 8 km. north of Eutimias, *Stewart 1750;* 15 km. east of La India, Llano de Guaje, *Stewart 1184;* near Tinaja Blanca, Sierra de las Cruces, *Stewart 2235;* Santa Elena, Sierra de las Cruces, *Johnston & Muller 236;* south base of Picacho de San José, *Johnston & Muller 801;* 5 mi. south of San José, *Johnston & Muller 1258* (TYPE, Gray Herb.); Cañon del Gringo, Sierra Planchada, *Stewart 1049;* Cañon de Hidalgo, Sierra Mojada, *Stewart 1096;* Sierra Mojada, *Jones 348;* Tanque Jerico, north margin of Cañada de Cuervo Grande, *Johnston 8345;* Puerto Colorado, *Johnston 8708;* western end of Sierra Fragua, high ridge north of Puerto Colorado, *Johnston 8786;* Soledad, 1880, *Palmer 845;* Saltillo, 1898, *Palmer 312;* Saltillo, 1878, *Parry 8;* 2 mi. west of Saltillo, *White 1660;* 4 mi. north of Peña, *Johnston 7718.* HIDALGO: Ixmiquilpan, 1905, *Purpus 1398.* GUANAJUATO: Jaral, 1887, *Schumann 351.*

A well marked species of the desert limestone mountains, growing on slopes and on outwash near their bases. It appears to favor silty soils. The lilac or pale violet or lavender corolla-lobes are elongate and taper to a point. The shape and color of its corolla-lobes, as well as its deeply cut calyx, which is equalled or over-topped by the capsule, readily distinguish the new species from *G. rigidula* Benth. Its pinnate leaves, with few distant slender elongate lobes, as well as its glanduliferous calyx, its abundant basal branching, and its lower stature, readily distinguish it from *G. incisa* Benth., probably its closest relative. Material from the eastern half of Coahuila appears to have smaller corollas (7–8 mm. long) than that from other areas. The corollas are usually 9–12 mm. long. The species is named in honor of Mr. Robert Stewart, who has made numerous collections of this charming little plant.

Gilia platyloba, sp. nov.

Planta erecta 2–3 dm. alta, ut videtur biennis, stricte ascendenter ramosa minute inconspicueque glandulifera ceterum glabra basim versus fruticulosa; foliis firmulis; foliis radicalibus congestis sub anthesi saepe delapsis; foliis caulinis pinnatis vel bipinnatis, infra medium caulis 2–6 cm. longis 1–2.5 cm. latis, lobis 2–4-jugatis linearibus vel anguste cuneatis integris vel sparse breviterque incisis; floribus numerosis laxe paniculatis, pedicellis 1–3 cm. longis rigidulis dense glanduliferis; calyce fere ad basim partito 5–6 mm. longo, lobis strictis cuneatis margine membranaceis partibus medialibus viridibus trinervatis et glanduliferis; corolla caerulea usque ad basim partita quam calyce plus quam duplo longiore, lobis obovatis 13–17 mm. longis 7–9 mm. latis supra medium latioribus apice rotundis vel obtusis basi in unguem angustatis; filamentis exsertis filiformibus quam antheris luteis oblongis valde longioribus; capsula late ellipsoideo-ovoidea apice lobos calycis attingentibus vel paulo superantibus; seminibus minutis numerosis sub aqua mucilaginosis.

COAHUILA: Saltillo, 1898, *Palmer 799* (TYPE, Gray Herb.); Fraile, *Stanford, Retherford & Northcraft 38;* 11 km. northeast of Jimulco, *Stanford, Retherford & Northcraft 38.* NUEVO LEON: Canyon Capulines above San Enrique, *Mueller 2377.* ZACARECAS: Concepcion del Oro, 1904, *Palmer 282;* 18 km. west of Concepcion del Oro, *Stanford, Retherford & Northcraft 602;* Cedros, *Lloyd 85.* DURANGO: Durango, 1896, *Palmer 353.*

Related to *Gilia Stewartii,* from which it differs chiefly in the shape of the corolla-lobes and their larger size and dark blue color. From *G. rigidula* Benth., with which it has been confused, the new species is readily distinguished by its cleft, inconspicuously glanduliferous calyx, and its more elongate capsule which equals or surpasses the calyx in length. From *G. incisum* Benth., another relative, it differs in its pinnate leaves and very large corollas.

Gilia aggregata Spreng., var. **texana** (Greene), comb. nov.

Callisteris texana Greene, Leaflets **1:** 160. 1905.

This is the variant of *G. aggregata* found in rocky arroyos in the oak-belt of the Sierra Madre of Tamaulipas and Nuevo Leon, in the desert ranges of Coahuila, and north into trans-Pecos Texas.

Gilia calothyrsa, sp. nov.

Herba biennis 3–5 dm. alta basim versus ramosa; ramis pluribus erectis strictis pilis minutis crispis albis mollibus vestitis; foliis pinnatifidis; foliis caulinis inferioribus 2–3 cm. longis 1.5–2 cm. latis, rhachi lineari utrinque segmenta 3 vel 4 anguste linearia 0.5–0.7 mm. lata gerente; foliis superioribus gradatim reductis supremis simplicibus linearibus; floribus in glomerulis 3–10-floris sessilibus vel ad 6 mm. longe pedunculatis gestis, in thyrsum elongatum 10–18 cm. longum subsecundum dispositis; calyce sparse inconspicueque glandulifero 5–7 mm. longo, lobis 2–3 mm. longis subulatis spinescentibus herbaceis quam tubo membranaceo brevioribus; corolla violaceo-purpurea saepe 1.5 (raro ad 2) cm. longa salviformi, tubo 2–3 mm. crasso plus minusve curvato, limbo 10–13 mm. diametro, lobis patentibus ovatis 3–5 mm. latis quam tubo duplo longioribus apice rotundis apiculatis; staminibus 5 ad tubum corollae valde inaequaliter affixis haud vel vix exsertis; stylo vix exserto basim versus pilis brevibus sparsis ornato; capsula et seminibus ignotis.

COAHUILA: Sierra de las Cruces, rocky slope about the summit of the highest peaks, flower light purple, *Stewart 1044* (TYPE, Gray Herb.). CHIHUAHUA: Just east of Organos, local on rocky flat, flowers violet, *Stewart & Johnston 2054;* Sierra de los Organos, *LeSueur 1391.*

A species related to *G. Macombii* Torr., *G. Thurberi* Torr., and *G. Pringlei* Gray, and occurring in an area to the east of that occupied by these species. It is probably closest to *G. Pringlei,* from which it differs in its coarser more branched stems, smaller leaves, and short salverform (rather than trumpet-shaped) corollas with flat rounded apiculate (rather than curved lance-ovate attenuate) lobes. It is a beautiful and attractive plant and merits cultivation.

Nama Marshii (Standley), comb. nov.

Nama biflorum var. *Marshii* Standley, Field. Mus. Pub. Bot. **22:** 167. 1940.

This species is most closely related to *N. propinquum* Mort. & Hitchc., having similar long-petiolate leaves and more or less cordate blades. The leaves, however, are thinner, green, and somewhat shaggy villous or glabrescent. The pedicels are more elongate and the stems are more slender and flaccid.

Nama serpylloides Gray, var. **confertum,** var. nov.

A varietate typica differt floribus confertis; pedicellis crassioribus 1–2 mm. longis maturitate vix elongatis; foliis cum pilis gracilioribus longioribus abundantibus velutinis; caulibus rigidioribus.

COAHUILA: 2 miles west of Cuatro Cienegas, spreading over a low bank of alkaline gypseous soil, leaves fleshy, 1938, *Johnston 7126* (TYPE, Gray Herb.); a mile west of El Anteojo (west of Cuatro Cienegas), confined to markedly saline gypseous soil, usually on low banks along contact of gypsum and saline clays, leaves grayish, succulent, corolla pale pink, 1941, *Johnston 8868;* Cuatro Cienegas, 1939, *Marsh 2016.*

A form evidently related to *N. serpylloides* var. *velutinum* Hitchc. (to which it was referred by the author of that variety), but differing in its coarser more loosely branched and more rigid branches, its denser yellowish (rather than grayish) velutinous indument, and especially in its permanently short-pedicellate congested flowers. In typical *N. serpylloides* and in the var. *velutinum,* the pedicels are slender, eventually spreading, and become 1–2 cm. long. The leaf-blade of the var. *confertum* is more succulent than in the var. *velutinum,* and perhaps even more revolute and becoming more pronouncedly boat-shaped.

Phacelia infundibuliformis Torr., var. **phanerandra,** var. nov.

A varietate typica differt filamentis lobos corollae evidenter sed breviter superantibus antheras aurantiacas conspicuas proferentibus.

COAHUILA: Sierra de las Cruces near Tinaja Blanca, frequent on arroyo-banks, March 12, 1942, *Stewart 2241* (TYPE, Gray Herb.). TEXAS: 14 mi. east of Castolon, Brewster Co., frequent along creek, *Cutler 749.*

This variety occurs far to the east of the known stations for typical *G. infundibuliformis* and appears to be a geographic race distinguished by its protruding stamens. In other characters it agrees closely with the typical form of the species.

Phacelia robusta (Macbride), comb. nov.

Phacelia integrifolia var. *robusta* Macbr. Contr. Gray Herb. **49**: 25. 1917.

A coarse glandular herb on rocky places, along arroyos, and about cliffs. It has been associated with *P. integrifolia* Torr., from which it differs in being non-gypsophilous and in having larger salverform (rather than subtubular) corollas and larger non-corrugated seeds. From trans-Pecos Texas (Chisos and Chinati mountains) it extends far south in Coahuila and Chihuahua. Under the name "*P. integrifolia* var. *arenicola*," Brand, Pflanzenfam. **59** (IV. 251): 81, *f. 17* (1913), has given a mediocre illustration of *P. robusta,* probably based on material collected near Chihuahua City by Pringle or by Palmer.

Phacelia pallida, sp. nov.

Herba e radice crassa lignosa oriens 1.5–3 dm. alta grisea pallida sparsissime glandulifera; caulibus numerosis erectis vel decumbentibus saepe simplicibus pilis minutis abundantibus retrorsis et setis gracilibus longioribus numerosis vestitis; foliis numerosis pallidis carnosulis; lamina oblonga 3–9 cm. longa 17–40 mm. lata, irregulariter crasseque sinuato-crenata saepe irregulariter lobulata hispidulo-villulosa, inferioribus 3–4 cm. longe petiolatis, superioribus duplo minoribus ca. 1 cm. longe petiolatis; cymis terminalibus pluribus densifloribus; calyce ca. 4 mm. longo, lobis oblongis ciliatis dorso glanduliferis cum setis vestitis ca. 1 mm. longe pedicellatis, fructiferis ad 6 mm. longis, lobis spathulatis capsulam evidenter superantibus; capsula ovoidea ca. 4 mm. longa hispidula; seminibus 4 nigris ca. 3 mm. longis corrugatis; corolla ca. 6 mm. longa, tubo basi 1.5 mm. apice 3–4 mm. crasso, 4 mm. longo, lobis ad 2 mm. longis ascendentibus; staminibus longe exsertis.

COAHUILA: Gypsum beds on the escarpment of Cañada Oscuro near Tanque La Luz, fleshy grayish non-glandular herb confined to gypsum, corolla lavender-white, *Johnston 8486* (TYPE, Gray Herb.).

A relative of *P. integrifolia* Torr., characterized by its practically glandless herbage, branching habit, large gray pallid frequently lobed petiolate leaves, and few terminal cymes. Many of the lower leaves have a pair of small lobes borne on the petiole just below, and separated from, the blade proper.

Phacelia petiolata, sp. nov.

Herba glandulifera 1–3 dm. alta e radice lignosa annua erumpens; caulibus pluribus erectis vel decumbentibus sparse ramosis foliosis pilis minutis vix rigidis abundantibus glanduliferis et pilis longioribus divergentibus sparsioribus vestitis; foliis numerosis evidenter petiolatis; lamina glandulis minutis sessilibus utrinque obsita pilis erectis vel ascendentibus gracilibus vestita, in ambitu late ovata vel elliptica, medium versus latiore, basi late acuta, obtusa vel reniformi, margine irregulariter crenata et non raro paulo lobulata; circinnis saepe terminalibus solitaribus vel geminatis densifloris; calyce pilis brevibus rigidulis ascendentibus vestito glandulifero, ad anthesin ca. 3 mm. longo ca. 0.8 mm. longe pedicellato, fructiferi ca. 5 mm. longo quam capsula conspicue longiore, lobis spathulatis ad apicem 1.3–1.7 mm. latis; corolla 6–8 mm. longa, tubo 4–5 mm. longo cylindrico apice 3.5–4 mm. diametro basi 1.5 mm. crasso, lobis 2 mm. diametro ascendentibus; staminibus longe exsertis; seminibus nigris 2–3 mm. longis margine carinaque corrugatis; capsula ovata ca. 3 mm. longa hispidula.

COAHUILA: San Lorenzo de la Laguna, 1880, *Palmer 851;* 12 mi. south of Ojinaga, abundant on bank of saline clays, corolla pale lilac, *Johnston 8040* (TYPE, Gray Herb.); 11.5 mi. south of Ojinaga, a few plants about a limestone ledge in deep arroyo, *Johnston 8036*.

A relative of *Phacelia integrifolia,* readily recognized by its broadly elliptic distinctly petiolate leaves, much branched low growth-habit, thickened woody root, sparse cymes, and black corrugated seeds. The lilac corolla has a moderately ampliated tube and throat.

Phacelia teucriifolia, sp. nov.

Annua herbacea erecta; caulibus solitariis vel pluribus saepe simplicibus 10–25 cm. longis rectis rigidulis pallidulis, cum pilis minutis gracilibus adpressis inconspicuis sparse vestitis; foliis basalibus ignotis; foliis caulinis 4–7-pinnatifidis vel pinnato-lobatis adpresse minuteque villosulo-hispidulis, inferioribus petiolatis 4–6 cm. longis in ambitu oblanceolatis, mediis et superioribus sessilibus gradatim reductis in ambitu oblongis vel ovatis, summum ad 4 cm. longis, lobos 3–5-jugos ovatos vel saepe lanceolatos gerentibus; cymis racemiformibus maturitate laxifloris; pedicellis 8–12 mm. longis ascendentibus rectis vel curvatis; calyce sub anthesi 5–6 mm. longo ca. 1.5 mm. lato, lobis oblongo-lanceolatis adpresse-hispidulis margine ciliolatis, fructiferis herbaceis accrescentibus 7–12(–15) mm. longis erectis vel ascendentibus quam capsula subduplo vel plus duplo longioribus; corolla rotato-campanulata 7–10 mm. longa 12–14 mm. diametro, lobis latis rotundis integris ascendentibus; staminibus sparse ciliatis 6–9 mm. longis; ovario dense piloso; stylo usque ad medium partito ciliolato; capsula subglobosa 4–6 mm. longa sparse adpresse hispidula; seminibus 10–20 irregulariter prismaticis 1.5–2.5 mm. longis nigris papillatis irregulariter foveolatis.

COAHUILA: Muzquiz, 1935, *Marsh 138a;* Muzquiz, April 12, 1936, *Marsh 2120* (TYPE, Gray Herb.) and *2135*. TEXAS: 4.7 mi. west of Menard, 1929, *Cory 640;* Tarrant County, 1923, *Ruth 459*.

Related to *P. strictiflora* Gray, and ranging to the west and south of that species. It differs from its relative in its erect or strictly ascending stems, less conspicuous less dense paler non-viscidulous indument of more appressed paler hairs, and its loosely ascending rather than strict fruiting pedicels. The plant dries a light green. The color, texture, and shape of its stem-leaves are suggestive of those found in forms of *Teucrium cubense* L.

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SCHIZOMUSSAENDA, A NEW GENUS OF THE RUBIACEAE

HUI-LIN LI

IN connection with a study of the accumulated unnamed collections of Chinese material in the herbarium of the Arnold Arboretum, my attention was called to a series of specimens which had been variously named. Some of them had been correctly determined as *Mussaenda dehiscens* Craib of the Rubiaceae, but others, although manifestly representing the same species, had been referred to *Emmenopterys Rehderi* Metcalf of the Rubiaceae and *Schizophragma macrosepalum* Hu of the Saxifragaceae. In view of the anomalous position of this dehiscent-fruited rubiaceous species in *Mussaenda,* a genus characterized by the indehiscent more or less fleshy berry-like fruits, a critical examination was made of all available material. As a result of this study, I have concluded that a distinct genus is represented, which is here described. At the same time the synonymy of the species is adjusted. All specimens cited are deposited in the herbarium of the Arnold Arboretum. This study was made possible by a grant from the Milton Fund of Harvard University to Dr. E. D. Merrill of the Arnold Arboretum.

Schizomussaenda gen. nov.

Inflorescentia terminalis cymosa trichotomo-racemosa, ob florum quorundam calycis lobum unicum in laminam amplam dilatatum conspicue 4–6-bracteata, ramulis ultimis erectis spiciformibus subscorpioideis vel scorpioideis, bracteis bracteolisque lineari-lanceolatis pilosulis persistentibus vel deciduis. Flores sessiles vel subsessiles, calycis tubo elongato-turbinato puberulo, margine 5-lobato, lobo interdum unico in laminam amplam petiolatam producto, lamina elliptica vel ovata, alba, apice acuta, basi cuneata rotundata vel subcordata, 5-nervia, in nervis tantum obscure puberula, laminae petiolo supra canaliculato, subtus sulcato, calycis lobis normalibus lanceolato-oblongis acutis erectis; corolla hypocrateriformi, extus dense adpresse pilosa, intus dense sulphureo-villosa, tubo longo, inferne tubuloso, superne subito ampliato, lobis 5 aestivatione valvatis deltoideo-ovatis, rubro-luteis, margine involutis; staminibus 5, tubo insertis, filamentis brevibus, antheris elongatis inclusis; ovario 2-loculari, disco annulari, stylo filiformi, stigmatibus 2 linearibus, ovulis numerosis, placenta peltata carnosa. Capsula nigro-brunnea, turbinata vel oblongo-obovata, apice loculicide dehiscens; seminibus numerosis, minutis, testa fragili brunnea foveolata.

Frutex, ramis quadrangularibus pallide brunneo-cinereis parce lenticellatis, ramulis dense subadpresse pilosis; foliis tenuiter chartaceis elliptico-oblongis vel oblanceolatis, apice acuminatis, basi cuneatis vel subcordatis, supra viridibus, subtus pallidioribus, costa nervisque supra leviter elevatis pilosis, subtus prominentibus laxe pilosis, nervis lateralibus utrinsecus 8–10 adscendentibus prope margine arcuatis et conjunctis, anastomosantibus, rete venularum utrinque subconspicuo; petiolis canaliculatis adpresse pilosis; stipulis caudato-lanceolatis integris adpresse pilosis, persistentibus vel deciduis.

One species in northern Burma, northern Siam, Tonkin, and southwestern and southern China (Yunnan, Kwangsi, and Kwangtung).

Schizomussaenda dehiscens (Craib) comb. nov.

Mussaenda dehiscens Craib in Kew Bull. **1916:** 263. 1916; Pitard in Lecomte, Fl. Gén. Indo-Chine **3:** 174, *fig. 12, 2–3.* 1923; Chun in Sunyatsenia **1:** 306, *fig. 5.* 1934.

Mussaenda Roxburghii sensu Drake del Castillo in Jour. de Bot. **9:** 216. 1895; non Hook. f. (1880).

Mussaenda glabra sensu Pierre ex Pitard in Lecomte, Fl. Gén. Indo-Chine **3:** 174. 1923, in syn. sub *Mussaenda dehiscente;* non Vahl (1794).

Greenea hoaensis Pierre ex Pitard in Lecomte, Fl. Gén. Indo-Chine **3:** 174. 1923, nomen, in syn. sub *Mussaenda dehiscente* (as *Greenia hoaensis*).

Schizophragma macrosepalum Hu in Jour. Arnold Arb. **11:** 48. 1930; Hu & Chun, Ic. Pl. Sin. **4:** 13, *t. 163.* 1935.

Emmenopterys Rehderi Metcalf in Lingnan Sci. Jour. **11:** 528. 1932.

BURMA: Keng Tung Territory, Meh Lui watershed, *J. F. Rock 2303* (syntype of *Emmenopterys Rehderi* Metcalf), Feb. 10, 1922. SIAM: Chiengmai Prov., between Meh Soi and Hue San, *J. F. Rock 1854* (syntype of *Emmenopterys Rehderi* Metcalf), Jan. 5, 1922. INDO-CHINA: Tonkin, Ha-coi, Chuk-phai, Taai Wong Mo Shan, *W. T. Tsang 26900,* Oct. 16–22, 1936, *29128,* May 21–31, 1939, *29248,* June 10–22, 1939; Tonkin, Tien-yen, Kau Nga Shan, *W. T. Tsang 27253,* Jan. 1–9, 1937, *30521,* Sept. 23 – Oct. 7, 1940; Tonkin, Dam-ha, Sai Wong Mo Shan, Lung Wan Village, *W. T. Tsang 29897, 30004,* May 19 – July 5, 1940, *30214,* July 18 – Sept. 9, 1940; Sontoy, *A. Pételot 6660,* Dec. 2, 1940. CHINA: Yunnan: Menglieh, *A. Henry 12825* (isoparatype of *Mussaenda dehiscens* Craib); Pieng-pien Hsien, *H. T. Tsai 61574,* Aug. 22, 1934; Fo-hai, *C. W. Wang 74949,* July 1936; Che-li Hsien, Sheau-meng-yeang, *C. W. Wang 75983,* Sept. 1936; Che-li Hsien, You-louh-shan, *C. W. Wang 78096,* Sept. 1936; Jenn-yeh Hsien, Meng-la, *C. W. Wang 80681,* Nov. 1936; Kwangsi: Shih Wan Tai Shan, south of Nanning, *R. C. Ching 7871* (merotype of *Schizophragma macrosepalum* Hu), Oct. 15, 1928; Shang-sze District, Shih Wan Tai Shan, near Hoh Lung Village, *W. T. Tsang 22627,* July 3, 1933; Shih Wan Tai Shan, Nam She Village, *W. T. Tsang 24509, 24576,* Oct. 22–31, 1934; Chen-pien District, *S. P. Ko 56004,* Nov. 4, 1935; Kwangtung: Ma Hou Ho, Shih Wan Tai Shan, *H. Y. Liang 69546,* July 11, 1937.

Craig described *Mussaenda dehiscens* in 1916, basing it on *Kerr 2522* from Siam and also *Henry 12825* from Yunnan and *Balansa 2683* and *2684* and *Wilson 13642* from Tonkin. Among these cited specimens, the Henry number is the only one actually available to me for study. This particular sheet was also studied by Hutchinson and was then determined by him simply as *Mussaenda sp.* in connection with his investigation of the Chinese species of that genus, published in Sarg. Pl. Wils. **3:** 395–400. 1916. In the same year Craib published his *Mussaenda dehiscens.* Craib's name was accepted for the Indo-Chinese plants in 1923 by Pitard, who also published Pierre's manuscript name *Greenea hoaensis* in synonymy. Chun redescribed the species on the basis of Kwangtung material in 1934, but cited no specimens. Not having seen Craib's type, and noticing certain differences between the Kwangtung plant and several particulars of Craib's and Pitard's descriptions, he was somewhat doubtful as to the disposition of his material. With ample material from the different localities now available for study, I can only conclude that all the specimens above cited represent a single species.

After a critical examination of the material and an examination of all species of *Mussaenda* in the herbarium of the Arnold Arboretum, it is felt that a separate genus should be established for this species. The relationship of this proposed new genus, *Schizomussaenda,* to *Mussaenda* is close, but the inclusion of the plant in the latter, in view of the manifest differences, is scarcely warranted. In vegetative as well as in floral characters, it resembles certain species of *Mussaenda.* The large petaloid calyx-lobe is a character common to both genera and increases their superficial resemblance. However, this new genus differs manifestly from *Mussaenda* in the elongated scorpioid branches of the inflorescence and in its loculicidally 2-valved capsular fruits. The inflorescences of *Mussaenda* are strictly cymose, and the fruits are fleshy berries, indehiscent and areolate at the top. The calyx-teeth are frequently persistent in *Schizomussaenda,* while they are usually deciduous in *Mussaenda.*

Hu placed the plant under discussion in the Saxifragaceae when he described it as *Schizophragma macrosepalum* in 1930; it was well illustrated by him in 1935. His descriptions are brief, but from the excellent illustration and from an examination of fragments of the type in the herbarium of the Arnold Arboretum, it is possible to determine the status of his species; it is in all respects the same as *Schizomussaenda dehiscens* (Craib) Li. Type material of *Emmenopterys Rehderi* Metcalf is in the herbarium of the Arnold Arboretum. All specimens so named by Metcalf represent *Schizomussaenda dehiscens* (Craib) Li. *Emmenopterys* Oliver is manifestly different from either this new genus or *Mussaenda,* notably in its paniculate cymes, large broad infundibular corolla with imbricate lobes, rounded ciliate calyx-lobes, large capsular fruits, and winged seeds. The genus *Emmenopterys* therefore remains a monotypic one. The distribution of the single species, *E. Henryi* Oliver, represented in this herbarium by numerous specimens from Chekiang, Anhwei, Kiangsi, Hunan, Hupeh, Szechuan, Yunnan, Kweichow, and Fukien, is limited to eastern, central, and southwestern China.

In the scorpioid-cymose inflorescences *Schizomussaenda* suggests *Greenea* Wight & Arn., in which genus Pierre placed it. *Greenea* has longer and more distinctly scorpioid inflorescence-branches, while its floral and fruit structures are very different. The fruits of both are two-valved, but in *Greenea* they are small, globose, completely and septicidally separating into two valves, with each valve again splitting at its tip, while in *Schizomussaenda* the fruits are larger, oblong, and loculicidally dehiscent for only about one-third their length. In *Greenea* the flowers are white, the calyx-tube globose, and the corolla-tube glabrous within, with the lobes twisted in the bud; in *Schizomussaenda* the flowers are yellow, the calyx-tube elongate, and the corolla-tube villose inside and with valvate lobes. In *Greenea* one of the calyx-lobes is slightly longer than the others, but none of them is accrescent, and the large petaloid sepal, so characteristic of *Mussaenda, Emmenopterys,* and *Schizomussaenda,* is entirely lacking.

Summarizing the above discussion, this new genus is related on the one hand in its vegetative and floral characters to *Mussaenda,* differing in the inflorescences and fruits; in its general facies, except in the scorpioid arrangement of its flowers, it is strongly suggestive of *Mussaenda,* in the latter character suggesting *Greenea* of the Rondeletieae. *Schizomussaenda* is evidently much closer to *Mussaenda* than to *Greenea,* but in its dehiscent capsular fruits it transcends the characters of the Mussaendeae; however, it seems best to retain it in the Mussaendeae in spite of its dehiscent fruits. In its combined characters it seems to be remote from the Rondeletieae.

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SALIX FLORIDANA CHAPMAN, A VALID SPECIES

CARLETON R. BALL

With one plate

THE purpose of this paper is to bring together the synonymy of *Salix floridana* Chapman and to discuss the various treatments of this species. An amplified description, based on all available collections, is given.

Salix floridana Chapman, Flora Southern U. S. 430. 1860.
Salix Chapmanii Small, Man. Southeastern Flora 414. 1933.
Salix astatulana Murrill & Palmer in Jour. Arnold Arb. **22:** 580. 1941.

In 1860 Dr. A. W. Chapman of Alabama described "*Salix Floridana*, n. sp." (l. c., above), and he repeated the description without change on page 430 of Edition 2 (1883) and page 453 of Edition 3 (1897), as follows:

"**S. Floridana** n. sp. Leaves ovate-lanceolate, acute, smooth above, glaucous beneath, finely serrate, rounded at the base, the petioles pubescent; stipules small, caducous; fruiting ament oblong, dense; capsule ovate-lanceolate, smooth. — Rocky banks, West Florida, fruiting in April. — Shrub 8°–12° high. Leaves thin, 2′ 3′ long. Fruiting aments 2′–3′ long, 1′ in diameter, enveloped in the copious wool of the seeds. Flowers not seen."

The leaf description ("ovate-lanceolate, acute, . . . rounded at the base . . ."), taken with that of the glabrous capsules, indicates a willow unlike any other species known in the southern states. Apparently the species was not collected again in the 41 years from 1860 to 1900, inclusive.

With the twentieth century, there began a second and more confused 41-year period for *S. floridana*. In 1903, Small described it (Flora SE. U. S. 342; also ed. 2, 1913) much as Chapman had and credited it, for some reason, to middle as well as western Florida. Chapman, lacking staminate specimens, made no attempt to indicate relationships. Small keyed it as having two stamens and placed it next to *S. cordata*.

In 1902, Dr. Roland M. Harper collected his no. *1381* in Pulaski Co., Ga., and, in 1938, his no. *3634* in a "semi-calcareous swamp of small creek about ½ mile east of Cedar Springs, Early Co., Ga., April 11, 1938." Both numbers represent full-grown foliage and were distributed (usually 2 sheets of *1381*) as *S. floridana*. The writer has seen these collections in each of five herbaria (Field Museum, Gray, Mo. Bot. Gard., N. Y. Bot. Gard., and U. S. Nat.). One sheet of *1381* carries vigorous shoots with enormous leaves, reaching a maximum size of 6 × 18 cm. Early in 1904, Dr. Harper published notes (Bull. Torrey Bot. Club **31:** 21–22. 1904) on his no. *1381*, but he does not mention the larger leaves, lacking on Chapman's fruiting specimen.

"Salix Floridana Chapm. I refer tentatively to this almost unknown species specimens collected in wet woods at the outer (eastern) base of the sand-hills of the Ocmulgee in Pulaski County below Hawkinsville, June 27 (*no. 1381*). My specimens were slender erect trees about ten feet tall and two inches in diameter, with tasteless bark roughish below and smooth above. The twigs were very brittle not only at the bases but throughout. No trace of fruit was found, but my material, as far as it goes, seems to be a perfect match for the type-specimen in the Torrey Herbarium, collected by Dr. Chapman in West Florida."

In 1913, Small published two more small volumes, *Shrubs of Florida* and *Florida Trees*. *Salix floridana* Chapman was described briefly in both (pages 9 and 13, respectively), and in the second Small adds: ". . . found in southern Georgia." He probably refers to Harper's collection in Pulaski County, which is just south of the center of the state.

Schneider, in January, 1918 (Bot. Gaz. **65:** 21) lists *S. floridana* as a synonym of *S. longipes* Shuttleworth. In 1919, he says (Jour. Arnold Arb. **1:** 25) that *S. longipes* "has been again described by Chapman (1860) as *S. floridana* and by Small (1913) as *S. amphibia*." He gives no reason for his conclusions and his annotation on the Torrey Herbarium isotype is dated 1919, after the above-cited papers were printed. Neither the Gray Herbarium isotype nor the Arnold Arboretum sheet of *Harper 1381* are annotated at all by Schneider.

In 1933, Small (Man. SE. Flora 414) described *S. Chapmanii* in essentially the same words previously used in describing *S. floridana*, and on p. 1504 he says: "Type, Middle Fla., Chapman, in herb. C(olumbia) U(niversity)." This specimen is the type of *S. floridana*. In this Manual, Small lists *S. floridana* as a synonym of *S. longipes*. He nowhere explains how the type of a synonymous species can be made the type of a later new species. Small placed his species in the *Cordatae*, with two stamens.

In 1941, Murrill and Palmer described and figured *Salix astatulana* sp. nov.,[1] discovered by Dr. Murrill in Lake and Levy Counties of Central Florida. The authors state that their species "appears to be most nearly related to *Salix longipes*" but is "a very different plant in its foliage," which is true also of *S. floridana* Chapman. The description of leaves, aments, and fruits closely parallels the description of *S. floridana* Chapman.

The writer borrowed the pistillate and staminate types from the Arnold Arboretum, and portions of the isotypes were generously contributed by Dr. Murrill, of the University of Florida. The types consist of several twig fragments plus detached mature leaves obviously from other plants or branches. The flowering specimens represent the juvenile stages of *S. floridana*, as the Chapman type and the Harper collections represent maturity.

The following amplified description is drawn up from all available authentic material, including two isotypes of *S. floridana* (and therefore of *S. Chapmanii*) from the New York Botanical Garden and the Gray Herbarium, *Harper 1381* and *3634* from the five herbaria named above, and the types of *S. astatulana* from the Arnold Arboretum and fragments

[1]Murrill, William A., and Ernest J. Palmer. A New Willow from Florida. Jour. Arnold Arb. **22:** 580–581. *1 fig.* Oct., 1941.

of the isotypes from the University of Florida. The type specimen of *S. floridana* cannot be located at the Missouri Botanical Garden.

Shrub or small tree, 2–4 m. tall; branchlets brittle (Harper), the older yellowish brown or grayish brown and sparsely pubescent or glabrous, the younger dark brown to blackish (as dried) and more or less pubescent; bud-scales 2–5 mm. long, colored and clothed as the branchlets; stipules, on vigorous shoots, 5–10 mm. long, semilunate, glandular-serrulate. Leaves lanceolate, broadly lanceolate, or ovate-lanceolate, mostly 5–12 cm. long and 2–4 cm. wide, on puberulent or pubescent petioles 0.7–1.5 cm. long (not 4 cm. as indicated in text-figure of *S. astatulana*); the lowest leaves on a given branchlet ovate, obtuse, 1.5–3 cm. long; the next higher or median leaves oval or elliptic-oval or somewhat obovate, obtuse to acute, 5–7 cm. long by 2.5–3 cm. wide; the remainder or normal leaves lanceolate to broadly lanceolate, acuminate, and 5–12 cm. long by 2.5–4 cm. wide or, on vigorous shoots (*Harper 1381*), broadly lanceolate and acuminate, 12–16 cm. long and 4–5 cm. wide, or the largest broadly elliptic and acute, 17–18 cm. long and 6 cm. wide, on puberulent petioles up to 2.5 or 3 cm. long; all leaves rounded to truncate to somewhat cordate at base, glandular-crenate-serrulate on the margins (serrulations averaging 3.5 to 7 per cm. on smaller and 2.5–4 per cm. on larger leaves), sometimes with small lobes near the base of the blade (as in *S. pseudomonticola* Ball) or with solitary glands or isolated pieces of glandular foliaceous tissue (remnants of once basal lobes) 0.5–1.5 mm. long, on the sides of the petiole 3–7 mm. below the blade and in its plane; usually densely pubescent while unfolding, becoming progressively glabrescent to glabrate with age; the yellowish midribs prominent beneath and usually remaining finely pubescent above, especially toward the base; glaucous beneath, becoming dark green above in age, the greenish yellow secondaries and tertiaries forming a coarse raised network on both surfaces as in *S. discolor* but never forming the fine flat mosaic of vein-islets so characteristic of *S. longipes, S. amygdaloides, S. nigra,* and related species.

Aments coetaneous, leafy-pedunculate, 3.5–6 cm. long, 1.5 cm. wide in flower, the pistillate 2–2.5 cm. wide in fruit; peduncles 0.5–1 cm. long, pubescent, bearing 1–3 small leaves 1–3 cm. long; flower-scales oblong-obovate, about 2 mm. long, yellowish to yellowish brown, rounded or sometimes truncate at apex, glabrate outside except on margin and base, densely villose inside; stamens 3 or 4 to 6 (sometimes only 2), filaments 5–7 mm. long, sparsely pilose at base; capsules ovate-lanceolate, 5–8 mm. long, glabrous, brown at maturity, the style 0.1–0.2 mm. long, bifid, the stigmas very short, the pedicel 2–4 mm. long, sparsely pilose, becoming glabrate; gland 1, ventral, 0.6–1 mm. long, stout, cylindric.

Salix floridana has lanceolate to ovate-lanceolate or broadly elliptic leaves with coarse venation, while the leaves of *S. longipes* are linear-lanceolate to narrowly lanceolate and with a very fine mosaic of vein-islets. The capsules of *S. floridana* are larger, the stamens fewer, and the flower-scales more glabrate. It is not certain that *S. floridana* is most nearly akin to *S. longipes* and other members of the Section *Bonplandianae*. It probably belongs to the Section *Triandrae*, represented by *S. triandra* L. of Eurasia and other species.

In any case, *S. floridana* is a species apparently on the verge of extinction. The type locality (per Gray Herbarium isotype) is Marianna, Jackson Co., northern Florida. It has been found once in each of two counties in southern Georgia, and in two counties of central Florida. Dr. Harper says the Pulaski County location probably has been destroyed. The species is relatively rare, if existent, at the other localities mentioned.

EXPLANATION OF PLATE

Salix floridana Chapman; isotype in Gray Herbarium.

U. S. DEPARTMENT OF AGRICULTURE,
WASHINGTON, D. C.

SALIX FLORIDANA Chapman

KARELIN (1801 – 1872) AND KIRILOV (1821 – 1842) EXPLORERS OF SIBERIA AND MIDDLE ASIA

Vladimir C. Asmous

On September 11, 1842,* there died in a small town, Arzamas, in central Russia, after a short illness, a student of St. Petersburg University—Ivan Petrovich Kirilov. He was on his way by stage from Siberia to Moscow, and in the absence of any relatives the police buried his remains; his death was unnoticed, and it seemed that he was forgotten by everybody.

One hundred years have passed, but the name of this youth still lives in the annals of the history of science. It is true that his name is usually connected with that of his senior partner, the more widely known explorer and botanist, Grigorij Silych Karelin. Their joint contributions to science are great and their famous expedition of 1840–45 into the Altai, Dzungaria, and Semirechensk regions is justly considered one of the most fruitful and important of the nineteenth century. Without exaggeration it may be said that they discovered and explored an enormous region for science.

These two members of one of the most perfect teams of botanists were very different men by reason of their age, social position, and temperament, and they met by mere chance. Karelin came to St. Petersburg in 1837 and there met a modest, lonesome, and apparently very poor student. Talking with him, he was struck by his intelligence, seriousness, and deep knowledge of botany. He recognized in this boy a future scientist of great promise, and, being a man of generous heart and quick impulse, he immediately took him under his protection.

"Don't be surprised, my dear," he wrote to his wife, "I am bringing with me a young man, whom I want you to take into our family as our son. He is I. P. Kirilov, an orphan, a poor devil, a great lover of botany, and a student at St. Petersburg University. He is like a fair girl in character but is unusually clever . . . " From that time "Vanichka" was a member of the hospitable family of the Karelins and followed his "daddy," as he affectionately called Karelin, in all his travels. A boundless enthusiasm for the study of nature united these men.

Very little is known about the short life of Kirilov. He was born in 1821 (or 1822) in Yalturovsk in Siberia, where his father was a chief of police; he studied in Tobolsk and later in Irkutsk, where he met the well known botanist N. S. Turczaninow, who instructed him in botany from 1835 to 1837. He collected with Turczaninow on the southern shores of Lake Baikal in 1835, and the next year he made another expedition into the western Baikal Mountains. In the preface to his *Flora Baikalensi-Daurica*, Turczaninow says (p. 20): "Mr. Kirilow a rempli cette mission avec un zèle

*All dates in this paper are according to the Julian calendar (old style), which was in general use in Russia before the revolution of 1917.

et un succès remarquables, ayant trouvé plusieurs espèces échappés a son prédécesseur." In 1837 Turczaninow brought Kirilov to St. Petersburg and helped him to enter the University.

Karelin esteemed his young assistant very highly. "Best regards to you," he wrote to A. V. Richter, "from I. P. Kirilov, the most industrious, most energetic, and the smartest of all students that I have ever met in this world." In the expedition of 1840–45, Kirilov was in charge of botanical collections; he made almost all the identifications, and the well known *Enumeratio plantarum* was written by him under the supervision of Karelin and Turczaninow. There is no doubt that in the untimely death of Kirilov science lost a botanist of unusual promise.

The life of Grigorij Silych Karelin is more colorful than that of his young assistant. He was born in January, 1801, in Petersburg Province, a son of the conductor of the concert band, but he lost his parents when he was eight years old. He was placed by his elder brother in the First Cadet Corps, from which he was graduated with distinction in 1817 as a second lieutenant of artillery. He was assigned to the Office of Military Settlements, but his chance of making a brilliant military career was ruined when he wrote some derisive verses, supplemented by a cartoon, about the secretary of war, Count Arakcheev, a very powerful man in the last years of the reign of Alexander I. This became known to the "dreadful count," and Karelin was sent on February 20, 1822, into virtual exile to the small town of Orenburg on the southeastern border of Russia.

This exile seemed to be a disaster, but actually it gave Karelin a chance to become a scientist and explorer. Deprived of the comfort and gay life of the capital, he turned to the study of natural history, to which he always had a strong inclination. He was fortunate in finding an excellent teacher in the person of E. F. Eversmann, a future professor of natural history at Kazan University. Due to his extraordinary abilities, Karelin became in a comparatively short time an expert in botany, zoology, and mineralogy, and soon he started field work in natural history. He corresponded with many outstanding Russian botanists, such as Ledebour, Fischer, Meyer, Bunge, and Turczaninow, and sent them specimens from the Caspian region. His collections of Caspian plants are preserved in the herbarium of the St. Petersburg Botanical Garden.

Besides his natural history studies, Karelin was engaged in a number of other activities which prove his unusual versatility. Fortunately two consecutive governors of the Orenburg region, Count Sukhtelen and Count V. Perovsky, both capable administrators, recognized the outstanding abilities of Karelin and utilized them fully in the development of that half-civilized part of Russia.

Karelin made surveys and descriptions of various Caspian regions, explored mineralogical resources, and made a study of steel and munition plants in the lower Ural region. In 1826 he was permitted to resign from the military service. After that, he made a journey with Professor Eversmann into the Kirghiz steppes (the so-called Bukeev Orda) and made a good map of that region. In 1829 he accompanied the expedition of the

Norwegian Professor Christopher Hansteen and Lieutenant Due for astronomical and geodetical observations in the lower Volga and the Ural regions and travelled in Bashkiria and Orenburg and Perm Provinces. In 1831 he explored the basin of the Tobol River. He also successfully managed intricate diplomatic relations with semi-independent khans of the Kirghiz steppes. It may be noted here that Karelin was very popular with nomadic tribes of the Caspian region. He possessed all the qualities which appeal to the imagination of oriental peoples: he was a good looking, powerfully built, energetic man, a skillful hunter and horseman, and, although he was generous and mild in dealing with other people and had a very gay and pleasant disposition, he was always ready to defend himself vigorously against any aggression. He inspired not only love but also respect and fear.

In 1831 Karelin was employed by the Asiatic section of the State Department and soon started a series of his explorations of the Caspian Sea regions, which separated him from his family for months at a time, for he had been married some years and was the father of two daughters at that time.

In 1832 he was at the head of an expedition including four ships and a detachment of one hundred and seventy Ural Cossacks. He explored the eastern shores of the Caspian Sea, made a number of good maps, and prepared descriptions of the adjoining regions.

Karelin in 1834 commanded another expedition in the same region, with a special mission to build a fortress on the eastern shore of the Caspian Sea in order to protect Russian settlements from the raids of nomadic tribes of the Kirghiz steppes and Chiwa. After careful investigations he selected Kara-su Bay for that purpose and on May 2, 1834, founded a fortress named by him Novo-Aleksandrovsk, which was completed, supplied, and garrisoned in less than three months. This enterprise was not only a complete military success, but it did not disturb the relations between Russia and Chiwa, because diplomatic parleys conducted by the emissaries of Karelin with the Khan of Chiwa prevented the bloodshed which was feared.

In 1836 Karelin was charged with the exploration of the eastern and southern shores and the islands of the Caspian Sea. He corrected the maps of these regions, travelled far inland, explored the steppes of Turkmenia, and made a survey of the old estuary of ancient Oxus or Amu-Darya. This particular map is a very valuable contribution to the science of geography. Finally he visited the shores of Asterabad Bay and laid the groundwork for the establishment of regular trade relations between Russia and Persia.

All these varied activities never prevented Karelin from continuing his scientific researches; he prepared extensive botanical and zoological collections, while his diaries include valuable data on the flora and fauna of the regions visited. His travels had made the name of Karelin widely known and he was elected to membership in many scientific societies. The Russian government recognized his services and rewarded him with a grant of 6,000 roubles and a pension of 900 roubles a year. Emperor Nicholas I invited him for a lunch and gave him a valuable diamond ring as his personal gift.

No wonder that in 1839 the oldest scientific society in Russia, the Société de Naturalistes de Moscou, invited him to take charge of a scientific expedition for the exploration of the Altai, Tarbagatai, and Sayan Mountains, and Dzungaria. Karelin willingly accepted and soon an agreement was reached as to the itinerary of the expedition and its financial support. Karelin was to receive 3,500 roubles a year plus all expenses of the expedition. Besides that, he retained his regular salary from the Finance Department, where he had been employed since 1838. He was to collect botanical, zoological, mineralogical, and geological specimens, ship his collections every two months, and submit a monthly report. The agreement was for a period of two years. It may be noted here that, although the Sayan Mountains were included in the itinerary of the expedition and there are some references in literature concerning Karelin's travels in this region, neither he nor any of the members of his expedition ever visited that region. The researches of Lipsky, Romanovsky, and Lipschitz and the study of Karelin's diaries prove this conclusively.

After careful preparations, which took several months, Karelin started his famous expedition on March 15, 1840, from Orenburg, going eastward through Troitzk, Petropavlovsk, and Omsk to Semipalatinsk. In addition to Kirilov, the party included a Cossack officer, G. A. Maslennikov, a very skillful hunter, and G. D. Karaulov, a zoological collector and preparator.

I make no attempt to give a detailed itinerary of Karelin's travels, but will merely summarize his explorations for each year. Fortunately he wrote many letters, sent his reports regularly to the Society of Naturalists of Moscow, and kept a diary of his travels. These letters and some of his reports are samples of brilliant, colorful scientific language. It is to be regretted that Karelin published so little and that all his manuscripts were destroyed by a fire in 1872.

In 1840 Karelin explored the Tarbagatai and Narym Mountains and the Semipalatinsk region. Kirilov made independent explorations to Lake Nor-Zaissan and to the northern slopes of the Tarbagatai Range. The results of the first year were very good. Fifty-two boxes of collections, including 38,000 botanical specimens representing 1,127 species, were sent to Moscow.

In 1841 the party explored the Alatau Mountains and the Semirechensk region. Besides his regular staff, Karelin had about fifty Cossacks who served as a convoy to the expedition, but he trained some of them as collectors and hunters. Of these men we should mention especially Captain S. M. Abakumov, who became a proficient botanical and ornithological collector. The results of the second year were even better than those of the first, although the expedition was many times attacked by "barantachi" (rebellious Kirghizs). About 55,000 botanical specimens were sent to Moscow. In the fall Kirilov was sent with some collections to Krasnoyarsk, where he worked under direction of Turczaninow on the preparation of the *Enumeratio plantarum*. The correspondence between Karelin and Turczaninow proves that the latter contributed greatly to this work, which is considered one of the best in Russian botanical literature. It lists 1891 species and includes descriptions of eight new genera and 220 new species. Lipsky is of opinion that the influence and constructive criticism of Turczaninow, the best Russian botanist of that time, added very much to the value of this work.

In 1842 Karelin was again in the Alatau Mountains, in eastern Altai, and in Dzungaria (Bayan Aul and Karakalinsk regions). All his diaries of this year are missing; probably they were lost with other papers (letters, reports, surveys) which Kirilov had with him when he died so suddenly at Arzamas, apparently of cholera. This tragedy, which deprived the expedition of a key assistant, was a severe personal blow to Karelin, who loved Kirilov no less than his own children. Sophia G. Karelina says in her recollections that her father was so distressed on receiving the news of Kirilov's death that he became hysterical, tried to drive his head against the wall, and his companions had to keep him under close watch for many days, fearing that he might commit suicide. After this violent period he became apathetic and morose and was not able to work. This depressed condition continued for some months but gradually passed. After the death of Kirilov, the work on the identification and description of the plants, which had been done mostly in the winter months, stopped. The botanical collections of 1842–44 were partly described later by S. S. Shchegleev.* It is a peculiar fact that after the death of Kirilov, Karelin never published a botanical paper in the remaining 30 years of his life (1842–72). This does not of necessity mean that he suddenly lost interest in botany. Although he is usually considered as a zoologist *par excellence,* this is hardly correct. At least he considered himself a botanist in the first place, and his earlier publications, his correspondence with the best Russian botanists of the time, and especially his diaries, where botanical observations always play a dominant role, prove that he was right in that respect. It must be borne in mind that he was manifestly an outdoor type, a man of action, a born traveller and explorer, and not a cabinet worker. He started to write regularly when he was over fifty years old and partially incapacitated as a traveller by a severe attack of rheumatism.

In 1843 Karelin made an expedition through the Kokbetinsk region to Lake Nor-Zaissan, described it, and explored the Upper Irtysh for 400 miles from its source to Ust' Kamenogorsk. There are no data on the number of specimens in the collection; it is known only that it contained 1678 species. Maslennikov made a separate expedition to the sources of the Lepsa River in the Alatau Mountains, where he collected zoological and botanical specimens.

*Shchegleev, S. S. [Stschégléew, S. S.]

1854a. Supplementum ad Floram Altaicam. Dissertatio. i–ii, i–iv, 1–119.
One chapter is in Latin, the rest in Russian; supplement to Karelin & Kirilov 1841 & 1842.

1854b. Nouveau supplément à la flore Altaïque. Bull. Soc. Nat. Moscou **27**(1): 145–211.
A republication of a chapter in Latin in the original work, with a preface in French.

Karelin explored the basin of Buchtarma River in 1844 and travelled in Dzungaria and in the border regions of northeastern China. Maslennikov again visited the Alatau Mountains and collected plants in the valleys of the Lepsa, Djamantash, and Tentek Rivers. There are no data on the size of the botanical collections assembled.

The expeditions having continued for almost five years, Karelin enthusiastically insisted that the work should be prolonged for at least one year more. This suggestion met a very unfavorable reception from all sides. The Society of Naturalists of Moscow helped Karelin in many ways and gave its moral support, but, after spending about 18,000 roubles on the expeditions, it discontinued financial aid in the middle of 1842. The only source of money was Karelin's salary, but even this meager supply became uncertain. The Secretary of Finance, from whose department Karelin was drawing his regular salary of 3,000 roubles, frowned on his scientific activities and advised him many times to return to his regular work in St. Petersburg, but Karelin always refused on some pretext. The long controversy came to a sudden end when the Finance Department asked Prince Gorchakov, Governor of Western Siberia, to induce Karelin to return to St. Petersburg. The Governor, who had a very strong personal dislike of Karelin, was very willing to do this. He provided a police escort and sent him out of Siberia in June, 1845. This was the sad end of the famous expedition. How it could happen that the famous explorer, honored personally by Emperor Nicholas I, was deported in such a humiliating way, by an arrogant provincial official, is very strange. Lipsky, the best biographer of Karelin, hints vaguely that there must have been some less obvious factors. A very careful study of all available documents relating to this deportation does not support this allegation, and we do not feel justified in making further speculations on that subject. As an aftermath of this unhappy affair, Karelin was retired from the Finance Department on November 14, 1845.

There are no complete data on the collections of Karelin and Kirilov, which are considered the richest ever made in that formerly almost unknown region. The dossier of that expedition, which was at one time in the archives of the Society of Naturalists of Moscow, was lost. Fortunately many copies of letters, reports, and some manuscripts, which were in the possession of Karelin's daughters, were saved. In one of his letters to Count Stroganov, Karelin gives the following data on his collections for three years (from May 9, 1840 to March 16, 1843): animals — 240, birds — 1669, insects — 9766, fishes — 8, snakes — 34, lizards — 169, plants — 90,142, seeds — 442, and minerals — 474. It should be noted that the number of plants in this particular list is apparently wrong; it must be larger. The number of botanical specimens for the first two years alone (1840–41) totaled 93,000. These collections are incorporated in the herbaria of Moscow and St. Petersburg Universities, the St. Petersburg Botanical Garden, and the Academy of Sciences. Many thousands of duplicates were distributed to the principal herbaria of Europe, as well as to some in America, thus making Karelin's expedition widely known.

After his forced retirement, Karelin joined his family, which had moved in 1842 from Orenburg to his small estate in Trubitsyno, near Moscow. Here he spent six years in the company of his wife and four daughters, working on his collections. It was apparently a happy period of his life, because the recollections of his daughters give us a picture of him as a very devoted father and husband and a man of gay, pleasant disposition, who loved rural life and its simple pleasures. But still his inborn longing for the study of nature and new places was stronger than his family ties. In 1852 he wrote to Count Perovsky, then the Governor of the Orenburg region: "For six years I have been living in Moscow and its vicinity and I feel now an irresistible desire to travel once more. I want to make a short trip this summer through the Ural steppes to the Caspian Sea. My goal is to explore the Inder Lake and the northern shores of the Caspian Sea . . ." He asked the permission of Perovsky to make this trip, and, permission being granted, Karelin departed on July 20, 1852, telling his daughters: "In six months, children, I shall be back, and now good-bye."

He never came back. He lived for twenty years a virtual hermit in the small town of Guriev, travelled occasionally in the Ural Cossack region, made some ornithological observations, and worked very assiduously on the description of his travels. It is known that he prepared for publication eleven large volumes of manuscripts, but lack of financial support prevented their publication. He suffered very much from severe rheumatism and was bedridden for the last two or three years of his life. His house and all his manuscripts and collections were destroyed by fire in the summer of 1872. This was too much for an old and sick man, for he failed to survive this final blow and soon died, on December 17, 1872.

Some facts regarding Karelin's life are strange and can hardly be explained in a satisfactory way, especially his self-exile to Guriev. The persons closest to him, his daughters, frankly confess that they were at a loss to find any reasons for the sad, solitary end of his life. There is no doubt that Karelin was a very complex human being and not as well balanced and happy as he seemed to be. The only personal comment regarding this last period of his life is the following excerpt from one of his last articles written in Guriev in 1868: "In 1852 I came for a short visit to the estuary of the Ural River, in order to make some observations on the migration, breeding, and moulting of birds. But I found such a wide field for other scientific explorations and such peace and freedom, which I needed for the arranging of the extensive materials collected on my travels, that instead of two years I stayed here more than sixteen years . . ."

This and another sentence in Karelin's letter of June 30, 1841, to Count Stroganov give us some hints for the better understanding of the character of this remarkable man. In that letter Karelin wrote: "My expedition is a great success. I am writing to you from the height of 9,000 feet, in the neighborhood of icebergs and eternal snow, but surrounded by such wonderful and rare flowers that some days I walk hatless in an ecstasy of reverie . . ." It seems to us that nature was the only great and real love of this enthusiastic scientist. On the altar of this passionate, all consuming love he sacrificed his happiness and his life.

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1905b. "Kareliniana" 1829–1905. In V. Lipsky, Flora Asiae Mediae pt. 3, pp. 743–787.
A very complete bibliography containing (1) works by Karelin, and (2) papers describing the life of Karelin or based on his works and collections.

LIST OF PLANTS NAMED IN HONOR OF G. S. KARELIN

Genus: *Karelinia* Less. (= *Pluchea* Cass.) in Compositae.

Species: *Acantholimon Karelini* Bunge, *Alfredia Karelini* Led., *Ammodendron Karelini* Fisch. et Mey., *Anabasis Kareliniana* Led., *Aquilegia Kareliniana* C. A. Mey., *Arctium Karelini* Kuntze, *Astragalus Karelini* Fisch., *Atraphaxis Karelini* Jaub. et Spach, *Carex Karelini* Meinsh., *Chara Karelini* Less., *Cousinia Karelini* Less., *Corydalis Kareliniana* Turcz., *Echinospermum Karelini* Fisch. et Mey., *Ferula Karelini* Bunge, *Frittillaria Karelini* Bak. (*F. gibbosa*), *Halimocnemis Karelini* Moq. Tand., *Karelinia caspica* Less., *Ligularia Kareliniana* Stsch., *Lomatopodium Karelinianum* Turcz., *Lonicera Karelini* Bunge (*Xylosteum Karelini* Rupr.), *Malcomia Karelini* Lipsky, *Rhinopetalum Karelini* Fisch., *Salix Karelini* Turcz., *Saussurea Karelinii* Stsch., *Suaeda Kareliniana* Fzl., *Statice Karelini* Stsch., *Tamarix Karelini* Bunge, *Zygophyllum Karelini* Fisch.

LIST OF PLANTS NAMED IN HONOR OF I. P. KIRILOV*

Genus: *Kirilowia* Bunge (= *Kirilovia* Lindl.) in Chenopodiaceae.

Species: *Carex Kirilowii* Turcz., *Halimocnemis Kirilowii* Fenzl, *Kirilowia eriantha* Bunge, *K. pilosa* Bunge (*Panderia pilosa*), *K. villosa* Benth. & Hook., *Lepidium Kirilowii* Trautv., *Pyrethrum Kirilowii* Turcz. (*Tridactylina Kirilowii* C. H. Schultz), *Salix Kirilowiana* Stsch.

Arnold Arboretum,
Harvard University.

*Borodin made a mistake in listing in his *Collectors and collections of the Siberian flora* (p. 47) *Sedum Kirilowii* Regel and *Senecio Kirilowii* Turcz. as plants named in honor of I. P. Kirilov. Lindemann (Dritter Bericht . . . no. 383) was also wrong in including in a similar list *Eupatorium Kirilowii* Turcz. and *Sorbaria Kirilowii* Maxim. These four species, according to Bretschneider (History of European botanical discoveries in China, pp. 346–352), were named in honor of Porfirij Evdokimovich Kirilov (1801–1864), a physician of the 11th Russian Ecclesiastic Mission to China, who travelled with Bunge in 1830 through Mongolia to Peking and who collected in China from 1830 to 1841.

Herder, in his *Biographische Notizen* (in Bot. Jahrb. **9:** 438. 1888), cites "Kiriloff, Joh. Porph." This mysterious collector is really a mixture of the two above-named Kirilovs. Biographical data and even first and middle names are evenly mixed up.

JOURNAL
OF THE
ARNOLD ARBORETUM

VOL. XXIV | APRIL, 1943 | NUMBER 2

TAXONOMIC NOTES ON THE OLD WORLD SPECIES OF WINTERACEAE

A. C. SMITH

With six text-figures

As implied by the title, this treatment is not monographic, its scope being primarily to bring together references to the taxonomic literature, to indicate the acceptable name for each species, to discuss the typification of species and genera, to mention the known distribution, and to cite the specimens available in American herbaria. From some regions there is a deplorable lack of available herbarium material in this country, and consequently my remarks must often be based upon those of previous workers. Some revision of specific lines will be inevitable when European herbaria can again be consulted, and doubtless a certain amount of revision will be dictated by future collections throughout the range of the family. For some of the genera in certain regions, such as New Guinea and Australia, enough material is available to make feasible the preparation of preliminary keys, but these are presented with the reservation that modification and expansion will be essential.

Prof. I. W. Bailey and the writer have in preparation a treatment of the inter-relationships of the six genera which make up the Winteraceae and the place of the family in the Ranales. Consequently, in the present paper I omit comprehensive generic descriptions and detailed discussions of generic relationships. During the preparation of this work, I have repeatedly called upon Prof. Bailey for advice, and many of the conclusions expressed are the result of his painstaking preparation and examination of material for microscope study. It is hoped that the present paper will provide an outline of the classification of the family and will bring up to date the sometimes complicated synonymy.

The Winteraceae has an interesting bihemispheric and presumably palaeoantarctic distribution, which I have recently discussed (5). In the Old World, species are found in the area roughly outlined by the Philippines, Borneo, New Guinea, the Solomon Islands, New Caledonia, New

Zealand, Tasmania, and eastern Australia. All of the six known genera occur in this region, while only one, *Drimys*, extends to America, where it is found from Cape Horn to southern Mexico. According to my interpretation, the family now contains about 88 species, of which only four are American. The type genus is *Drimys* (of which *Wintera* is a synonym), and the type species of *Drimys* is *D. Winteri* J. R. & G. Forst. of southern South America. This species, therefore, is the nomenclatural basis of the family.

Many students have included *Drimys* and *Illicium* L. in the same family, subfamily, or tribe. There appear to be no sound morphological, anatomical, or genetic reasons for this broad concept. The wood structure, nodal anatomy, pollen grain, carpellary structure, and many other characters of *Illicium* remove it from the Winteraceae. Whitaker (8) has pointed out that *Illicium* cytologically bears no resemblance to either *Drimys* or members of the Magnoliaceae, being suggestive, in its chromosome number, of *Schizandra* and *Kadsura*. Therefore the genus is not considered in connection with the present study; whether it should be placed in the Schizandraceae or in an independent family must be decided by future study.

The directors and curators of the following institutions have kindly loaned herbarium material, which is cited in this paper as indicated by the parenthetical letters: Arnold Arboretum (A), Field Museum of Natural History (F), Gray Herbarium (GH), Missouri Botanical Garden (M), New York Botanical Garden (NY), University of California (UC), and U. S. National Museum (US).

WINTERACEAE Lindl. Nat. Syst. Bot. ed. 2. 17, pro parte. 1836; Miers in Ann. Mag. Nat. Hist. III. **2**: 33, pro parte. 1858, Contrib. Bot. **1**: 123, pro parte. 1861; Eichl. in Mart. Fl. Bras. **13**(1): 127. 1864; Hutchinson in Kew Bull. **1921**: 185, pro parte. 1921, Fam. Fl. Pl. Dicot. 81, pro parte. 1926.

Wintereae R. Br. ex DC. Reg. Veg. Syst. Nat. **1**: 548, pro parte. 1817; Lindl. Introd. Nat. Syst. Bot. 26, pro parte. 1830, Nixus Pl. 9, pro parte. 1833.

Magnoliaceae Trib. *Illicieae* DC. Prodr. **1**: 77, pro parte. 1824.

Magnoliaceae Trib. *Wintereae* R. Br. ex Meisn. Pl. Vasc. Gen. 3 (pars alt. 5), pro parte. 1836; Benth. & Hook. f. Gen. Pl. **1**: 17, pro parte. 1862.

Magnoliaceae Subordo *Illicieae* DC. ex Endl. Gen. Pl. 838, pro parte. 1839.

Magnoliaceae Trib. *Illicieae* Sect. *Winterineae* Spach, Hist. Nat. Veg. **7**: 435. 1839.

Magnoliaceae II. *Wintereae* Lindl. Veg. Kingd. ed. 2. 419, pro parte. 1847, ed. 3. 419, pro parte. 1853.

Magnoliaceae III. *Illicieae* Prantl in E. & P. Nat. Pfl. III. **2**: 18, pro parte. 1891.

Magnoliaceae Subfam. *Drimyoideae* Harms in Ber. Deutsch. Bot. Gesell. **15**: 358. 1897.

Drimytacées v. Tiegh. in Jour. de Bot. **14**: 354. 1900.

Drimytacées Trib. *Drimytées* and Trib. *Exospermées* v. Tiegh. in Jour. de Bot. **14**: 354. 1900.

Drimytaceae Diels in Bot. Jahrb. **55**: 133. 1917.

Magnoliaceae Subfam. *Drimydoideae* Skottsb. in Växternas Liv **5**: 349, pro parte. 1940.

The principal interpretations of the taxonomic position of the group now known as the Winteraceae are indicated by the above synonymy. Most of the early writers linked *Drimys* and *Illicium* in the same tribe or section, but the classification of Spach, in 1839, is interesting because of his proposal of different sections of the Tribe Illicieae for these two genera. Harms' concept of Magnoliaceae Subfam. Drimyoideae (1897) is synonymous with the Winteraceae in the modern sense. The most precise delimitation of the family, however, has been that of van Tieghem (6), who apparently neglected to use the Latin form of his "Drimytacées" anywhere in his treatment.

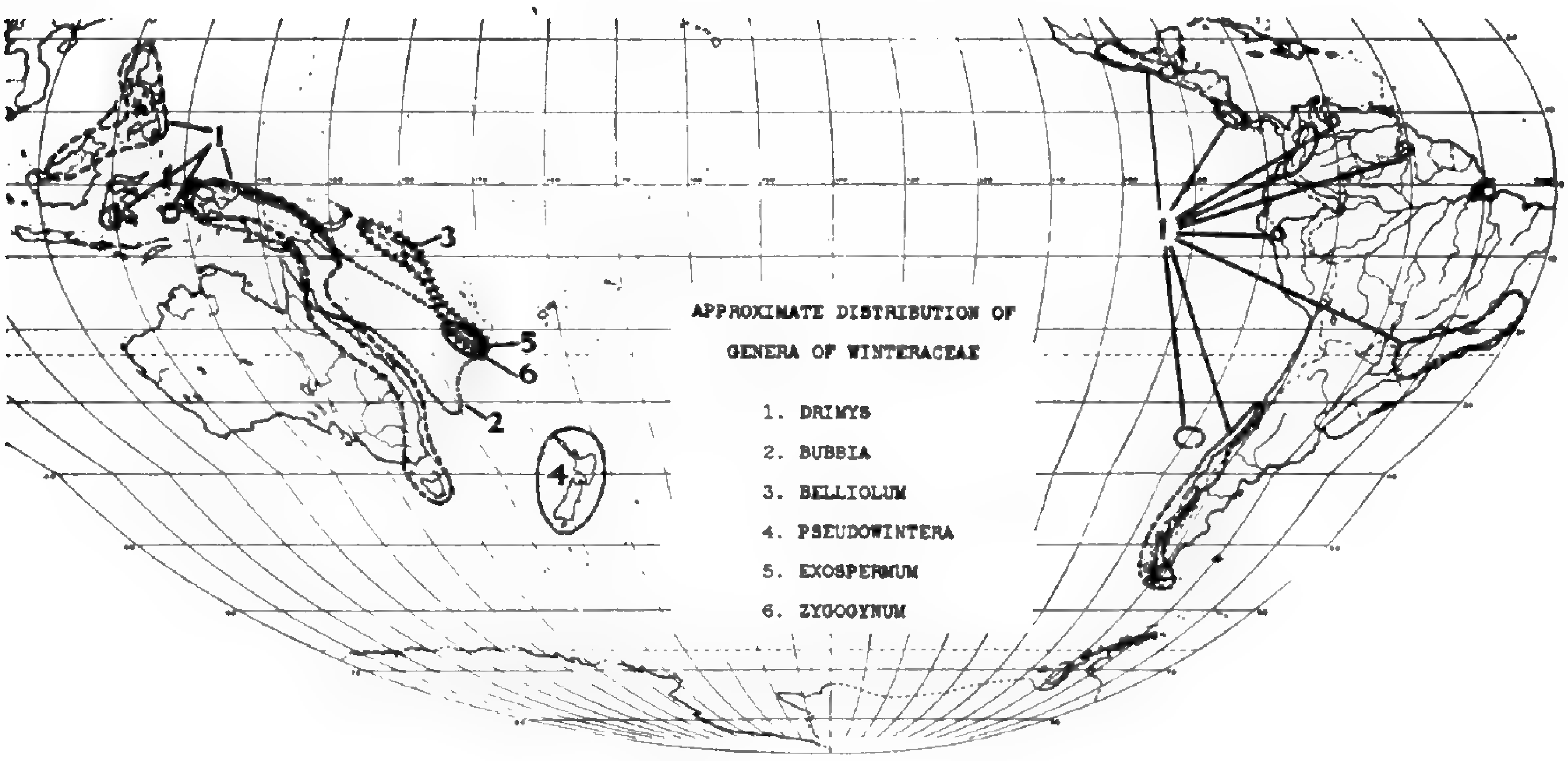

FIG. 1. Approximate distribution of the genera of Winteraceae. From Goode's series of base maps, no. 108.

KEY TO THE GENERA IN THE OLD WORLD

Calyx submembranaceous or papyraceous, calyptrate, completely enclosing the bud, at length splitting into 2 or 3 lobes and often caducous; plants dioecious or polygamo-dioecious; carpels free, with the stigmatic surface extended along the ventral suture; anther-locules vertical or subvertical, distally extrorse-lateral, the filaments comparatively slender, subterete .... 1. *Drimys* Sect. *Tasmannia*.

Calyx papyraceous to subcoriaceous, persistent, often rotate, not calyptrate, not enclosing the bud; plants hermaphrodite; carpels often with a short stigmatic ridge (or elliptic or subpeltate stigma in ***Zygogynum***); filaments carnose, flattened.

  Carpels free, sometimes appressed-contiguous (in ***Bubbia*** and ***Exospermum***), not developing into a syncarp.

    Inflorescence terminal or pseudoterminal, the flowers or inflorescence-rays aggregated around the growing point.

      Anther-locules apical, horizontal or oblique at the apex of distally enlarged filaments, not exceeded by the connective.

        Carpels usually free even in young flowers, rarely appressed-contiguous at anthesis; placental surface essentially corresponding to the external stigmatic surface .... 2. ***Bubbia***.

        Carpels appressed-contiguous, free only after anthesis; placentation diffuse and scattered on distal surfaces .... 5. ***Exospermum***.

      Anther-locules vertical, extrorse-lateral, exceeded apically by the connective .... 3. ***Belliolum***.

    Inflorescence axillary; flowers fasciculate (rarely solitary), often arising from branchlets of several years' growth .... 4. ***Pseudowintera***.

  Carpels firmly concrescent, the placentation primarily on the dorsal surface; fruit a syncarp .... 6. ***Zygogynum***.

1. DRIMYS

Drimys J. R. & G. Forst. Char. Gen. 83. 1776.

The Old World representatives of the genus all belong in the Section *Tasmannia*, which is separable from the American Section *Wintera* as pointed out in my recent treatment of that group (4: 10). I have already listed the principal references to the genus *Drimys* as a whole, and consequently the following references pertain only to the Old World portion of the genus.

Drimys Sect. **Tasmannia** (R. Br.) F. v. Muell. Pl. Indig. Col. Vict. **1**: 20. 1860; Baill. Hist. Pl. **1**: 160. 1867–69.

Tasmannia R. Br. ex DC. Reg. Veg. Syst. Nat. **1**: 445, 547. 1817, ex DC. Prodr. **1**: 78. 1824; Lindl. Nat. Syst. Bot. ed. 2. 17. 1836; Meisn. Pl. Vasc. Gen. 3 (pars alt. 5). 1836; Spach, Hist. Nat. Veg. **7**: 433. 1839; Endl. Gen. Pl. 838. 1839, Enchir. Bot. 428. 1841; Lindl. Veg. Kingd. ed. 2. 419. 1847; Hook. f. Fl. Tasm. **1**: 10. 1855; Miers in Ann. Mag. Nat. Hist. III. **2**: 109. 1858, Contrib. Bot. **1**: 138. 1861.

Drimys J. R. & G. Forst. sensu Benth. Fl. Austral. **1**: 49. 1863; F. M. Bailey, Queensl. Fl. **1**: 18. 1899.

Drimys Sect. *Winterana* Baill. Hist. Pl. **1**: 160. 1867–69.

Drimys Sect. *Eudrimys* v. Tiegh. in Jour. de Bot. **14**: 288, pro parte. 1900; Pilger in E. & P. Nat. Pfl. Nachtr. **2**: 108, pro parte. 1906; non DC. (1824).

Drimys occurs in the Old World in Australia and Tasmania, New Guinea, the Philippines, Borneo, Celebes, and Amboina. Its occurrence in other high eastern Malayan islands is possible, but thus far no other regions are represented in the herbaria examined by me, nor have published records of other occurrences been found. It is a typically montane genus, reaching elevations of 3800 m. in New Guinea and Borneo, but descending to sea-level in the southern part of its range in Tasmania. Six species are known from Australia and Tasmania, 29 from New Guinea, and one from the Philippines-Amboina region. In order to make this treatment more usable, I propose to discuss and key the Australian and the New Guinean-Malayan species separately.

The genus *Tasmannia* was originally based on *T. aromatica* R. Br. and *T. insipida* R. Br., Australian species which are referable to *Drimys lanceolata* (Poir.) Baill. and *D. insipida* (R. Br.) Pilger respectively. The Sections *Tasmannia* and *Wintera* are sharply differentiated, but their common origin is indisputable and the separating characters do not seem generic in quality. The total variability of *Drimys* in the Old World, especially in New Guinea, is considerable, particularly when the region is compared to America, where, in an area extending from southern Mexico to Cape Horn, no more than four species can be recognized. I have attempted to use essentially similar standards for specific delimitation in the two hemispheres. In spite of the greater number of Old World species, it is much easier to draw specific lines in Sect. *Tasmannia* than in Sect. *Wintera*, while intraspecific variability seems much less pronounced in the Old World than in the New. From this fact one might assume that isolating mechanisms have been at work longer in Sect. *Tasmannia* than in

Sect. *Wintera* and that extensive interchange of genetic material between parts of the population ceased earlier in the Old World than in the New.

Following De Candolle's treatments, many subsequent writers maintained the genus *Tasmannia* as distinct from *Drimys,* but modern students have submerged it. I believe that it is well retained as a section with a status similar to that of the American Section *Wintera* (Murr.) DC. Baillon proposed to divide *Drimys* into four sections, but one of these, Sect. *Winterana,* is difficult to typify from his brief treatment. I assume that he meant to base it on "*Winterania*" *lanceolata* Poir., an Australian species, and consequently I list it as a synonym of Sect. *Tasmannia.* Van Tieghem's four sections of *Drimys* are all based exclusively on American species with the exception of Sect. *Eudrimys,* which, curiously enough, includes the most extreme forms of the genus. The Old World representatives of van Tieghem's Section *Eudrimys* are referable to Mueller's Sect. *Tasmannia,* but the actual type of Sect. *Eudrimys* v. Tiegh. is the American *D. Winteri.*

Australian species

The six recognizable Australian species are quite distinct from the New Guinean representatives, all being characterized by having their pistillate flowers lacking stamens (a feature of only a few New Guinean species). However, the Australian species do not appear to form a single coherent group, and it is not to be assumed that they were derived from a single recent prototype. *Drimys lanceolata* and its two allies (*D. stipitata* and *D. Vickeriana*) are entirely distinct from any New Guinean species and appear to have no close relatives; they have probably been isolated for a long time from the main trends of evolution in the Section *Tasmannia.*

The only Australian species which appears to have a close affinity with the New Guinean species is, as might be expected, *D. membranea,* of Queensland, which has much in common with *D. hatamensis* Becc. This relationship has already been suggested by Diels (in Bot. Jahrb. **54:** 242. 1916). However, *D. hatamensis* (like its closest New Guinean allies *D. dictyophlebia* Diels and *D. coriacea* Pulle) has pistillate flowers with at least three carpels, while those of *D. membranea* have a single carpel. There are also differences in the shape of the perianth-parts and fruits, but in foliage the Queensland species and *D. hatamensis* are remarkably similar.

Ridley (in Trans. Linn. Soc. II. Bot. **9:** 12. 1916) has pointed out the possible relationship of his *D. densifolia* to *D. insipida* (i. e. *D. dipetala*), but the Australian species differs in its narrower leaves, larger petals, more numerous stamens in staminate flowers, and usually solitary carpel. The actual relationship of these two species is probably quite remote, in spite of the similarity of their leaf-bases.

It seems desirable to redescribe three of the older Australian species and one novelty, but I do not find it necessary to repeat Vickery's excellent descriptions (7) of *D. purpurascens* and *D. stipitata.*

KEY TO THE AUSTRALIAN SPECIES

Leaf-blades with (5–)7–18 short anastomosing secondary nerves, these erecto-patent at an angle of (20–)30–45°, the blades (4–)6–20 cm. long; petals 2, very rarely 3.
  Leaf-blades gradually narrowed toward a suddenly obtuse and often auriculate base; carpels 1 (rarely 2) in both staminate and pistillate flowers; fruit 1-carpellate, ellipsoid, usually 13–20 mm. long, obtuse at base, with (8–)15–27 seeds .... 1. *D. insipida*.
  Leaf-blades acute to attenuate at base.
    Petals up to 8 mm. long at anthesis; filaments 0.5–3.5 mm. long; carpels 1 (rarely 2 or 3) in both staminate and pistillate flowers; fruit 1-carpellate, often nearly subglobose, not more than 10 mm. long, rounded at base, usually with 4–7 seeds .... 2. *D. membranea*.
    Petals 10–12 mm. long; filaments 2–6 mm. long; carpels 2–8 in both staminate and pistillate flowers; fruit 2–8 (usually 3- or 4-)-carpellate, the carpels oblong-globose, 10–15 mm. long, short-stipitate .... 3. *D. purpurascens*.
Leaf-blades with 3–7 elongate secondary nerves, these sharply ascending at an angle of 10–20° or completely immersed and obscure, the blades not exceeding 11 cm. in length, acute to attenuate at base, never auriculate.
  Sepals 3.5–6 mm. in diameter; petals 4–9 mm. long, 1.5–3.5 mm. broad; stamens in staminate flowers 15–45; fruiting carpels with at least 6 seeds; leaf-blades rarely less than 4 cm. long and 1 cm. broad.
    Petals in staminate flowers 5–8, in pistillate flowers usually 4; carpels in both staminate and pistillate flowers 1, rarely 2 or 3, subglobose or ellipsoid, sessile, the stigmatic ridge occupying the entire apex and ventral edge; fruit 1-carpellate, essentially subglobose, rounded at base .... 4. *D. lanceolata*.
    Petals 2; carpels in staminate flowers 1 or 2, in pistillate flowers 2–8, obovoid-ellipsoid, obviously stipitate, the stigmatic ridge obliquely apical or extending to base of ovary; fruit 2–8(usually 3- or 4-)-carpellate, the carpels oblong-ellipsoid, conspicuously stipitate .... 5. *D. stipitata*.
  Sepals 2.5–3 mm. in diameter; petals 2, not exceeding 3 mm. in length and 1 mm. in breadth at anthesis; stamens in staminate flowers 10–12; carpel in staminate flowers 1, subsessile; fruit 1-carpellate, subglobose, with about 3 seeds; leaves congested, the blades small, up to 16 mm. long and 5 mm. broad .... 6. *D. Vickeriana*.

1. **Drimys insipida** (R. Br.) Pilger in E. & P. Nat. Pfl. Nachtr. **2:** 108. 1906; Druce in Rep. Bot. Exch. Cl. Brit. Isles **1916:** 620. 1917; Domin in Bibl. Bot. **22** [Heft 89]**:** 115. 1925; Vickery in Proc. Linn. Soc. N. S. Wales **62:** 82. 1937.
  Tasmannia insipida R. Br. ex DC. Reg. Veg. Syst. Nat. **1:** 445. 1817; DC. Prodr. **1:** 78. 1824; Miers in Ann. Mag. Nat. Hist. III. **2:** 110. 1858; F. v. Muell. Pl. Indig. Col. Vict. **1:** 21, as synonym. 1860; Miers, Contrib. Bot. **1:** 140. 1861.
  Tasmannia dipetala R. Br. ex DC. Prodr. **1:** 78, as synonym. 1824.
  Tasmannia monticola A. Rich. Sert. Astrolab. 50. 1834 (Atlas *pl. 19.* 1833); F. v. Muell. Pl. Indig. Col. Vict. **1:** 21, as synonym. 1860.
  Drimys dipetala F. v. Muell. Pl. Indig. Col. Vict. **1:** 21. 1860; Benth. Fl. Austral. **1:** 49. 1863; Baill. Hist. Pl. **1:** 160. 1867–69; F. M. Bailey, Syn. Queensl. Fl. 5. 1883; C. Moore, Handb. Fl. N. S. Wales 13. 1893; Maiden in Agric. Gaz. N. S. Wales **5:** 600 (Dorrigo For. Res. 8). 1894; Parment. in Bull. Sci. Fr. & Belg. **27:** 227, 301. 1896; F. M. Bailey, Queensl. Fl. **1:** 18. 1899; Pilger in E. & P. Nat. Pfl. Nachtr. **2:** 108. 1906; F. M. Bailey, Compr. Cat. Queensl. Pl. 21. *f. 7.* 1913; Maiden & Betche, Census N. S. Wales Pl. 79. 1916.

Shrub or small tree, up to 3 m. or more high, the branchlets subterete, brownish or nigrescent, rugulose, slender, 1–3 mm. in diameter near apices; leaves scattered, sometimes appearing subopposite toward apex of branchlets; petioles rugulose, shallowly canaliculate, often inconspicuous, 0.5–4 mm. long, 0.7–2 mm. in diameter; leaf-blades chartaceous, brownish or

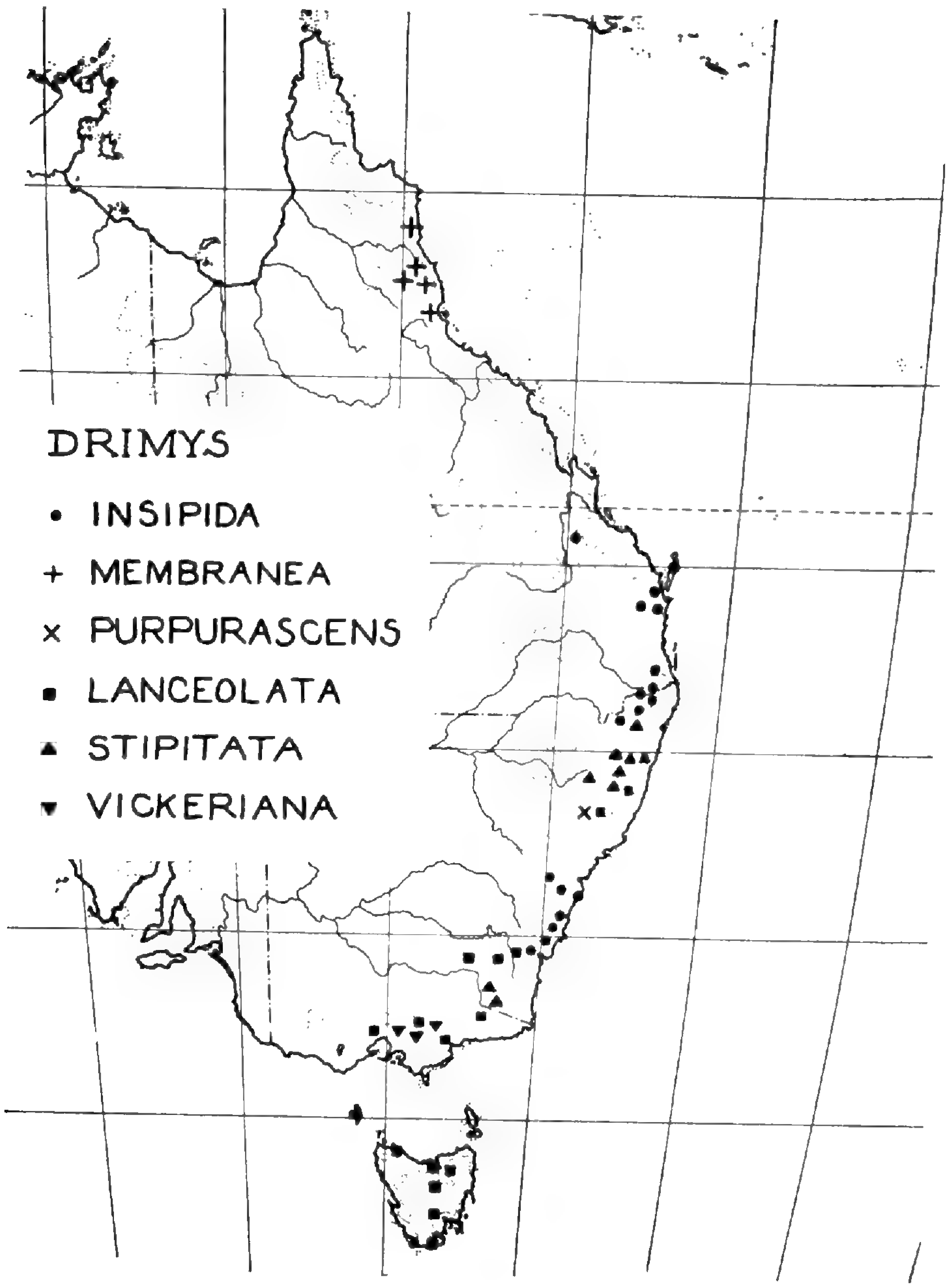

FIG. 2. Approximate known distribution of the Australian and Tasmanian species of *Drimys*. From Goode's series of base maps, no. 107.

dark green when dried, oblong- or obovate-lanceolate, (4–)8–20 cm. long, (0.7–)1.5–3.7 cm. broad, gradually narrowed to an abruptly obtuse or inconspicuously auriculate base, gradually and often long-acuminate at apex, slightly recurved at margin, the costa slightly raised or narrowly canaliculate above, prominent beneath, the secondary nerves 7–18 per side, short, erecto-patent at an angle of (20–)30–45°, usually freely anastomosing toward margin, prominulous on both surfaces, the veinlets loosely reticulate and faintly prominulous or obscure on both surfaces; flowers single, numerous, congested around the growing point of branchlets, at length pseudolateral, subtended by numerous bracts, these papyraceous, oblong, 5–11 mm. long, obtuse, soon caducous, the pedicels slender, 10–25 mm. long at anthesis (sometimes shorter in pistillate plants), up to 30 mm.

long in fruit; staminate flowers: sepals 2, submembranaceous, densely but obscurely yellow-glandular, ovate-deltoid, 5–7 mm. long and broad, obtusely apiculate at apex; petals 2, submembranaceous, eglandular to densely glandular-punctate, obovate- or spatulate-linear, 7.5–13 mm. long, 1.5–2.5 mm. broad, conspicuously narrowed at base, obtuse at apex; stamens usually 30–38, 3- or 4-seriate, the filaments subcarnose, ligulate, obscurely pellucid-glandular, 1–5 mm. long, the locules 1–2 mm. long; carpel 1 (rarely 2), sterile, ellipsoid, slightly falcate, often yellow-glandular, 2.5–4 mm. long at anthesis, the stigmatic ridge elongate; pistillate flowers: sepals as in staminate but usually longer than broad, obtuse at apex; petals similar but smaller, up to 10 mm. long, 1–1.5 mm. broad; stamens none; carpel 1, ellipsoid, about 3 mm. long at anthesis, obtuse at apex, the stigmatic ridge extending from apex nearly to base, the ovules about 28; fruit 1-carpellate, ellipsoid, at maturity (9–)13–20 mm. long and (5–)7–10 mm. broad, obtuse at base and apex, obscurely marked ventrally by the stigmatic ridge, the pericarp carnose, copiously yellow-glandular, the seeds (8–)15–27, loosely imbedded in sparse mucilaginous pulp, coriaceous, black, shining, obovoid, slightly or strongly falcate, 3–3.5 mm. long, 1.5–2.5 mm. broad, acute at base, rounded at apex.

DISTRIBUTION: Southeastern Queensland and eastern New South Wales, from about lat. 24° to 35°30′, from sea-level to about 1500 m. in mountains; usually reported as occurring in rain-forest. The type was collected by Brown at or near Port Jackson.

AUSTRALIA: Queensland: Fraser Island, *Epps 229* (NY); Tinana Creek, *White 3476* (A); Imbil, *Wilson* (A); Eumundi, *Simmonds* (A); Tallebudgera, *White 1866* (A); Roberts Plateau, Lamington National Park, *White 6062* (A, NY); Cunningham's Gap, Main Range, *White 6862* (A, NY); Mt. Spurgeon, *White 10737* (A); Mt. Greville, *White 9949* (A), *Everist 556* (A); Tambourine Mt., *White 3568* (A); National Park, Macpherson Range, *White* (A); Mistake Range, *White* (A), *Bailey* (US); New South Wales: Richmond River, *Henderson* (UC); Upper Williams River at Salisbury, *White 11473* (A); Wentworth Falls, *Maiden* (UC), *Burges* (NY); Moonambale, *Maiden* (A); Port Jackson, *Caley* (A).

NATIVE NAME: *Pepper shrub.*

White reports the sepals as red, the petals paler red, and the stamens yellow; other collectors have not mentioned the flower-color. The fruit is usually noted as purple to black at maturity, but some collectors indicate that it is white (probably only when juvenile).

The first occurrence of the name *Tasmannia dipetala* in literature is De Candolle's reference to it, in the Prodromus, as a synonym of *T. insipida*. In transferring the species to *Drimys,* Mueller unfortunately selected the epithet *dipetala* and has been followed by many students. The correct transfer of the epithet *insipida* was apparently first made in 1906. Subsequently to Pilger's publication of the binomial *Drimys insipida,* both Druce and Domin proposed the combination as new.

Richard's description and illustration of *Tasmannia monticola* portray an apparently hermaphrodite flower, with numerous stamens and two fertile carpels. In staminate flowers of *D. insipida* one occasionally finds two carpels, but these are always sterile; the fact that Richard illustrates ovules suggests either faulty observation or a very unusual individual, since there can be no doubt of the identity of his plant with *D. insipida*.

2. **Drimys membranea** F. v. Muell. Fragm. Phyt. Austr. **5:** 175. 1866; F. M. Bailey, Syn. Queensl. Fl. 5. 1883; Parment. in Bull. Sci. Fr. & Belg. **27:** 227, 302, as *D. membranacea.* 1896; F. M. Bailey, Queensl. Fl. **1:** 18. 1899; Pilger in E. & P. Nat. Pfl. Nachtr. **2:** 108, as *D. membranacea.* 1906; F. M. Bailey, Compr. Cat. Queensl. Pl. 21. 1913.

Shrub or tree up to 15 m. high, the branchlets subterete or slightly angled, rugulose, brownish, 1.5–4 mm. in diameter near apices; leaves often more or less congested toward apices of branchlets, the petioles stout, 1–2 mm. broad, often flattened and narrowly winged, 1–7 mm. long; leaf-blades chartaceous or subcoriaceous, brownish when dried, narrowly obovate, (4–)6–13 cm. long, (1–)1.5–4.3 cm. broad, gradually attenuate at base and decurrent on the petiole, obtusely cuspidate or short-acuminate at apex, slightly recurved at margin, the costa broad, slightly raised or shallowly canaliculate above, usually subprominent beneath, the secondary nerves (5–)8–14 per side, erecto-patent at an angle of 30–45°, prominulous on both surfaces, freely anastomosing near margin, the veinlets reticulate, faintly prominulous on both surfaces; flowers single, clustered around growing point of branchlets, at length pseudolateral, subtended by bracts, these papyraceous, oblong, about 5 mm. long, soon caducous, the pedicels slender, 12–33 mm. long (sometimes shorter in pistillate plants); staminate flowers: sepals 2, submembranaceous, eglandular or obscurely yellow-glandular, suborbicular-deltoid, 4–5.5 mm. long and broad, obtuse or rounded at apex; petals 2, similar to sepals in texture, obovate-linear, about 8 mm. long and 2–3.5 mm. broad at anthesis, narrowed to base, obtuse or rounded at apex; stamens 25–35, 3- or 4-seriate, the filaments subcarnose, subterete-ligulate, obscurely yellow-glandular, 0.5–3.5 mm. long, the locules 0.7–1.3 mm. long; carpels 1 or 2 (or 3, ex Mueller), sterile, obovoid-ellipsoid, 2.5–3 mm. long at anthesis, the stigmatic ridge obvious, elongate; pistillate flowers: sepals and petals similar to staminate in texture, the sepals ovate-oblong, 3.5–6 mm. long, 2.5–3 mm. broad, the petals about 8 mm. long and 2–2.5 mm. broad; stamens none; carpel 1, ellipsoid, 2.5–4 mm. long at anthesis, short-stipitate, the stigmatic ridge obvious, extending from apex nearly to base, the ovules 14–36 (or possibly sometimes more, with some aborted); fruit 1-carpellate, oblong-ellipsoid to nearly subglobose, 6–10 mm. long and 5–7 mm. broad at maturity, rounded at base and apex, the stigmatic ridge elongate, obscure, the pericarp carnose, obscurely yellow-glandular, the seeds usually 4–7 (with many aborted), black, shining, obovoid, slightly falcate, 3–3.5 mm. long and about 2 mm. broad at maturity, subacute at base, rounded at apex.

Distribution: Eastern Queensland, from about lat. 16° to 18°, at elevations of 800–1600 m. (or perhaps occurring down to sea-level); in rain-forest or low bush, sometimes common (Kajewski).

Australia: Queensland: Thornton Peak, *Brass 2291* (A); Gadgarra, Peeramon, Atherton, *Kajewski 1065* (A, NY, UC); Mt. Bartle Frere, *Kajewski 1291* (A, NY); Bellenden Ker, near summit, *White* (A); Rockingham Bay, *Dallachy* (GH, NY).

The sepals and petals are reported as white by Brass, green by Kajewski; the mature fruit is said to be black. The young leaves, bracts, and sometimes the whole plant are often tinged with purple.

Mueller's original description is based on an apparently staminate specimen collected by Dallachy "ad fontes fluminis Mackay-River," whereas the Dallachy specimens cited above, from Rockingham Bay, are pistillate. The type specimen must have very young leaves, as none of those seen by me could be considered membranaceous. Mueller describes the petals as *2* or 3, but all my specimens have them 2.

Drimys membranea is doubtless a close relative of *D. insipida,* which it resembles in leaf-shape and texture, differing primarily in the quite different leaf-base. Both species have the sepals and petals of the pistillate flowers narrower than those of the staminate. In *D. membranea* both sepals and petals are shorter and usually proportionately narrower. The fruit of *D. membranea* appears to be consistently smaller and with fewer seeds than that of *D. insipida.*

3. **Drimys purpurascens** Vickery in Proc. Linn. Soc. N. S. Wales **62:** 78. *f. 1*; *pl. 5.* 1937; Fraser & Vickery, l. c. 288. 1937.

DISTRIBUTION: Thus far known only from a restricted area on the Mt. Royal Ranges in the vicinity of the Barrington Tops, New South Wales, at an altitude of 1350–1500 m.

AUSTRALIA: New South Wales: Barrington Tops, *Boorman* (US), *White 11472* (A).

The original description is very complete, being based upon several collections from the same locality; the type is *Fraser & Vickery* (in May, 1936). The species is readily distinguished from its allies, *D. insipida* and *D. membranea,* by its more numerous carpels and several-carpellate fruits, as well as by its usually broader leaf-blades and broad subalate petioles. White indicates that the species is very common locally in both rain-forest and *Eucalyptus* forest.

4. **Drimys lanceolata** (Poir.) Baill. Hist. Pl. **1:** 159. *f. 205–207.* 1867–69; Parment. in Bull. Sci. Fr. & Belg. **27:** *225*, as synonym. 1896; Pilger in E. & P. Nat. Pfl. Nachtr. **2:** 108. 1906; Ewart, Fl. Vict. 517. 1930; Vickery in Proc. Linn. Soc. N. S. Wales **62:** 82. 1937; Fraser & Vickery, l. c. 288. 1937.

Winterania lanceolata Poir. Encycl. **8:** 799. 1808.

Tasmannia aromatica R. Br. ex DC. Reg. Veg. Syst. Nat. **1:** 445. 1817; Deless. Ic. Sel. **1:** *22. pl. 84.* 1820; DC. Prodr. **1:** 78. 1824; Lindl. Bot. Reg. **31:** *pl. 43.* 1845; Hook. f. Fl. Tasm. **1:** 11. 1855; Miers in Ann. Mag. Nat. Hist. III. **2:** 110. 1858, Contrib. Bot. **1:** 139. 1861; Baill. Hist. Pl. **1:** 159, as synonym. 1867–69; Meredith, Bush Friends Tasm. Ser. Ult. *pl. 11.* 1891.

Drimys aromatica F. v. Muell. Pl. Indig. Col. Vict. **1:** 20. 1860; Benth. Fl. Austral. **1:** 49. 1863; F. v. Muell. Nat. Pl. Vict. **1:** 19, 187. *f. 44.* 1879, Key Syst. Vict. Pl. **2:** 6. *pl. 3.* 1885, op. cit. **1:** 121. 1888; C. Moore, Handb. Fl. N. S. Wales 13. 1893; Parment. in Bull. Sci. Fr. & Belg. **27:** *225*, 298. *pl. 11, f. 41.* 1896; Rodway, Tasm. Fl. 5. 1903; De Wildem. in Ic. Sel. Hort. Then. **5:** 127. *pl. 191.* 1906; Maiden & Betche, Census of N. S. Wales Pl. 79. 1916; Ewart, Handb. For. Trees Vict. For. 116. 1925; Johnstone in Jour. Roy. Hort. Soc. **62:** 96. *f. 25.* 1937.

Drimys aromatica var. *aromatica* Parment. in Bull. Sci. Fr. & Belg. **27:** *226.* 1896.

?*Drimys xerophylla* Parment. in Bull. Sci. Fr. & Belg. **27:** *226*, 299, ***nomen subnudum.*** 1896; Vickery in Proc. Linn. Soc. N. S. Wales **62:** 83, as synonym. 1937.

Shrub or small tree, 2–10 m. high, the branchlets subterete or slightly angled, rugulose, reddish brown or purplish, slender, 1–3 mm. in diameter toward apices; leaves scattered, the petioles rugulose, shallowly canaliculate, 2–15 mm. long, 0.7–2 mm. in diameter, often swollen at base; leaf-blades subcoriaceous or chartaceous, pale green or yellow-green when dried, oblanceolate or narrowly elliptic-obovate, (3–)4–11 cm. long, 0.6–3 cm.

broad, attenuate at base and decurrent on the petiole, obtuse or subacute at apex, narrowly recurved at margin, the costa subplane or slightly raised above, more obviously elevated beneath, the secondary nerves 3–7 per side, elongate, sharply ascending at an angle of 10–20°, inconspicuously anastomosing toward margin, immersed or prominulous above, prominulous beneath, the veinlets immersed or obscurely prominulous beneath; flowers single, aggregated around growing point of branchlets, at length pseudolateral, subtended by bracts, these papyraceous, oblong, obtuse, 4–13 mm. long, soon caducous, the pedicels slender, 8–25 mm. long (staminate flowers) or 4–12 mm. long (pistillate flowers and fruits); staminate flowers: sepals 2 (rarely 3), membranaceous, densely but obscurely pellucid-glandular, ovate-suborbicular, 3.5–6 mm. long and broad, obtuse at apex; petals 5–8, resembling sepals in texture, linear-oblong or narrowly obovate, 4–9 mm. long, 1.5–3.5 mm. broad, obtuse at apex; stamens 15–28, 2- or 3-seriate, the filaments eglandular, 0.7–3.5 mm. long, the locules ellipsoid, 0.9–1.3 mm. long, the carpel 1 (rarely 2 or perhaps 3), sterile, ellipsoid, 0.7–1 mm. long at anthesis, the stigmatic ridge obvious, occupying entire rounded apex and extending to base; pistillate flowers: sepals as in staminate or slightly narrower; petals 4 (in all available specimens), as in staminate but 3.5–5.5 mm. long and 0.7–2 mm. broad; stamens none; carpel 1 (rarely 2), subglobose or ellipsoid, about 1.5 mm. in diameter at anthesis, rounded at base and apex, the stigmatic ridge extending over apex and along entire ventral edge, the ovules 10–18; fruit 1-carpellate, oblong-subglobose or subglobose, often appearing obscurely bilobed, 5–10 mm. long and 5–8 mm. broad at maturity, rounded at base and apex, the stigmatic ridge elongate, the pericarp subcarnose, rugulose, obscurely yellow-glandular, the seeds 6–18, dark castaneous or black, shining, obovoid, strongly falcate, 2.5–3.5 mm. long, 1.3–2 mm. broad, acute at base, rounded at apex.

DISTRIBUTION: New South Wales, Victoria, and Tasmania, extending southward from about lat. 31°, at elevations up to 1200 m. in the north, occurring down to sea-level in Tasmania; usually found in wet forest in New South Wales and Victoria; abundant in Tasmania and forming dense thickets on margins of streams in rich humid soil.

AUSTRALIA: New South Wales: Hastings River, *Moore* (GH); Braidwood, *Baker* (US); Sugarloaf Mt., Braidwood, *Boorman* (US); Bago, *de Beuzeville 201* (A); Tumbarumba, *Cambage* (GH); Victoria: *Kuntze 20113* (NY); Mt. Baw Baw, *Melvin* (GH); Mt. Mueller, near Mt. Baw Baw, *Mueller* (GH); Tasmania: *R. Brown s. n.* or *2918* (type coll. of *Tasmannia aromatica,* F, GH, M, NY), *Gunn* (A, F, GH, M, US), *Archer* (GH); Golden Valley, toward Westbury Road, *Rodway 125* (A); Mt. Wellington, *Gunn 777* (GH, M), *Oldfield* (US); without definite locality: *Labillardière* (TYPE COLL., GH), *Paterson* (A).

NATIVE NAMES: *Pepper-tree, native pepper, mountain pepper, wild pepper-corn.*

Mueller describes the petals as white with a red or green streak down the middle; colored plates show the petals as white, but none of the specimens seen by me have adequate color-notes.

Many of the descriptions cited above, such as those of Hooker, Mueller, and De Wildeman, are based on a more comprehensive concept than admitted in my description; these authors include in the species material from the Victorian Alps which is much reduced in foliage and floral characters and which I describe below as *D. Vickeriana.* The species which Vickery has described as *D. stipitata* is also included in some of the early concepts of the present species, as indicated by references to the petals as 2–8 in number; I believe that *D. lanceolata* never has fewer than 4 petals. Mueller describes the ovaries as 1–11 and in some of his plates shows 4 carpels; his concept doubtless included specimens which are referable to *D. stipitata,* but even there no more than 8 carpels have otherwise been reported.

5. **Drimys stipitata** Vickery in Proc. Linn. Soc. N. S. Wales **62:** 80. *f. 2.* 1937.

Drimys aromatica var. *pedunculata* Maiden in Agric. Gaz. N. S. Wales **5:** 600 (Dorrigo For. Res. 8). 1894; Maiden & Betche, Census N. S. Wales Pl. 79. 1916.

DISTRIBUTION: Fairly common in northeastern New South Wales between about lat. 29° and 32°, at elevations of 600–1200 m., and also occurring near the boundary with Victoria perhaps at slightly higher altitudes; probably to be found elsewhere in New South Wales and in adjacent Victoria.

AUSTRALIA: New South Wales: Dorrigo Forest Reserve, Beilsdown Creek, *Maiden* in 1893 (type coll. of *D. aromatica* var. *pedunculata,* A); Dorrigo State Forest, toward Wild Cattle Creek, *White 7572* (A, NY); Mt. Kosciusko, tree-line to about 2100 m., *Maiden & Forsyth* (UC); Snowy River, *Cheel 813* (A, US).

The original description is ample and is based upon several additional collections, the type of the species being *Maiden* (in 1895), collected at Guy Fawkes. Although *D. stipitata* is scarcely distinguishable from *D. lanceolata* in foliage, the differences in number of petals and carpels, and especially in the shape of the carpels, are quite obvious. The carpels of the present species are conspicuously stipitate in fruiting specimens, and this character is also apparent in both staminate and pistillate flowers. However, there can be no doubt that *D. lanceolata* and *D. stipitata* are close relatives, and I believe that they are too far separated in Vickery's key (7: 83). The pistillate flowers, as in other Australian species, lack stamens, while carpels in the staminate flowers (1 or 2 in my material) are sterile.

6. **Drimys Vickeriana** sp. nov. FIG. 3, a-e.

Drimys aromatica var. *alpina* Parment. in Bull. Sci. Fr. & Belg. **27:** 226, 300, *nomen subnudum.* 1896.

Drimys lanceolata var. *parvifolia* Vickery in Proc. Linn. Soc. N. S. Wales **62:** 83. 1937.

Frutex compactus, ramis crassis multiramulosis, ramulis subteretibus cinereis apicem versus 1–3 mm. diametro cicatricibus foliorum delapsorum copiose ornatis; foliis dense congestis, petiolis rugulosis semiteretibus 1–3 mm. longis 0.8–1 mm. diametro, laminis coriaceis siccitate fuscis oblongis vel anguste ellipticis, 8–16 mm. longis, 2–5 mm. latis, basi acutis vel attenuatis, apice obtusis vel rotundatis, margine anguste recurvatis, costa supra obscura vel leviter insculpta subtus plana vel minute elevata, nervis secundariis utrinsecus circiter 3 adscendentibus utrinque immersis vel supra inconspicue impressis, venulis obscuris; floribus singulis aggregatis terminalibus demum pseudolateralibus, bracteis submembranaceis pellucido-glandulosis obovatis, 3–4 mm. longis, 2–2.5 mm. latis, apice rotundatis, mox caducis; pedicellis gracilibus teretibus 3–5 mm. longis; floribus ♂ solis visis: sepalis 2 submembranaceis eglandulosis suborbicularibus 2.5–3 mm.

diametro, apice rotundatis; petalis 2 submembranaceis obovato-oblongis, sub anthesi 2.5–3 mm. longis et circiter 1 mm. latis, apice rotundatis; staminibus 10–12, 2-seriatis, filamentis subteretibus eglandulosis 0.5–1.5 mm. longis, loculis ellipsoideis 0.6–0.8 mm. longis; carpello unico sterili ellipsoideo sub anthesi circiter 1 mm. longo, basi et apice obtuso, carina stigmatum apicali-ventrali circiter 0.5 mm. longa; fructibus 1-carpellatis subglobosis maturitate 4–5 mm. diametro, pericarpio subcarnoso ruguloso

FIG. 3. *a-e. Drimys Vickeriana,* drawn from the type: *a.* flowering branchlet, × ½; *b.* staminate flower, × 3; *c.* stamens, introrse and extrorse views, × 5; *d.* sterile carpel, × 5; *e.* sterile carpel, longitudinal section, × 5. *f-i. Drimys microphylla,* drawn from the type: *f.* flowering branchlet, × ½; *g.* staminate flower, × 2; *h.* stamens, extrorse and introrse views, × 5; *i.* sterile carpel, × 5. *j-n. Drimys obovata,* drawn from the type: *j.* flowering branchlet, × ½; *k.* young staminate flower, × 1½; *l.* mature staminate flower, × 1½; *m.* stamens, introrse and extrorse views, × 5; *n.* sterile carpel, × 5. *o, p. Drimys Brassii,* drawn from the type: *o.* fruit, showing three carpels, × 1; *p.* seed, × 5.

obscure glanduloso, seminibus circiter 3 castaneis nitidis obovoideis leviter falcatis, 2.5–3 mm. longis, 1.5–2 mm. latis, basi obtusis, apice rotundatis.

DISTRIBUTION: Southern portion of the Australian Alps, Victoria, at elevations of about 1200–1500 m.

AUSTRALIA: Victoria: Mt. Baw Baw, *Mueller* (US); Mt. Mueller, near Mt. Baw Baw, *J. G. Luehmann & C. French* in 1893 (GH, TYPE, UC), *French* in 1895 (GH, NY, UC).

No specimen is cited with Parmentier's brief note on *D. aromatica* var. *alpina,* but the specimen I have selected as the type of the new species bears this herbarium name; the type of *D. lanceolata* var. *parvifolia* is *J. Staer* in April 1911, from the Upper Yarra. In order to avoid ambiguity I have thought it better to propose the above-described entity as a new species rather than to take up one of the varietal names. The species is named for Miss Joyce W. Vickery, in recognition of her work on the Australian *Drimytes*. Additional specimens are cited with her varietal description, and she describes the leaf-blades as 8–23 mm. long, but none of those available to me exceed 16 mm.

Drimys Vickeriana is very distinct in its compact habit, small crowded leaves, small floral parts, reduced number of stamens and seeds, etc. Like *D. lanceolata*, it has a subglobose 1-carpellate fruit which is rounded at base, while it resembles *D. stipitata* in having only two petals. It appears to me to be one of the most distinct species of the genus, and I am unable to consider it merely a variety of either of its relatives.

New Guinean and Malayan species

The Section *Tasmannia* reaches its greatest development in New Guinea, in its total variability, number of species, and number of individuals. Until the extensive exploration of New Guinea began, no more than forty years ago, the genus was supposed to occur there only sparsely, as represented by a very few collections referred to *D. hatamensis* Becc. and *D. piperita* Hook. f. We are now aware that the genus is one of the predominant elements in many of the montane regions of New Guinea, having been collected at all elevations between 800 and 3800 m. Its occurrence toward the lower limit of this altitudinal belt is presumably sparse, and therefore it was not observed in quantity until explorers gained access to the interior mountains. In this treatment I am able to recognize 29 species from New Guinea, although many of these are known to me only from the original descriptions. This number contrasts with the six species known from Australia and Tasmania and the single species known from the Philippines, Borneo, Celebes, and perhaps Amboina.

Key to the New Guinean and Malayan species

Microphyllous species, probably always epiphytic, the leaf-blades 5–10 mm. long.
  Petals 2, about 3 mm. long; stamens about 8, 1- or 2-seriate; leaf-blades 5–7 mm. long .... 7. *D. vaccinioides*.
  Petals 4–6, 4–5 mm. long; stamens 14–18, usually 3-seriate; leaf-blades (5–)6–10 mm. long .... 8. *D. microphylla*
Small-leaved species, sometimes epiphytic, usually sclerophyllous, the leaf-blades (0.9–)1–4 (rarely to 5.5) cm. long.
  Leaf-blades (9–)10–18 mm. long, 4–12 mm. broad; petals 2–4, up to 8 mm. long; stamens in staminate flowers 18–27, in hermaphrodite flowers 13–18 .... 9. *D. buxifolia*.
    Doubtfully distinct from preceding .... 10. *D. Versteegii*. 11. *D. reducta*.
  Leaf-blades (1.5–)2–4(–5.5) cm. long.
    Petals none (rarely 1); stamens in staminate flowers 4–6; leaf-blades lanceolate-oblong, obtusely acuminate at apex .... 12. *D. oligandra*.
    Petals 2; stamens in staminate flowers probably 12–27; leaf-blades elliptic- or oblong-obovate, obtuse or rounded at apex.
      Leaf-blades with obvious venation, (10–)15–25 mm. broad; stamens in pistillate flowers none; petals 4–4.5 mm. long; carpels 2–4; ovules about 16 .... 13. *D. rubiginosa*.
      Leaf-blades with immersed venation.

Carpels in hermaphrodite flowers 5 or 6; stamens 20–25; leaf-blades 15–22 mm. broad .... 14. *D. pittosporoides.*
Carpels (in fruit) 1–3; seeds 15–24; petals in staminate flowers 5.5–7 mm. long; leaf-blades (4–)6–13 mm. broad .... 15. *D. Brassii.*
Petals 5 or more (rarely 4); stamens in staminate flowers 12–30 or more.
Leaf-blades fistulose, strongly revolute at margins, 1–5 mm. broad; petals 10–12, the outer ones broadest and sepaloid.................... 16. *D. fistulosa.*
Leaf-blades more or less flattened, at least 5 mm. broad.
Flowers large, the petals about 18 mm. long and 7 mm. broad; stamens in staminate flowers about 30, the carpel solitary .... 17. *D. elongata.*
Flowers smaller, the petals less than 10 mm. long.
Petals 10 or more, variable in size, the outer and inner series smaller than the middle series; stamens about 25; leaf-blades 5–10 mm. broad, with obsolete nerves................................. 18. *D. myrtoides.*
Petals 7–14; stamens in staminate flowers 19–22; leaf-blades 12–23 mm. broad .... 24. *D. arfakensis.*
Petals 4–6.
Leaf-blades obovate, about 2 cm. long and 1 cm. broad, rigidly coriaceous; petals linear-oblong or subspatulate, about 4 mm. long and 2 mm. broad .... 19. *D. parviflora.*
Leaf-blades elliptic-obovate, 1.5–3 cm. long, 1–2 cm. broad, thick-coriaceous, with reticulate-prominulous nerves; petals oblanceolate or narrowly oblong, 3-5 mm. long, about 2.5 mm. broad .... 20. *D. pachyphylla.*
Leaf-blades elongate-obovate or oblong-spatulate, 2–4 cm. long, 0.6–1.4 cm. broad, coriaceous; petals narrowly spatulate, 6–8 mm. long, 1.5–2 mm. broad .... 21. *D. Lamii.*
Large-leaved trees or shrubs, the leaf-blades usually more than 5 cm. long.
Leaves verticillate, or at least closely aggregated, in clusters of 3–6; petals 7 or 8.
Pedicels about 1 cm. long; largest petals about 6 mm. long and 1–1.7 mm. broad; leaf-blades attenuate at base .... 22. *D. verticillata.*
Pedicels 6–7 cm. long; largest petals about 14 mm. long and 5 mm. broad; leaf-blades broadly rounded at base .... 23. *D. rosea.*
Leaves alternate or subopposite, not verticillate.
Petals 5 or more (sometimes 4 in no. 25).
Flowers small, the petals 4–6 mm. long at anthesis, the stamens in staminate flowers usually 15–22.
Petals 7–14; leaf-blades obovate-lanceolate, up to 6 cm. long and 2.3 cm. broad .... 24. *D. arfakensis.*
Petals 4–6; leaf-blades narrowly oblanceolate-oblong, 6–10 cm. long, 1.3–2.5 cm. broad .... 25. *D. reticulata.*
Flowers larger, the petals 6–14 mm. long at anthesis, the stamens in staminate flowers 25–65 (or rarely more).
Leaves sessile, whitish beneath, the secondary nerves about 7 pairs; flowers large, the petals in staminate flowers 8 or 9, about 10 mm. long. .... 26. *D. grandiflora.*
Leaves petiolate (petioles at least 3 mm. long), slightly paler beneath or concolorous.
Secondary nerves and veinlets sharply insculpted above; sepals 8–10 mm. long and broad; petals 5–7 in staminate flowers, 10–14 mm. long .... 27. *D. macrantha.*
Secondary nerves and veinlets prominulous on both surfaces, rarely slightly impressed above; sepals 3–6.5 mm. long and broad (rarely to 8 mm.); petals 6–8 (–11) in staminate flowers, usually 6–12 mm. long .... 28. *D. piperita.*
Petals 2–4.
Leaf-blades narrow, 1–2.2 cm. broad, 4–8 cm. long, the veinlet-reticulation prominulous on both surfaces.

Apex of leaf-blades abruptly long-acuminate, the texture pergamentaceous; pedicels 3–4 cm. long ....29. *D. acutifolia.*
Apex of leaf-blades obtusish, the texture coriaceous; pedicels 1.8–2 cm. long ....30. *D. Beccariana.*
Apex of leaf-blades acuminate, the texture coriaceous; pedicels 1.5–1.7 cm. long ....31. *D. cyclopum.*
Leaf-blades broader, usually more than 3 cm. broad and 10 cm. long.
Leaf-blades obtuse and auriculate at base ....32. *D. densifolia.*
Leaf-blades gradually narrowed to base and decurrent on the petiole.
Veinlet-reticulation of the leaf-blades only faintly prominulous, sometimes obsolete above, the costa raised above; stamens in staminate flowers 35–55 ....33. *D. obovata.*
Veinlet-reticulation of the leaf-blades conspicuously prominulous, at least beneath; stamens in staminate flowers fewer than 35.
Leaf-blades chartaceous, the costa nearly plane or slightly impressed above; branchlets 2–4 mm. in diameter toward apex; pedicels 7–25 mm. long ....34. *D. hatamensis.*
Leaf-blades rigidly coriaceous, the costa impressed above; branchlets not more than 4 mm. in diameter toward apex; pedicels 30–35 mm. long ....35. *D. dictyophlebia.*
Leaf-blades thick-coriaceous, the nerves impressed on the upper surface; branchlets about 7 mm. in diameter toward apex; pedicels to 30 mm. long ....36. *D. coriacea.*

7. **Drimys vaccinioides** Ridley in Trans. Linn. Soc. II. Bot. **9:** 13. *pl. 1, f. 1–6.* 1916.

DISTRIBUTION: Netherlands New Guinea, known only from the type collection, made by Kloss on the Wollaston Expedition at an altitude of about 3180 m. on Mt. Carstensz.

This species and the following are sharply characterized by their small-leaved epiphytic habit and small flowers; they are quite unmistakable among the New Guinean *Drimytes.* Differences between the two species are chiefly of degree, but the fact that *D. vaccinioides* has 2 petals and *D. microphylla* 4–6 petals seems to indicate that they are not conspecific.

8. **Drimys microphylla** A. C. Sm. in Jour. Arnold Arb. **23:** 418. 1942. FIG. 3, f-i.

DISTRIBUTION: Netherlands New Guinea, known only from the type collection, *Brass 12006* (A), from the Idenburg River region at 1800 m.

9. **Drimys buxifolia** Ridley in Trans. Linn. Soc. II. Bot. **9:** 13. 1916; A. C. Sm. in Jour. Arnold Arb. **23:** 419. 1942.

Drimys hatamensis sensu F. v. Muell. in Trans. Roy. Soc. Vict. **1**(2): 1. 1889; non Becc.

DISTRIBUTION: Netherlands and British New Guinea, known from the type collection (*Kloss*, Mt. Carstensz) and *Brass 4239, 4322,* and *4602* (all A, NY) from the Central Division, British New Guinea; also collected by MacGregor (ex F. v. Muell.); alt. 2500–3680 m.

I discussed the variation in this species in 1942 and expressed doubt of the specific status of the two following entities, having seen authentic material of neither of them.

10. **Drimys Versteegii** Diels in Nova Guin. Bot. **14:** 77. 1924.

DISTRIBUTION: Netherlands New Guinea, known only from the type collection, "Hubrecht-Gruppe, auf offenem Gelände, bei 3100 m. ü. M. (Versteeg apud Pulle n. 2412 . . .)."

11. **Drimys reducta** Diels in Nova Guin. Bot. **14:** 77. 1924.

DISTRIBUTION: Netherlands New Guinea, known only from the type collection, "Gipfel des Wichmann-Berges, 3000 m . . . (Pulle n. 976)."

Diels has noted the close relationship of this species and the preceding to *D. buxifolia* Ridley. From a comparison of the original descriptions of the three entities, it is difficult to point out characters which will serve to separate them.

12. **Drimys oligandra** A. C. Sm. in Jour. Arnold Arb. **23:** 420. 1942.

DISTRIBUTION: Netherlands New Guinea, known only from the type collection, *Brass 12975* (A), from the Idenburg River region at 1300 m.

13. **Drimys rubiginosa** A. C. Sm. in Jour. Arnold Arb. **23:** 420. 1942.

DISTRIBUTION: Netherlands New Guinea, known from the type collection, *Brass 12629* (A), from the Idenburg River region at 2150 m. Probably also represented by *Brass 9104* (A) from Lake Habbema, 3225 m.

14. **Drimys pittosporoides** Diels in Nova Guin. Bot. **14:** 76. 1924.

DISTRIBUTION: Netherlands New Guinea, reported only from the type collection, *Lam 2167,* "Central-Gebirge, Fuss des Doorman-Gipfels, 3250 m. ü. M . . . "

This species is known to me only from the original description, from which I conclude that it is closely related only to the following. It is possible that the montane small-leaved species of New Guinea will prove to be less stable than supposed when ample material is available, at which time the specific lines will need reconsideration.

15. **Drimys Brassii** A. C. Sm. in Jour. Arnold Arb. **23:** 421. 1942. FIG. 3, o, p.

DISTRIBUTION: Netherlands New Guinea, in the Lake Habbema and Mt. Wilhelmina region, alt. 3000–3800 m. Represented by *Brass 9068* (TYPE), *9536, 10671, Brass & Myer-Drees 10126, 10303* (all A), and probably also by *Brass & Myer-Drees 10111* and *10309* (both A).

16. **Drimys fistulosa** Diels in Nova Guin. Bot. **14:** 78. 1924.

DISTRIBUTION: Netherlands New Guinea, reported from two collections, *Lam 1615* and *1653,* "Central-Gebirge, unterhalb des Doorman-Gipfels," alt. 3250–3500 m.

From the original description this appears to be a very distinct species, characterized by its very narrow revolute-margined leaf-blades and its numerous petals of diverse sizes.

17. **Drimys elongata** Ridley in Hook. Ic. Pl. **31:** *pl. 3051.* 1916, in Trans. Linn. Soc. II. Bot. **9:** 12. 1916.

DISTRIBUTION: Netherlands New Guinea, reported only from the collection of Kloss on Mt. Carstensz, alt. 750–1650 m. In the second publication cited it is implied that the species is represented by two collections, both apparently unnumbered.

Drimys elongata appears to be a well-marked species, by virtue of its large flowers and elongate pedicels. Its relationship is presumably with the following.

18. **Drimys myrtoides** Diels in Bot. Jahrb. **54:** 241. 1916.

DISTRIBUTION: Northeastern New Guinea, reported from several collections (by Ledermann, Schlechter, and Schultze Jena) from the Sepik region and the Torricelli Mts., at altitudes of 800–2070 m. The type collection is *Ledermann 12877.*

Drimys myrtoides is said to be characterized by its epiphytic small-leaved habit and its numerous petals of diverse sizes. One would anticipate the discovery of this species in the neighboring part of Netherlands New Guinea, but I feel reasonably sure that it is not represented in the collections of the Archbold Expeditions.

Diels has also proposed a variety *gracilis* (in Bot. Jahrb. **54**: 242. 1916), based on *Ledermann 8430* (type coll.) and *11424*, from the Sepik region at 1050 m.; it is said to be more slender ("zierlicher") in all parts than the typical form of the species.

19. **Drimys parviflora** Ridley in Trans. Linn. Soc. II. Bot. **9**: 12. 1916.
Bubbia parviflora Burtt in Hook. Ic. Pl. **34**: sub *pl. 3315*. 1936.

DISTRIBUTION: Netherlands New Guinea, recorded only from the type collection, *Kloss*, Mt. Carstensz, alt. about 2500–3330 m.

Burtt has transferred Ridley's species to *Bubbia* without comment, but the original description contains no suggestion that a species of *Bubbia* is represented. The facts that the leaves are very small (2 by 1 cm.) and that the sepals are 2 and connate seem to indicate the place of the plant in *Drimys*. However, Burtt has doubtless seen the specimen and has a good reason for his transfer; if this is correct, Ridley's description must be quite inaccurate. For the time being I treat the species on the basis of its original description, which leads me to believe that it is a close relative of the two following.

20. **Drimys pachyphylla** Diels in Nova Guin. Bot. **14**: 78. 1924.

DISTRIBUTION: Netherlands New Guinea, "Central-Gebirge, am Doorman-Gipfel, 3260 m. ü. M.," *Lam 1812*. Probably also *Lam 1707* from the same locality and altitude.

21. **Drimys Lamii** Diels in Nova Guin. Bot. **14**: 77. 1924.

DISTRIBUTION: Netherlands New Guinea, "Unterhalb des Doorman-Gipfels, an offenen Stellen oberhalb der Waldgrenze, 2900 m.," *Lam 1871;* also *Lam 1928,* same locality, alt. 2480 m.

22. **Drimys verticillata** Pulle in Nova Guin. Bot. **8**: 633. 1912; Diels in Nova Guin. Bot. **14**: 78. 1924.

DISTRIBUTION: Netherlands New Guinea, "auf dem Gipfel des Hellwig-Gebirges in c. 2000 m. ü. M.," *von Römer 1214* and *1318* (ex Pulle); same locality, alt. 1800–2600 m., *Pulle 585, 734, 735, 918* (ex Diels).

According to the descriptions, this species and the following seem well distinguished by having their leaves at least pseudoverticillate; Diels remarks that the leaves of *D. verticillata* are not strictly in whorls.

23. **Drimys rosea** Ridley in Trans. Linn. Soc. II. Bot. **9**: 11. 1916.

DISTRIBUTION: Netherlands New Guinea, recorded only from the type collection, made by Kloss on Mt. Carstensz, alt. about 3030 m.

24. **Drimys arfakensis** Gibbs, Phyt. Fl. Arfak Mts. 135. 1917; A. C. Sm. in Jour. Arnold Arb. **23**: 423. 1942.

DISTRIBUTION: Netherlands New Guinea, Arfak Mts., alt. 1800–2400 m., known from *Gibbs 5533,* the type, and *Kanehira & Hatusima 13408* (A).

Not having seen the type collection, I am not certain of the identity of the Kanehira & Hatusima plant, which differs from the description as noted in 1942. Although Gibbs states that the flowers of her specimen are staminate, the fact that she mentions the ovules and does not describe the stamens leads me to believe that she saw only pistillate flowers. The species has small flowers and comparatively small leaves, but its affinities seem to be with my large-leaved group, as indicated in my key to species.

25. **Drimys reticulata** Diels in Bot. Jahrb. **54**: 242. 1916; A. C. Sm. in Jour. Arnold Arb. **23**: 423. 1942.

DISTRIBUTION: Northeastern New Guinea, Sepik region, alt. 1400–1500 m. (*Ledermann 12433,* type coll.), and the adjacent Idenburg River region of Netherlands New Guinea (*Brass 11857, 12149, 12494* [all A]), alt. 1800–2150 m.

26. **Drimys grandiflora** Ridley in Trans. Linn. Soc. II. Bot. **9**: 11. 1916.

DISTRIBUTION: Netherlands New Guinea, reported only from the type collection, made by Kloss on Mt. Carstensz, alt. about 3200 m.

27. **Drimys macrantha** A. C. Sm. in Jour. Arnold Arb. **23**: 422. 1942.

DISTRIBUTION: British New Guinea, known only from *Brass 4519* (A, TYPE, NY), Wharton Range, Central Division, alt. 2840 m.

28. **Drimys piperita** Hook. f. in Hook. Ic. Pl. **9**: *pl. 896.* 1852; Becc. Malesia **1**: 185. 1877; Stapf in Trans. Linn. Soc. II. Bot. **4**: 128. 1894; Parment. in Bull. Sci. Fr. & Belg. **27**: 227, 302. 1896; Pilger in E. & P. Nat. Pfl. Nachtr. **2**: 108. 1906; Merr. in Philip. Jour. Sci. **1**: Suppl. 53. 1906, in Philip. Jour. Sci. Bot. **2**: 272. 1907; Merrill & Merritt in Philip. Jour. Sci. Bot. **5**: 349. 1910; Merr. Enum. Philip. Fl. Pl. **2**: 154. 1923.

Tasmannia piperita Miers in Ann. Mag. Nat. Hist. III. **2**: 110. 1858, Contrib. Bot. **1**: 140. 1861.

Drimys reticulata F. v. Muell. Pl. Indig. Col. Vict. **1**: 21, sphalm for *D. piperita.* 1860.

Dioecious shrub or small tree, up to 4 m. high or more, the branchlets subterete, striate-rugulose, 2–5 mm. in diameter near apices, dark brown or purplish, sometimes glaucous when young; leaves scattered along branchlets, the petioles rugulose, shallowly canaliculate, often narrowly winged, (5–)7–14 mm. long, usually stout, (0.5–)1–2 mm. in diameter; leaf-blades coriaceous or thin-coriaceous, often papyraceous or submembranaceous when young, dark brown or dark olivaceous when dried, often glaucous beneath and frequently with a thin wax-like coating (this smooth, dispersed-punctate, sooner or later completely lost), oblong-obovate or narrowly elliptic, (4–)6–17 cm. long, (1.5–)2.5–6(–7) cm. broad, gradually narrowed toward base and decurrent on the petiole, obtuse to gradually acuminate at apex, narrowly recurved at margin, the costa shallowly canaliculate or slightly raised and flattened above, prominent beneath, the secondary nerves (6–)10–14 per side, spreading at an angle of 45–65°, sharply raised on both surfaces or sometimes slightly impressed above, copiously anastomosing toward margin, the veinlets forming an intricate and obvious reticulum, usually sharply prominulous on both surfaces, rarely somewhat obscure or slightly impressed above; flowers usually numerous, aggregated around growing point of branchlets, at length pseudolateral, solitary or fasciculate in clusters of 2–4, subtended by bracts, these often numerous, papyraceous, oblong-deltoid, 7–15 mm. long, 3–8 mm. broad, acute, soon caducous, leaving obvious scars; pedicels slender, 10–37 mm. long; staminate flowers: sepals 2, submembranaceous, sparsely glandular, broadly elliptic or suborbicular, 4–6.5 mm. long, 3.5–6 mm. broad, obtuse or obtusely apiculate at apex; petals 6–8 (rarely to 11), membranaceous, sparsely glandular, oblanceolate, 6–12 mm. long and 1.5–4 mm. broad at anthesis, rounded or obtuse at apex; stamens 25–60, 3–5-seriate, the filaments slightly flattened, eglandular, 1–5 mm. long, the locules oblong-ellipsoid or subglobose, 0.5–1 mm. long, the connective sometimes obscurely glandular at apex; carpels 1–3, sterile, obovoid, 1.5–2 mm. long at anthesis, obtuse at apex, short-stipitate at base, the stigmatic ridge conspicuous, extending over apex and down the ventral edge nearly to base; pistillate flowers: sepals as in staminate but slightly smaller; petals 5–7, similar to those of staminate flowers but not exceeding 7.5 by 2.5 mm.; stamens none; carpels 2–5, obovoid, 2–2.5 mm. long at anthesis, similar in shape to those of staminate flowers, the ovules 12–30; fruits 1–5-carpellate, the carpels ellipsoid, at maturity 5–15 mm. long and 3–8 mm. broad, obtuse to short-stipitate at base, obtuse or rounded at apex, obviously marked by the stigmatic ridge, the pericarp carnose, the seeds usually 12–30, castaneous or black, obovoid, slightly or strongly falcate, 2–3 mm. long, 1–1.5 mm. broad, subacute at base, rounded at apex.

DISTRIBUTION: Philippine Islands, Borneo, and Celebes (also reported from Amboina by Beccari), at elevations of 1000–2900 m. (up to 3800 m. on Mt. Kinabalu); usually reported as occurring in mossy-forest and often in exposed situations. The type is from Mt. Kinabalu, Borneo.

PHILIPPINE ISLANDS: Luzon: Ilocos Norte Prov., Mt. Palimlim, *Ramos 33329* (NY), *33353* (A, GH, UC, US); Benguet Prov., *Loher 21* (M, NY, US), *Clemens 17150a* (UC); Pauai, *Santos 32050* (A, UC); Suyoc to Pauai, *Merrill 4782* (NY, US); Mt. Pulog, *Ramos & Edaño 44911* (UC); Mt. Pulogloco, *Ramos & Edaño 40407* (A, UC); Bontoc Prov., *Clemens 2326* (UC); Mt. Pukis, *Ramos & Edaño 37822* (A); Mt. Caua, *Ramos & Edaño 38017* (A, GH); Pauai Benguet to Mt. Data, *Clemens 7326* (UC); Nueva Vizcaya Prov., Mt. Alzapan, *Ramos & Edaño 45739* (UC); Nueva Ecija Prov., Mt. Umingan, *Ramos & Edaño 26297* (A, UC, US); Zambales Prov., *Ramos 5025* (NY, US); Bataan Prov., Mt. Mariveles and upper Lamao R., *Williams 745* (NY, US), *754* (GH, NY, US), *Whitford 149* (NY, US), *1103* (NY, US), *Copeland 260* (US), *Elmer 6817* (NY), *Borden 2093* (NY, US); Rizal Prov., *Loher 14054* (A), *14060* (UC), *14418* (A), Angilog, *Loher 5511* (US); Mabiluang, *Loher 14442* (A, UC); Montalban, *Loher* (UC), *12189* (A, UC); Tabayas Prov., Mt. Camatis, *Edaño 4519* (A), *4964* (A); Mt. Binuang, *Ramos & Edaño 28572* (A); Mt. Banahao, *Gates 7192* (F), *Loher 13678* (A, UC); Laguna Prov., Mt. Banahao, *Ramos 19583* (NY, US), *Sulit 30071* (UC), *Loher 5512* (US); Camarines Sur Prov., Mt. Isarog, *Edaño 76264* (NY), *76247* (NY); Mindoro: Mt. Halcon, *Merrill 6134* (NY, US); Leyte: *Wenzel 778* (A, GH, M, US); Negros: Canlaon Volcano, *Merrill 248* (US); Dumaguete, Cuernos Mts., *Elmer 9912* (A, M, NY, US); Mindanao: Bukidnon Prov., Mt. Lipa, *Edaño 38561* (A, GH, UC); Mt. Candoon, *Ramos & Edaño 38897* (A), *38905* (A, UC); Agusan Prov., Cabadbaran, Mt. Urdaneta, *Elmer 13799* (A, F, GH, M, NY, UC, US); Davao Prov., *Kanehira 2692* (NY); Mt. Apo, *Williams 2553* (A, NY), *Mearns* (US), *Copeland 1065* (US), *Elmer 11410* (M, NY, US), *Clemens 15609* (UC), *15610* (UC).

BORNEO: British North Borneo: Mt. Kinabalu, *Low* (UC, TYPE COLL.), *Clemens 10564* (A, UC), *10687* (A), *31670* (A, UC), *31950* (A, UC), *50632* (UC), *50987* (A), *Griswold 44* (A), *48* (A), *76* (A); Sarawak: Mt. Murud, *Mjoberg 101* (UC), *102* (UC); Mt. Poi, *Mjoberg 193* (A, NY, UC); Mt. Dulit, *Richards 1645* (A), *2507* (A).

CELEBES: Gowa, Lembaja, *Neth. Ind. For. Serv. 20554* (A, NY); Gowa to Mt. Lompobatang, *Neth. Ind. For. Serv. s. n.* (A).

NATIVE NAMES: In Philippine dialects, as recorded by Merrill, 1923: *Amutútin* (Igorot), *bauang* (Manobo), *inotótan* (Igorot), *lupol* (Bontok), *malagus* (Bagóbo).

The above redescription of *D. piperita,* based on abundant material, seems advisable, since the only other descriptions are those of Hooker and Miers, both based entirely on the type collection. This is the only Asiatic species of *Drimys* known to occur outside of New Guinea and Australia. In view of the great diversity of the genus in those regions, it is a striking contrast to find that the material from the Philippines, Borneo, and Celebes is remarkably constant in its salient characters. I find no basis for the further division of *D. piperita,* although two Philippine specimens not cited above (*Ramos & Edaño 30731* [A, GH, UC, US], from Mt. Madiass, Panay, and *Elmer 7747* [A, M, NY, US], from Lucban, Tayabas Prov., Luzon) appear to represent an extreme form. These specimens have unusually large sepals (up to 8 by 7 mm.), as many as 11 petals (whereas no more than 8 were found in the remaining material), which are up to 16 by 5.5 mm., and numerous stamens (up to 100). Since these two specimens are otherwise identical with the bulk of the material, it seems likely that they represent only a local and aberrant form.

The occurrence of *D. piperita* on Amboina is recorded by Beccari, whose determination is very likely correct; however, this station should be verified. It seems possible that the species will also be found on other high islands in the region. Mention of the occurrence of *D. piperita* in New Guinea probably dates from Mueller's record of it in 1889; I believe that Mueller actually had specimens of *D. hatamensis,* for no New Guinean collections referable to *D. piperita* are available to me nor were any cited by Diels.

The relationship of *D. piperita* is with the New Guinean species with large leaves and 5 or more petals, especially *D. macrantha* and *D. grandiflora,* and to a lesser extent *D. arfakensis* and *D. reticulata.* Of these New Guinean species, only *D. macrantha* is sufficiently similar to *D. piperita* to cause any doubt of its specific status; for the time being I believe that these two species are amply distinguished, but it must be kept in mind that the interior of New Guinea is still largely unknown and that future collections may cause students to extend the range of *D. piperita* to that island.

Collectors of material of *D. piperita* have indicated that the petals are white, the stamens yellow, and the fruit at first red, finally black, with a deep purple bitter juice.

29. **Drimys acutifolia** Pulle in Nova Guin. Bot. **8**: 633. 1912; Diels in Nova Guin. Bot. **14**: 76. 1924.

Distribution: Netherlands New Guinea, "Vorgebirge des Hellwig-Gebirges (Erica-Gipfel) in c. 1400 m. ü. d. M.," *von Römer 1044* and *1045* (ex Pulle); "Perameles-Gebirge, 1100 m. ü. M.," *Pulle 482* and *483* (ex Diels).

This species and the two following, according to the descriptions, appear to differ from each other in minor characters only. A comparison of the various collections is highly desirable.

30. **Drimys Beccariana** Gibbs, Phyt. Fl. Arfak Mts. 133. *f. 9.* 1917; Diels in Nova Guin. Bot. **14**: 75. 1924.

Distribution: Netherlands New Guinea, reported only from the Arfak Mts. as represented by *Gibbs 5651* (type coll.) and *Gjellerup 1204,* alt. 2500–2700 m.

31. **Drimys cyclopum** Diels in Nova Guin. Bot. **14**: 76. 1924.

Distribution: Netherlands New Guinea, apparently known only from the type collection, *Gjellerup 549,* from the Cyclops Mts., alt. 1800 m.

Reports of this species from British New Guinea are referred to *D. hatamensis* Becc.

32. **Drimys densifolia** Ridley in Trans. Linn. Soc. II. Bot. **9:** 12. 1916.

DISTRIBUTION: Netherlands New Guinea, recorded only from the type collection, made by Kloss on Mt. Carstensz, alt. about 3175–3330 m.

This species is presumably amply differentiated from its allies by having its leaf-blades obtuse and auriculate at base, somewhat like those of the Australian *D. insipida* (R. Br.) Pilger, which in other respects is not a very close relative of *D. densifolia.*

33. **Drimys obovata** A. C. Sm. in Jour. Arnold Arb. **23:** 424. 1942. FIG. 3, j-n.

DISTRIBUTION: Netherlands New Guinea, vicinity of Lake Habbema and the Bele River, alt. 2200–2800 m., represented by *Brass 10567, 10570, 11295* (TYPE), and *11312* (all A).

34. **Drimys hatamensis** Becc. Malesia **1:** 185. 1877; Parment. in Bull. Sci. Fr. & Belg. **27:** *227*, 301. *pl. 10, f. 38.* 1896; Pilger in E. & P. Nat. Pfl. Nachtr. **2:** 108. 1906; Diels in Bot. Jahrb. **54:** 242. 1916; A. C. Sm. in Jour. Arnold Arb. **23:** 425. 1942.

Drimys piperita sensu F. v. Muell. in Trans. Roy. Soc. Vict. **1**(2): 1. 1889; non Hook. f.

Drimys cyclopum sensu Lane-Poole, Rep. For. Res. Papua 86. 1925; White & Francis in Proc. Roy. Soc. Queensl. **38:** 228. 1927; non Diels.

DISTRIBUTION: Netherlands, Northeastern, and British New Guinea. The type is a Beccari collection from the Arfak Mts. at 2000 m.; also from the Arfak Mts. are *Kanehira & Hatusima 13785* and *13935* (both A). For the probable occurrence of this species elsewhere in New Guinea and discussions of its status, see Diels in 1916 and my notes in 1942.

35. **Drimys dictyophlebia** Diels in Nova Guin. Bot. **14:** 75. 1924.

DISTRIBUTION: Netherlands New Guinea, represented by the type collection, *Pulle 845,* from the Hellwig Mts. at 1900 m., and probably also by *Brass 13704* (A), from the Idenburg River region at 700 m.

36. **Drimys coriacea** Pulle in Nova Guin. Bot. **8:** 634. 1912; Diels in Nova Guin. Bot. **14:** 75. 1924.

DISTRIBUTION: Netherlands New Guinea, Hellwig Mts., alt. 2000–2600 m., *von Römer 1209, 1281* (ex Pulle), *Pulle 577, 595, 958, 959* (ex Diels).

According to the original description, this species is amply characterized by its thick-coriaceous leaves and very stout branchlets.

OLD WORLD SPECIES OF DRIMYS EXCLUDED FROM THE GENUS

Many workers in this group have accepted *Drimys* in a very broad sense, taking its limits to be essentially those of the family. Therefore, practically all of the early species were first described in *Drimys;* these binomials are referred to the appropriate species of the other five genera in the following pages. The species listed immediately below, however, should apparently be removed from the family altogether.

DRIMYS MUELLERI Parment. in Bull. Sci. Fr. & Belg. **27:** *227*, 300. *pl. 10, f. 36, 37, nomen subnudum.* 1896; Vickery in Proc. Linn. Soc. N. S. Wales **62:** 83. 1937.

Drimys intermedia Parment. in Bull. Sci. Fr. & Belg. **27:** *223*, 224, sphalm for *D. Muelleri.* 1896; Vickery in Proc. Linn. Soc. N. S. Wales **62:** 83. 1937.

The secondary wood of this species does not suggest a species of *Drimys,* as pointed out by van Tieghem (6: 284).

DRIMYS OBLONGA S. Moore in Jour. Bot. **55:** 302. 1917 = **Hypsophila Halleyana** F. v. Muell. (Celastraceae), according to Dandy in Jour. Bot. **71:** 45. 1933.

2. BUBBIA

Bubbia v. Tiegh. in Jour. de Bot. **14**: 278, 293. 1900; Pilger in E. & P. Nat. Pfl. Nachtr. **2**: 108. 1906; Hutchinson in Kew Bull. **1921**: 190. 1921; Dandy in Jour. Bot. **72**: 40. 1934; Vickery in Proc. Linn. Soc. N. S. Wales **62**: 83. 1937.

Bubbia Sect. *Eububbia* v. Tiegh. in Jour. de Bot. **14**: 294. 1900; Pilger in E. & P. Nat. Pfl. Nachtr. **2**: 109. 1906.

Bubbia Sect. *Monoclada* v. Tiegh. in Jour. de Bot. **14**: 294. 1900; Pilger in E. & P. Nat. Pfl. Nachtr. **2**: 109. 1906.

Bubbia Sect. *Diploclada* v. Tiegh. in Jour. de Bot. **14**: 294. 1900; Pilger in E. & P. Nat. Pfl. Nachtr. **2**: 109. 1906.

Tetrathalamus Lauterb. in K. Schum. & Lauterb. Fl. Deutsch. Schutzg. Südsee Nachtr. 319. 1905; Engl. in E. & P. Nat. Pfl. ed. 2. **21**: 229. 1925.

Bubbia is here interpreted to include 30 species, which are distributed eight in New Caledonia, one in Lord Howe Island, two in Queensland, and nineteen in New Guinea. The first species referable to the group was described in 1869 by Mueller (*Drimys Howeana*) and this is also the genotype. The genus is readily separated from *Drimys* on characters pertaining to the calyx, from *Zygogynum* by its separate carpels, from *Pseudowintera* by its terminal inflorescence, from *Belliolum* by its stamens, and from *Exospermum* by its placentation and free carpels (which are rarely appressed-contiguous in young flowers). In many respects *Bubbia* appears to have retained the hypothetical primitive characters of the family better than the other genera, although its carpellary characters are diverse and probably more highly evolved than those of *Drimys* Sect. *Tasmannia*.

Van Tieghem's three sections are based on the greater or lesser degree of branching of the primary rays of the inflorescence, a character which appears of no more than specific value. I find it impossible to propose sectional segregations within the genus, as the inter-relationships of the various species are highly complex. Possibly a classification may eventually be based upon characters of the carpel, such as the position and extent of the stigmatic ridge and the extent of placental areas. The key to the New Guinean species proposed below is entirely artificial.

Species of New Caledonia and Lord Howe Island

On the basis of herbarium material available in America, it is impossible properly to evaluate the eight species of *Bubbia* reported from New Caledonia and the species from Lord Howe Island. The original descriptions of these species are for the most part inadequate, and a consideration of their status must await examination of the collections in the herbaria at Paris and the British Museum. However, a few brief notes on these entities are given below, in order to bring together references to literature. For lack of a better method, I discuss the names in chronological order.

1. **Bubbia Howeana** (F. v. Muell.) v. Tiegh. in Jour. de Bot. **14**: 293. 1900; Pilger in E. & P. Nat. Pfl. Nachtr. **2**: 109. 1906; Vickery in Proc. Linn. Soc. N. S. Wales **62**: 84. 1937.

Drimys Howeana F. v. Muell. Fragm. Phyt. Austral. **7**: 17. 1869; Parment. in Bull. Sci. Fr. & Belg. **27**: 230, 307. 1896.

Drimys insularis Baill. ex F. v. Muell. Fragm. Phyt. Austral. **9**: 76, *nomen*. 1875; Parment. in Bull. Sci. Fr. & Belg. **27**: 230, 307, as synonym. 1896.

Bubbia Muelleri v. Tiegh. in Jour. de Bot. **14**: 293, *nomen*. 1900; Pilger in E. & P. Nat. Pfl. Nachtr. **2**: 109, *nomen*. 1906.

DISTRIBUTION: Lord Howe Island; type collected by C. Moore.

I have seen no material of *Bubbia* from Lord Howe Island, and the original description of *Drimys Howeana* by Mueller does not permit the accurate placing of the species, although its generic identity is beyond doubt. This species was selected by van Tieghem as the type of *Bubbia*. *Drimys insularis* has never been adequately described, and I do not question Vickery's reference (7: 84) of it to synonymy under *Bubbia Howeana*. *Bubbia Muelleri* was named, but not described, by van Tieghem on the basis of Mueller's discussion (Fragm. Phyt. Austral. **7**: 17. 1869) of a second plant from Lord Howe Island, known in fruit only and said by Mueller to be perhaps conspecific with *Drimys Howeana*. The name *Bubbia Muelleri* has no status of consequence, and until collections offer proof to the contrary, one may assume that there is only one species of *Bubbia* on Lord Howe Island.

2. **Bubbia Balansae** (Baill.) v. Tiegh. in Jour. de Bot. **14**: 293. 1900; Pilger in E. & P. Nat. Pfl. Nachtr. **2**: 109. 1906.

Drimys Balansae Baill. in Adansonia **10**: 335. 1873; Guillaumin in Ann. Mus. Col. Marseille II. **9**: 95. 1911.

DISTRIBUTION: New Caledonia, apparently known only from the type collection, *Balansa 1844*, from Mt. Humboldt, alt. 1100 m.

Van Tieghem (6: 294) proposes his Sect. *Monoclada* on this species alone. The species is said to be characterized by its very small leaves and flowers and the small number of its inflorescence-rays, each of which bears only two flowers at its summit.

3. **Bubbia Deplanchei** v. Tiegh. in Jour. de Bot. **14**: 293. 1900; Pilger in E. & P. Nat. Pfl. Nachtr. **2**: 109. 1906.

Drimys Deplanchei Vieill. ex v. Tiegh., l. c., as synonym.

DISTRIBUTION: New Caledonia, thus far reported only from the type collection, *Vieillard 2279*, from Wagape.

This species is briefly characterized by van Tieghem as having its flowers arranged in a simple umbel; it was the only species of the genus known to him with this character and he placed it alone in his Sect. *Eububbia*. This choice of a sectional name is unfortunate, since elsewhere (6: 278) van Tieghem clearly states that the type-species of the genus *Bubbia* is *B. Howeana*.

4. **Bubbia auriculata** v. Tiegh. in Jour. de Bot. **14**: 293. 1900; Pilger in E. & P. Nat. Pfl. Nachtr. **2**: 109. 1906; A. C. Sm. in Jour. Arnold Arb. **23**: 438. 1942.

Drimys amplexicaulis Vieill. ex Parment. in Bull. Sci. Fr. & Belg. **27**: 231, 308. *pl. 10, f. 34, nomen subnudum*. 1896; Vieill. ex v. Tiegh. in Jour. de Bot. **14**: 293, as synonym. 1900; Bak. f. in Jour. Linn. Soc. Bot. **45**: 267. 1921.

Bubbia amplexicaulis Dandy in Jour. Bot. **72**: 40. 1934; Burtt in Hook. Ic. Pl. **34**: sub *pl. 3315*. 1936.

DISTRIBUTION: New Caledonia, reported from the type collection, *Vieillard 2280* (GH) from Wagape, and also from *Compton 1551* (ex Bak. f.) or *1581* (ex Dandy) from Ignambi.

This is one of the species which Burtt (1) believes to weaken the generic distinctions between *Bubbia* and *Belliolum*. I have recently (3: 438) discussed the points raised by him and also questioned Dandy's acceptance of Parmentier's specific epithet. *Bubbia auriculata* is readily distinguished by its long narrow subsessile leaf-blades with auriculate subamplexicaul bases.

5. **Bubbia heteroneura** v. Tiegh. in Jour. de Bot. **14:** 294. 1900; Pilger in E. & P. Nat. Pfl. Nachtr. **2:** 109. 1906.

Drimys heteroneura v. Tiegh. ex Bak. f. in Jour. Linn. Soc. Bot. **45:** 267. 1921.

DISTRIBUTION: New Caledonia, recorded by van Tieghem from *Vieillard 20* (type coll.) and *Deplanche 293,* both from Puepo; doubtfully reported by Baker from *Compton 1130* from Mt. Canala.

Van Tieghem's description is very inadequate, but, since he mentions a few details of the leaf and cites specimens, the publication must be considered valid.

6. **Bubbia isoneura** v. Tiegh. in Jour. de Bot. **14:** 294. 1900; Pilger in E. & P. Nat. Pfl. Nachtr. **2:** 109. 1906.

DISTRIBUTION: New Caledonia, reported only from the type collection, *Vieillard 17* (GH), from Wagape.

From the original brief descriptions of the two species, this and *B. heteroneura* appear to be weakly differentiated. Burtt (1) has reduced *B. isoneura* to *Bubbia crassifolia* (i.e. *Belliolum crassifolium*). The available type duplicate of *Bubbia isoneura* bears very young fruiting carpels, in which the ovules are aggregated in two closely appressed rows corresponding to the obliquely ventral stigmatic ridge. In this character, therefore, the plant would appear to be properly placed in *Bubbia,* although verification from staminal characters is desirable. In the carpels of *Belliolum crassifolium,* as represented by *Schlechter 15348,* the ovules are in two rows which are slightly removed laterally from the ventral suture of the carpel. This tendency is probably characteristic of *Belliolum,* to which, on the basis of its stamens, *Schlechter 15348* belongs. The two specimens under discussion show slight intangible differences in foliage; on the basis of the evidence now available I cannot agree with Burtt's reduction, and therefore I list *Bubbia isoneura* as an independent species.

7. **Bubbia Comptonii** (Bak. f.) Dandy in Jour. Bot. **72:** 41. 1934.

Drimys Comptonii Bak. f. in Jour. Linn. Soc. Bot. **45:** 267. 1921.

DISTRIBUTION: New Caledonia, reported only from the type collection, *Compton 1815,* from Mt. Panié, alt. 750–1200 m.

In describing three new species of this complex from New Caledonia, Baker, although his descriptions are fairly complete, omits the staminal details which are necessary to distinguish species of *Bubbia* from those of *Belliolum*. In transferring the specific epithets to *Bubbia,* Dandy has doubtless considered this point and has found that Baker's species belong in *Bubbia* in van Tieghem's original sense, not as later expanded by Burtt. It is significant that Baker does not compare any of his three species with any of van Tieghem's; consequently one should see type material of all the New Caledonian species before reaching conclusions as to their specific status.

According to the original description, *B. Comptonii* is characterized by having its stamens often reduced to 3 and its carpel usually solitary.

8. **Bubbia odorata** (Bak. f.) Dandy in Jour. Bot. **72:** 41. 1934.
Drimys odorata Bak. f. in Jour. Linn. Soc. Bot. **45:** 268. 1921.

DISTRIBUTION: New Caledonia, reported only from the type collection, *Compton 1982* (ex Baker) or *1983* (ex Dandy), from Tonine, alt. above 750 m.

Baker remarks, "The noticeable features of this species are the oblanceolate glabrous leaves with a thick midrib, the flowers with a strong sweet scent, the petals being white with a purple patch towards the base, the generally 5 stamens and 2 carpels."

9. **Bubbia pauciflora** (Bak. f.) Dandy in Jour. Bot. **72:** 41. 1934.
Drimys pauciflora Bak. f. in Jour. Linn. Soc. Bot. **45:** 268. 1921.

DISTRIBUTION: New Caledonia, reported only from the type collection, *Compton 1761* (ex Baker) or *1768* (ex Dandy), from Mt. Panié, alt. about 450 m.

Baker remarks, "Easily distinguished by the slender leaves much attenuate below, with very slender indistinct lateral nerves, the few flowers on long pedicels, and generally 3 carpels."

AUSTRALIAN SPECIES

The genus *Bubbia* apparently has a very limited range in Australia, thus far being known only from eastern Queensland approximately between latitudes 16° and 18°. To the single species previously reported from this region, *B. semecarpoides,* I here add a second, which is probably a montane derivative from a common ancestor. The two species are essentially similar in fundamental details, but I believe that the points brought out in the following key are of specific value. The specimen from Bellenden Ker which Domin refers to *Drimys semecarpoides* should be re-examined in comparison with my new species. As the descriptions of Mueller and Bailey are incomplete, I have redescribed *B. semecarpoides* from more recent material.

The two Australian species do not show a close affinity to any of the New Guinean species, having floral characters somewhat resembling those of *B. oligocarpa* (Schlecht.) Burtt and its allies, but in foliage they are more suggestive of some of the New Caledonian species.

KEY TO THE AUSTRALIAN SPECIES

Petioles stout, 2–3 mm. in diameter, 15–27 mm. long; leaf-blades 12–20 cm. long, 3–7 cm. broad, the costa impressed above; inflorescence compound, the primary rays 2- or 3-flowered; stamens 25–32; carpels 5–8 per flower, the ovules 10–16; seeds usually 10–12 at maturity .... 10. *B. semecarpoides.*

Petioles slender, 1–1.5 mm. in diameter, 5–20 mm. long; leaf-blades 6–12 cm. long, 1.5–4.5 cm. broad, the costa subplane above; inflorescence simple, the flowers rarely paired on short peduncles; stamens 18 or 19; carpels 3 or 4 per flower, the ovules 7–10; seeds 3–6 at maturity .... 11. *B. Whiteana.*

10. **Bubbia semecarpoides** (F. v. Muell.) Burtt in Hook. Ic. Pl. **34:** sub *pl. 3315.* 1936.
Drimys semecarpoides F. v. Muell. in Vict. Nat. **8:** 15. 1891, in Bot. Centralbl. **46:** 204. 1891; F. M. Bailey, Queensl. Fl. **1:** 19. 1899, Compr. Cat. Queensl. Pl. 21. 1913; Domin in Bibl. Bot. **22**[Heft 89]: 115. 1925.

Tree to 20 m. high, the branchlets stout (4–7 mm. in diameter toward apices), subterete, brownish or cinereous; leaves aggregated toward apices of branchlets, the petioles rugulose, semiterete, 15–27 mm. long, stout (2–3 mm. in diameter), the leaf-blades subcoriaceous or chartaceous, dark olivaceous or brownish when dried, concolorous or conspicuously glaucous beneath, oblong- or elliptic-obovate, 12–20 cm. long, 3–7 cm. broad, gradually narrowed to an attenuate base and decurrent on the petiole, rounded or broadly obtuse at apex, narrowly recurved at margin, especially toward base, finely rugulose on both surfaces, the costa impressed above, prominent beneath, the secondary nerves 10–18 per side, erecto-patent at an angle of 45–60°, obscurely anastomosing toward margin, slightly prominulous on both surfaces or nearly obscure, the veinlets immersed; inflorescence pseudoterminal, sessile, the primary rays apparently about 4, 2.5–8 cm. long including flowers or fruits, once- or rarely twice-branched, 2- or 3-flowered, granular-papillose, the bracts and bracteoles soon caducous, the pedicels 3–5 mm. long before anthesis, up to 15 mm. long in fruit; calyx papyraceous, rotate, deeply 2–4-lobed, the lobes sparsely glandular, ovate-deltoid, 2–3 mm. long and broad, obtuse; petals immature in our specimen (coll. White) but apparently several, carnose; stamens 25–32, 2- or 3-seriate, up to 1.3 mm. long (immature), the filaments subcarnose, flattened, broadened distally, sparsely yellow-glandular, the locules apical, obliquely horizontal, 0.3–0.5 mm. long; carpels 5–8, obovoid, 1.5–2 mm. long slightly before anthesis, contracted toward base, the stigmatic ridge subapical, 0.3–0.6 mm. long, the ovules 10–16, on short ventral-apical placentas; carpels in fruit 5–8, usually 3 or 4 maturing, the others abortive, occasionally only 1 maturing; mature carpels obovoid, up to 12 mm. long (excl. stipe) and 10 mm. broad, the basal stipe stout, about 2 mm. thick and long, the apex rounded, the stigmatic ridge inconspicuous, subapical; pericarp coriaceous, 1–1.5 mm. thick, obscurely rugulose without; seeds usually 10–12 at maturity, closely appressed, oblong-obovoid, slightly falcate, about 5 mm. long and 2.5 mm. thick, subacute at base, rounded at apex.

Distribution: Northeastern Queensland, apparently limited to the region from the Atherton Tableland to the vicinity of Rockingham Bay, lat. about 17–18°, at altitudes up to 700 m. The type was collected by W. Sayer on "Russell's Creek," a locality I have not located on modern maps but which is probably near Rockingham Bay. Other collections from this region which have been cited by Bailey and Domin were made by Dallachy, W. Hill, and Domin, the latter from Bellenden Ker.

Australia: Queensland: Boonjie, Atherton Tableland, *White* (A); East Malanda, Atherton Tableland, *Kajewski 1216* (A, NY) (common in rain-forest).

Although I have not seen authentic material of Mueller's species, it is obvious from his original description that he had the large-leaved species described above and not the following.

11. **Bubbia Whiteana** sp. nov. Fig. 4, a-f.

Arbor ad 8 m. alta, ramulis subteretibus brunneis crassis, apicem versus 3–4 mm. diametro; foliis secus ramulos copiose dispersis; petiolis rugulosis semiteretibus 5–20 mm. longis, 1–1.5 mm. diametro; laminis coriaceis siccitate olivaceis, utrinque conspicue rugulosis, subtus plerumque glaucis, elliptico-obovatis, 6–12 cm. longis, 1.5–4.5 cm. latis, basi attenuatis et in petiolum decurrentibus, apice rotundatis vel obtusis, margine recurvatis vel conspicue revolutis, costa supra subplana subtus prominente, nervis secundariis utrinsecus 8–15 obscuris angulo 45–60° a costa abeuntibus, rete venularum immerso; inflorescentia pseudoterminali simplici, floribus 3–6 apicem ramulorum circa dispositis raro pedunculo brevi binis, pedicellis gracilibus papillosis sub anthesi 8–18 sub fructu ad 25 mm. longis; calyce papyraceo rotato profunde 2- vel 3-lobato, lobis parce glandulosis ovato-deltoideis, 2–2.5 mm. longis, 2.5–4 mm. latis, apice obtusis; petalis 6 vel 7 subcarnosis oblongis vel obovato-oblongis, apice rotundatis vel obtusis, exterioribus sub anthesi 6–6.5 mm. longis et 2.5–3.5 mm. latis, interioribus paullo minoribus; staminibus 18 vel 19, 2-seriatis, sub anthesi 1.5–2 mm.

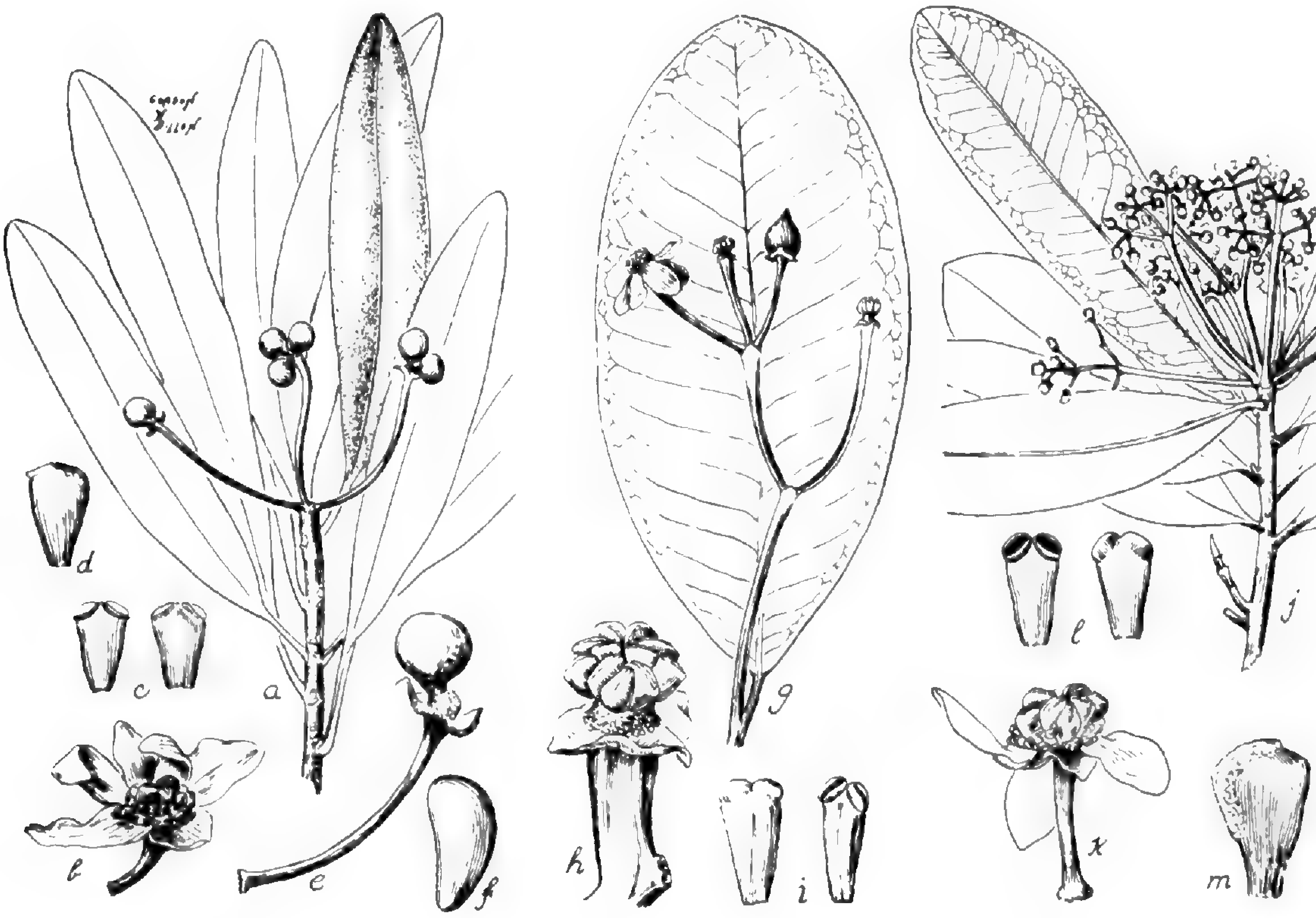

FIG. 4. *a-f. Bubbia Whiteana,* drawn from the type: *a.* fruiting branchlet, × ½; *b.* flower, with two petals removed, × 2; *c.* stamens, extrorse and introrse views, × 5; *d.* carpel, × 5; *e.* fruit, with one mature carpel, × 1; *f.* seed, × 2. *g-i. Bubbia Clemensiae,* drawn from the type: *g.* inflorescence and leaf, × ¾; *h.* flower, past anthesis, with petals and stamens fallen, × 1; *i.* stamens, introrse and extrorse views, × 3. *j-m. Bubbia Archboldiana,* drawn from the type: *j.* flowering branchlet, × ¼; *k.* flower, with two petals removed, × 1½; *l.* stamens, extrorse and introrse views, × 5; *m.* carpel, × 5.

longis, filamentis complanatis apicem versus incrassatis, loculis apicalibus 0.3–0.5 mm. longis, horizontalibus vel leviter obliquis; carpellis 3 vel 4 obovoideis sub anthesi 1.5–2 mm. longis, basi contractis, carina stigmatum subapicali 0.3–0.5 mm. longa, ovulis 7–10, placentis brevibus ventrali-apicalibus; carpellis fructiferis maturitate 1–3 subglobosis vel obovoideis, 8–11 mm. diametro, basi breviter stipitatis (stipite circiter 2 mm. longo et diametro), apice rotundatis, carina stigmatum obscura brevi subapicali, pericarpio carnoso demum coriaceo 0.5–2 mm. crasso extus obscure ruguloso, seminibus maturitate 3–6 nigris oblongo-obovoideis leviter falcatis, 4.5–5 mm. longis, 2–2.5 mm. crassis, basi obtusis, apice rotundatis.

DISTRIBUTION: Known only from the type locality in northeastern Queensland, lat. about 16° 15′.

AUSTRALIA: Queensland: Thornton Peak (Mt. Alexander), Daintree River region, alt. 1200–1350 m., *Brass 2278* (A, TYPE), Mar. 14, 1932 (small tree of the low scrubs near summit; leaves silver-gray beneath, much recurved at margin; flowers yellow, on red pedicels; fruits black), *Kajewski 1495* (A, NY) (small gnarled tree up to 8 m. high, common in poor scrub on top of mountain; leaves silver beneath; pedicels brown; petals cream-green; fruits black when ripe).

Although the new species is doubtless a close relative of *B. semecarpoides,* I believe that it is worthy of specific rank on the basis of its substantially smaller leaves, simpler inflorescence, and fewer stamens, carpels, ovules, and seeds. The species is named for Dr. C. T. White, of the Botanic Gardens of Brisbane, who has contributed much to our knowledge of Queensland plants.

New Guinean species

Bubbia apparently reaches its greatest development in New Guinea, where 19 species are now known. The total variability of the New Guinean population considerably exceeds that of the New Caledonian, as indicated in the extremes of carpel-structure, fruit-size and shape, number and surface of seeds, number of stamens, and types of foliage. Many of the New Guinean species are known from single collections, and some of these I have not seen; therefore the following key is based to a certain extent on descriptions, but in general these are ample. This treatment will need considerable revision when more ample material is available, for it seems certain that additional species will be discovered and that some of the existing ones will need amplification. *Bubbia* is less important than *Drimys* in New Guinea as an element of the vegetation, if one may judge from the existing collections. It occurs at lower elevations, usually between 400 and 2800 m., but sometimes as low as 100 m. and in one species as high as 3600 m. One may assume, from field notes, that the species are usually of scattered occurrence and are never dominant, as are certain species of *Drimys* at high elevations.

Key to the New Guinean species

Leaf-blades comparatively small, 6.5–14 cm. long, 2.5–4.5 cm. broad; inflorescence comparatively few-flowered, the primary rays simple or once- or twice-branched.
- Lateral nerves of the leaf-blades inconspicuous, prominulous or slightly prominent, the blades not bullate.
  - Inflorescence simple, about 3-flowered; calyx about 3-lobed; petals about 4 mm. long; carpel 1; leaf-blades papyraceous .... 12. *B. Ledermannii.*
  - Inflorescence once- or twice-branched, several-flowered; calyx 5–7-lobed; petals 8–11 mm. long; carpels 3 or 4, adnate at anthesis, at length free; leaf-blades thick-coriaceous .... 13. *B. pachyantha.*
- Lateral nerves of the leaf-blades strongly prominent beneath and impressed above, the blades bullate and coriaceous .... 14. *B. bullata.*

Leaf-blades larger, 14–40 cm. long, 5–14 cm. broad, rarely slightly smaller; inflorescence many-flowered, the primary rays 2- or 3-times branched (essentially simple in no. 24).
- Lateral nerves of the leaf-blades leaving the costa at an angle of 50–70(–75)°.
  - Primary lateral nerves of the leaf-blades 20–40, the blades papyraceous. .... 15. *B. polyneura.*
  - Primary lateral nerves of the leaf-blades 8–20 (about 22 in nos. 20 and 22), the blades coriaceous or chartaceous.

Flowers large, the petals usually 6 in number, 11–17 mm. long, 5–12 mm. broad; calyx irregularly 6–9-lobed; stamens 100–125, 5- or 6-seriate; primary rays of inflorescence 3 or 4 .... 16. ***B. Clemensiae.***

Flowers smaller, the petals less than 10 mm. long; calyx 2- or 3-lobed (subentire in no. 18); stamens not more than 35, usually 2- or 3-seriate.

Petals 5–10; stigma strictly apical, not extending down the ventral edge of the carpel.

Primary rays of inflorescence 1–4; petals apparently 5–8, probably not exceeding 8 mm. in length and 3.5 mm. in breadth; stamens 12–18.

Carpels 1 or 2; stamens about 17 or 18 (possibly 10–20); leaf-blades 20–30 cm. long, 7–12 cm. broad.

Calyx 3-lobed; petals 6 or 7, about 6 mm. long and 3.5 mm. broad; anther-locules obliquely apical-lateral; carpels 2 .. 17. *B. oligocarpa.*

Calyx essentially circular and entire at margin; petals 5, not more than 5 mm. long and 3 mm. broad; anther-locules horizontal; carpel solitary .... 18. ***B. monocarpa.***

Carpels 3 or 4; stamens 12–16, the anther-locules horizontal.

Leaf-blades 15–18 cm. long, 4–6 cm. broad; petals 8, the outer ones about 3.5 mm. long and 2 mm. broad; stamens about 12; carpels 4, adnate .... 19. ***B. montana.***

Leaf-blades 35–40 cm. long, 9–11 cm. broad, glaucous and farinose-ceriferous beneath; stamens 14–16; carpels 3, free; fruit subglobose, up to 3 cm. in diameter, the seeds conspicuously plicate-rugose .... 20. ***B. longifolia.***

Primary rays of inflorescence 6–8; petals 8–10, the outer ones 8–10 mm. long and about 6 mm. broad; stamens 22–35, the anther-locules horizontal; carpels 3–5, free; leaf-blades 14–22 cm. long, 5–7.5 cm. broad .... 21. *B. sylvestris.*

Petals 4 or 5 (not known in nos. 23 and 24); stigma apical and also extending at least part of the way down the ventral edge of the carpel.

Primary lateral nerves of the leaf-blades about 22; flowers small, the petals about 2 mm. long; primary rays of inflorescence 5 or 6; stamens about 20; carpels 3 or 4 .... 22. ***B. umbellata.***

Primary lateral nerves of the leaf-blades 8–15; flowers larger, the petals probably at least 5 mm. long.

Petioles (0.8–)1–2 cm. long; stigmatic ridge inconspicuous, apparently occupying less than half of both apical and ventral faces of carpel, 3–5 mm. long in fruit; seeds 2–11; rays of inflorescence 3–6.

Leaf-blades coriaceous, the veinlets usually immersed; rays of fruiting inflorescence 2- or 3-times branched; carpels 4–6 .... 23. *B. idenburgensis.*

Leaf-blades chartaceous, the veinlets usually prominulous on both surfaces; rays of fruiting inflorescence essentially simple or once-branched; carpels probably 2 in flower, often solitary in fruit .... 24. ***B. glauca.***

Petioles usually less than 1 cm. long; stigmatic ridge elongate, occupying most of both apical and ventral faces of carpel.

Primary rays of inflorescence 6–11; carpels 9 or 10; stigmatic ridge occupying about ⅔ of both apical and ventral faces of carpel; locule straight, the ovules about 16, biseriate .. 25. *B. Archboldiana.*

Primary rays of inflorescence 3–5; carpel 1; stigmatic ridge extending along entire apical and ventral faces of carpel; locule sharply curved, the ovules 50 or more, several-seriate; fruit to 4 cm. by 5 cm., the seeds numerous .... 26. ***B. megacarpa.***

Lateral nerves of the leaf-blades widely spreading, leaving the costa at an angle of 70–85°; venation conspicuous on both surfaces; stigmatic ridge strictly apical.

Petioles 1–1.8 cm. long; leaf-blades comparatively narrow, 4–6.5 cm. broad, the primary lateral nerves 15–20 per side; rays of inflorescence 10–13 .... 27. *B. argentea.*
Petioles longer, 1.5–3 cm. long; leaf-blades broader, 6–14 cm. broad, the primary lateral nerves more than 20; rays of inflorescence apparently less than 8.
Leaf-blades oblanceolate, 6–10 cm. broad, the primary lateral nerves 25 or fewer per side; petioles 1.5–2.5 cm. long.
Primary rays of inflorescence stout, to 12 cm. long; stamens 25–30; petals 8–10 mm. long .... 28. *B. calothyrsa.*
Primary rays of inflorescence slender, 12–15 cm. long; stamens 12–22; petals 5–7 mm. long .... 29. *B. sororia.*
Leaf-blades oblong-elliptic, 10–14 cm. broad, the primary lateral nerves 25–35 per side; petioles about 3 cm. long; primary rays of inflorescence to 15 cm. long .... 30. *B. calophylla.*

12. **Bubbia Ledermannii** (Diels) Burtt in Hook. Ic. Pl. **34:** sub. *pl. 3315,* as *B. Ledermanni.* 1936.
Drimys Ledermannii Diels in Bot. Jahrb. **54:** 243. 1916.

DISTRIBUTION: Northeastern New Guinea, reported from *Ledermann 8990* (type coll.) and *8973,* from the Sepik region, alt. about 850 m.

13. **Bubbia pachyantha** A. C. Sm. in Jour. Arnold Arb. **23:** 428. 1942.

DISTRIBUTION: British New Guinea, known only from the type collection, *Brass 4371* (A, TYPE, NY), from Mt. Albert Edward, Central Division, alt. 3550–3600 m.

14. **Bubbia bullata** (Diels) A. C. Sm. in Jour. Arnold Arb. **23:** 426. 1942.
Drimys bullata Diels in Bot. Jahrb. **54:** 243. 1916.

DISTRIBUTION: Northeastern New Guinea, known only from the type collection, *Schultze Jena 342,* from the Kaiserin Augusta River region.

15. **Bubbia polyneura** (Diels) Burtt in Hook. Ic. Pl. **34:** sub. *pl. 3315.* 1936.
Drimys polyneura Diels in Bot. Jahrb. **54:** 244. 1916.

DISTRIBUTION: Northeastern New Guinea, reported only from the type collection, *Ledermann 8986,* from the Sepik River region, alt. about 850 m.

16. **Bubbia Clemensiae** A. C. Sm. in Jour. Arnold Arb. **23:** 431. 1942. FIG. 4, g-i.

DISTRIBUTION: Northeastern New Guinea, known only from *Clemens 4596* (A) and *5157* (A, TYPE), from the Morobe District, alt. 1750–1800 m.

17. **Bubbia oligocarpa** (Schlecht.) Burtt in Hook. Ic. Pl. **34:** sub *pl. 3315.* 1936.
Drimys oligocarpa Schlecht. in Bot. Jahrb. **50:** 71. *f. 1.* 1913; Diels in Nova Guin. Bot. **14:** 79. 1924.

DISTRIBUTION: Northeastern and Netherlands New Guinea, reported originally from *Schlechter 16470* (TYPE COLL., UC), from Wobbe, Northeastern New Guinea, alt. about 400 m., and *Moszkowski 281,* from Taua, Netherlands New Guinea. Diels adds the following records: *Lam 794, 1165,* and *1225,* from the Mamberamo region of Netherlands New Guinea, alt. about 200 m.

In keying this species I have relied upon the original description and the type collection, which has about 18 stamens. Diels reports that the Lam collections have 10–20 stamens and have leaves which are variable in width. Even including this variation in one's concept, the species remains clearly separable from its closest allies, which are the three following species in this treatment.

18. **Bubbia monocarpa** A. C. Sm. in Jour. Arnold Arb. **23:** 428. 1942.

DISTRIBUTION: Netherlands New Guinea, known only from *Kanehira & Hatusima 12105* (A, TYPE), from Dalman, inland from Nabire, alt. 400 m.

In this species and its close relatives (nos. 17–21 in my key) the stigmatic ridge is strictly apical and the ovules are pendulous.

19. **Bubbia montana** (Lauterb.) A. C. Sm. in Jour. Arnold Arb. **23:** 426. 1942.
Tetrathalamus montanus Lauterb. in K. Schum. & Lauterb. Fl. Deutsch. Schutzg. Südsee Nachtr. 319. 1905, in Bot. Jahrb. **58:** 15. *f. 4.* 1922; Engl. in E. & P. Nat. Pfl. ed. 2. **21:** *229. f. 100.* 1925; Burtt in Kew Bull. **1938:** 458. 1938.

DISTRIBUTION: Northeastern New Guinea, recorded only from the type collection, *Schlechter 13984,* from the Bismarck Mts., alt. 1200 m.

The monotypic genus *Tetrathalamus,* originally placed in the Guttiferae, was first referred to the Winteraceae by Burtt.

20. **Bubbia longifolia** A. C. Sm. in Jour. Arnold Arb. **23:** 429. 1942.

DISTRIBUTION: Netherlands New Guinea, known only from *Brass 13868* (A, TYPE), from the Idenburg River, alt. 175 m.

21. **Bubbia sylvestris** A. C. Sm. in Jour. Arnold Arb. **23:** 430. 1942.

DISTRIBUTION: Netherlands New Guinea, Morobe District, alt. 1500–1800 m., known from *Clemens 4122* (A), *4463* (A), *41142* (A, TYPE), and probably also *5008* (A) and *41800* (A) (alt. 750–1350 m.).

22. **Bubbia umbellata** (Ridley) Dandy in Jour. Bot. **72:** 41. 1934.
Drimys umbellata Ridley in Trans. Linn. Soc. II. Bot. **9:** 11. 1916.

DISTRIBUTION: Netherlands New Guinea, reported only from the type collection, made by Kloss in the Otakwa River region, south of Mt. Carstensz, alt. about 1200 m.

23. **Bubbia idenburgensis** A. C. Sm. in Jour. Arnold Arb. **23:** 432. 1942.

DISTRIBUTION: Netherlands New Guinea, Idenburg River region, alt. 900–1250 m., known from *Brass 13028* (A, TYPE) and *13313* (A).

24. **Bubbia glauca** A. C. Sm. in Jour. Arnold Arb. **23:** 433. 1942.

DISTRIBUTION: British New Guinea, known only from *Brass 7191* (A, TYPE), from the upper Fly River region, Western Division, alt. 100 m.

25. **Bubbia Archboldiana** A. C. Sm. in Jour. Arnold Arb. **23:** 433. 1942. FIG. 4, j-m.

DISTRIBUTION: Netherlands New Guinea, known only from *Brass 12712* (A, TYPE), from the Idenburg River region, alt. 2100 m.

26. **Bubbia megacarpa** A. C. Sm. in Jour. Arnold Arb. **23:** 434. 1942.

DISTRIBUTION: Netherlands New Guinea, known only from *Brass 10249* (A, TYPE), from the vicinity of Lake Habbema, alt. 2800 m.

27. **Bubbia argentea** A. C. Sm. in Jour. Arnold Arb. **23:** 436. 1942.

DISTRIBUTION: British New Guinea, known only from *Brass 4740* (A, NY, TYPE), from the Wharton Range, Central Division, alt. 2840 m.

28. **Bubbia calothyrsa** (Diels) A. C. Sm. in Jour. Arnold Arb. **23:** 427. 1942.
Drimys calothyrsa Diels in Bot. Jahrb. **54:** 244. 1916.

DISTRIBUTION: Northeastern New Guinea, reported from *Ledermann 11028* (type coll.) and *11166,* from the Sepik region, alt. 1300–1350 m.; probably also *Ledermann 12978,* from the same region, alt. 1400–1500 m.

29. **Bubbia sororia** (Diels) A. C. Sm. in Jour. Arnold Arb. **23:** 427. 1942.
Drimys sororia Diels in Bot. Jahrb. **54:** 245. 1916.

DISTRIBUTION: Northeastern New Guinea, reported from *Ledermann 11661, 11898* (type coll.), and *12141,* from the Sepik region, alt. 1900–2070 m.

30. **Bubbia calophylla** A. C. Sm. in Jour. Arnold Arb. **23:** 436. 1942.

DISTRIBUTION: Northeastern New Guinea, known only from *Clemens 5061* (A, TYPE), from the Morobe District, alt. about 1800 m.

3. BELLIOLUM

Belliolum v. Tiegh. in Jour. de Bot. **14**: 278, 330. 1900; Pilger in E. & P. Nat. Pfl. Nachtr. **2**: 109. 1906; Hutchinson in Kew Bull. **1921**: 190. 1921.

Drimys Sect. *Sarcodrimys* Baill. in Adansonia **8**: 200. 1867, Hist. Pl. **1**: 159, 160. 1867–69.

Belliolum Sect. *Monocladiscum* v. Tiegh. in Jour. de Bot. **14**: 331. 1900; Pilger in E. & P. Nat. Pfl. Nachtr. **2**: 109. 1906.

Belliolum Sect. *Dicladiscum* v. Tiegh. in Jour. de Bot. **14**: 331. 1900; Pilger in E. & P. Nat. Pfl. Nachtr. **2**: 109. 1906.

Belliolum is thus far known to be represented by eight species, four of which occur in New Caledonia and the remainder in the Solomon Islands. However, several of these species are known in fruiting condition only, and, since the distinction between *Bubbia* and *Belliolum* depends primarily upon staminal characters, there is reason to question the generic disposition of these species. The geographic distribution of *Belliolum* forms a curious contrast to that of *Bubbia;* both genera are known from New Caledonia, but the first is lacking from New Guinea and the second is lacking from the Solomons. To be sure, future collections may modify this picture, and no conclusions should be drawn from our present incomplete knowledge of this distribution.

In proposing the genus (6: 278), van Tieghem states that it is typified by two species of Baillon, *Drimys crassifolia* and *D. Pancheri,* but in a subsequent footnote (6: 331) he states that, of the four species he refers to *Belliolum,* the flowers of only *B. Pancheri* are known. It is evident, therefore, that van Tieghem's concept of *Belliolum* is based primarily upon *B. Pancheri* and that this may be designated as the type species.

The first description of a plant belonging to this group is Baillon's description of *Drimys crassifolia,* which is proposed as the type of *Drimys* Sect. *Sarcodrimys.* This fact has no bearing upon the designation of a lectotype for *Belliolum* v. Tiegh. Van Tieghem's two sections are based upon the degree of branching of the inflorescence, but this is surely merely a detail of specific value and demonstrates no basic cleavage in the genus.

Burtt (1) has discussed in some detail the reasons for his reduction of *Belliolum* to *Bubbia,* and I have elsewhere (3: 437–438) expressed the tentative opinion that the two genera are maintainable. The latter arrangement is continued in the present treatment, but the question can be finally settled only by the examination of more abundant material than is now available.

New Caledonian species

To the four species, all from New Caledonia, upon which *Belliolum* was originally based, no more from that region have been added up to the present. As I have seen type material of only one of these species, a final evaluation of them is impossible, and it is even uncertain whether all of them belong in the genus, since *Bubbia* and *Belliolum* are not positively to be distinguished in the absence of stamens. The New Caledonian species are listed in the order suggested for them by van Tieghem.

1. **Belliolum Pancheri** (Baill.) v. Tiegh. in Jour. de Bot. **14**: 330. 1900; Pilger in E. & P. Nat. Pfl. Nachtr. **2**: 109. 1906.

Drimys Pancheri Baill. in Adansonia **10:** 336. 1873; Guillaumin in Ann. Mus. Col. Marseille II. **9:** 95. 1911; Bak. f. in Jour. Linn. Soc. Bot. **45:** 267. 1921.
Bubbia Pancheri Burtt in Hook. Ic. Pl. **34:** sub *pl. 3315*. 1936.

DISTRIBUTION: New Caledonia; in the original publication Baillon cites 6 specimens (of Pancher, Vieillard, and Balansa) without indicating a type, but perhaps, because of the specific epithet, one should designate the Pancher collection ("inter sylvas, ad 300 metr. alt.") as the actual type. Guillaumin and Baker have added other specimens in their citations, but van Tieghem has definitely removed two of Baillon's original specimens from this concept and referred them to *Belliolum rivulare* and *Bubbia isoneura* respectively.

Belliolum Pancheri is the single species referred by van Tieghem to his Section *Monocladiscum,* characterized by having each ray of the inflorescence simply umbellate. Baillon's description of the stamens demonstrates beyond doubt that the species falls into *Belliolum* rather than *Bubbia.*

2. **Belliolum crassifolium** (Baill.) v. Tiegh. in Jour. de Bot. **14:** 330. 1900; Pilger in E. & P. Nat. Pfl. Nachtr. **2:** 109. 1906.
Drimys crassifolia Baill. in Adansonia **8:** 199. 1867, Hist. Pl. **1:** 159. 1867–69; Guillaumin in Ann. Mus. Col. Marseille II. **9:** 95. 1911.
Bubbia crassifolia Burtt in Hook. Ic. Pl. **34:** sub *pl. 3315*. 1936.

DISTRIBUTION: New Caledonia; the type and only specimen originally cited by Baillon is an unnumbered collection of Vieillard from Balade. Guillaumin cites nine specimens as representing this species, in complete disregard of the fact that van Tieghem, some years earlier, had cited several of them as representing three other species of *Belliolum* and *Bubbia.*

I have seen no material which I can refer with certainty to *Belliolum crassifolium. Schlechter 15348* (A, GH), which has been referred to this species by Guillaumin, Burtt, and the present writer (3: 437), does not agree in all respects with Baillon's description, but on the other hand it almost certainly represents none of the other three New Caledonian species referred to *Belliolum* in the present treatment.

3. **Belliolum Vieillardi** v. Tiegh. in Jour. de Bot. **14:** 331. 1900; Pilger in E. & P. Nat. Pfl. Nachtr. **2:** 109, as *B. Vieillardii.* 1906.
Drimys Vieillardi Baill. ex v. Tiegh. in Jour. de Bot. **14:** 331, as synonym. 1900.

DISTRIBUTION: New Caledonia; van Tieghem cites *Vieillard 16* and *47,* from Balade.

The species is said to be characterized by its stout branches and large leaves, but a comparison of van Tieghem's brief description with Baillon's description of *Drimys crassifolia* is not too convincing; a comparison of type material is obviously desirable.

4. **Belliolum rivulare** v. Tiegh. in Jour. de Bot. **14:** 331. 1900; Pilger in E. & P. Nat. Pfl. Nachtr. **2:** 109. 1906.
Drimys rivularis Vieill. ex Parment. in Bull. Sci. Fr. & Belg. **27:** *229*, 306. *pl. 10, f. 33, nomen subnudum*. 1896; Vieill. ex v. Tiegh. in Jour. de Bot. **14:** 331, as synonym. 1900.
Bubbia rivularis Burtt in Hook. Ic. Pl. **34:** sub *pl. 3315*. 1936.

DISTRIBUTION: New Caledonia; known with certainty only from the type collection, *Vieillard 2278* (F, GH), from Wagape. Parmentier has based his concept in part on a collection by Pancher (l. c. 230), which may not be conspecific with the Vieillard specimen.

The type collection bears young fruiting carpels, which are fairly numerous (5–8 per flower) and have a short subapical stigmatic ridge and ventral placentas. On the basis of the latter character, the species may fall into either *Belliolum* or *Bubbia,* and final determination must await the collection of flowering specimens. The small leaves, ascending secondaries, and large freely branching inflorescences characterize the species, which is quite distinct.

This species and the two preceding were placed by van Tieghem in his Section *Dicladiscum,* with the primary rays of the inflorescence branched twice. Actually, the inflorescence-rays of *B. rivulare* are 2, 3, or 4 times branched.

Solomon Islands species

The four species of *Belliolum* from the Solomon Islands have all been recently described. As two of them are known in fruiting condition only, a dependable key cannot at present be proposed. However, characters of foliage and fruit amply differentiate the species, and the flowers of the first two species listed below indicate that good floral characters may also be expected in the others. For discussions of specific characters, the reader is referred to my earlier treatment (3). The species of this region are all characterized by having carpels with a short apical stigmatic ridge and horizontal placentas situated near the middle; that is, the placentas do not correspond in position to the external stigmatic surface. On the basis of present evidence, I judge that the New Caledonian species have a more primitive type of carpel, with the stigmatic ridge obliquely apical and the placentas more nearly corresponding to this position. Future study may indicate these characters to be a basis for sectional differentiation.

5. **Belliolum haplopus** (Burtt) A. C. Sm. in Jour. Arnold Arb. **23:** 438. 1942.
Bubbia haplopus Burtt in Hook. Ic. Pl. **34:** *pl. 3315.* 1936.

Distribution: Solomon Islands; the type collection is *Waterhouse 90* (F, NY), from Bougainville, while other collections are *Kajewski 1658, 1994,* and *2007* (all A), from Bougainville, and *Brass 2959* (A), from Ulawa. The species occurs in rain-forest at altitudes up to 850 m.

6. **Belliolum Burttianum** A. C. Sm. in Jour. Arnold Arb. **23:** 439. 1942. Fig. 5, a-e.

Distribution: Solomon Islands, known only from the type, *Kajewski 1680* (A), from Bougainville, alt. 950 m.

7. **Belliolum gracile** A. C. Sm. in Jour. Arnold Arb. **23:** 439. 1942.

Distribution: Solomon Islands; the type is *Brass 2898* (A), from San Cristoval; other collections are *Brass 3063* and *3063A* (both A), from San Cristoval, and *Kajewski 2630* (A), from Guadalcanal. The species grows in forest at 900–1700 m.

8. **Belliolum Kajewskii** A. C. Sm. in Jour. Arnold Arb. **23:** 440. 1942.

Distribution: Solomon Islands, known only from *Kajewski 2099* (A, type), from Bougainville, and *Kajewski 2574* (A), from Guadalcanal, at altitudes of 1200–1500 m.

4. PSEUDOWINTERA

Pseudowintera Dandy in Jour. Bot. **71:** 121. 1933.

Drimys J. R. & G. Forst. Char. Gen. 83, pro parte, excl. *D. Winteri.* 1776; sensu Cheesem. Man. N. Zeal. Fl. 29. 1906, ed. 2. 455. 1925.

Wintera sensu Forst. f. Fl. Ins. Austr. Prodr. 42. 1786; v. Tiegh. in Jour. de Bot. **14:** 277, 290. 1900; Pilger in E. & P. Nat. Pfl. Nachtr. **2:** 108. 1906; Hutchinson in Kew Bull. **1921:** 190. 1921; non Murray (1784).

Drimys Sect. *Drimys* DC. Reg. Veg. Syst. Nat. **1**: 442. 1817.
Drimys Sect. *Eudrimys* DC. Prodr. **1**: 78. 1824; Baill. Hist. Pl. **1**: 158, 160. 1867–69.
Wintera Sect. *Euwintera* v. Tiegh. in Jour. de Bot. **14**: 291. 1900; Pilger in E. & P. Nat. Pfl. Nachtr. **2**: 108. 1906.
Wintera Sect. *Pleurowintera* v. Tiegh. in Jour. de Bot. **14**: 291. 1900; Pilger in E. & P. Nat. Pfl. Nachtr. **2**: 108. 1906.

The generic status of the New Zealand species of the Winteraceae has been subject to confusing vicissitudes. *Drimys* J. R. & G. Forst. was based

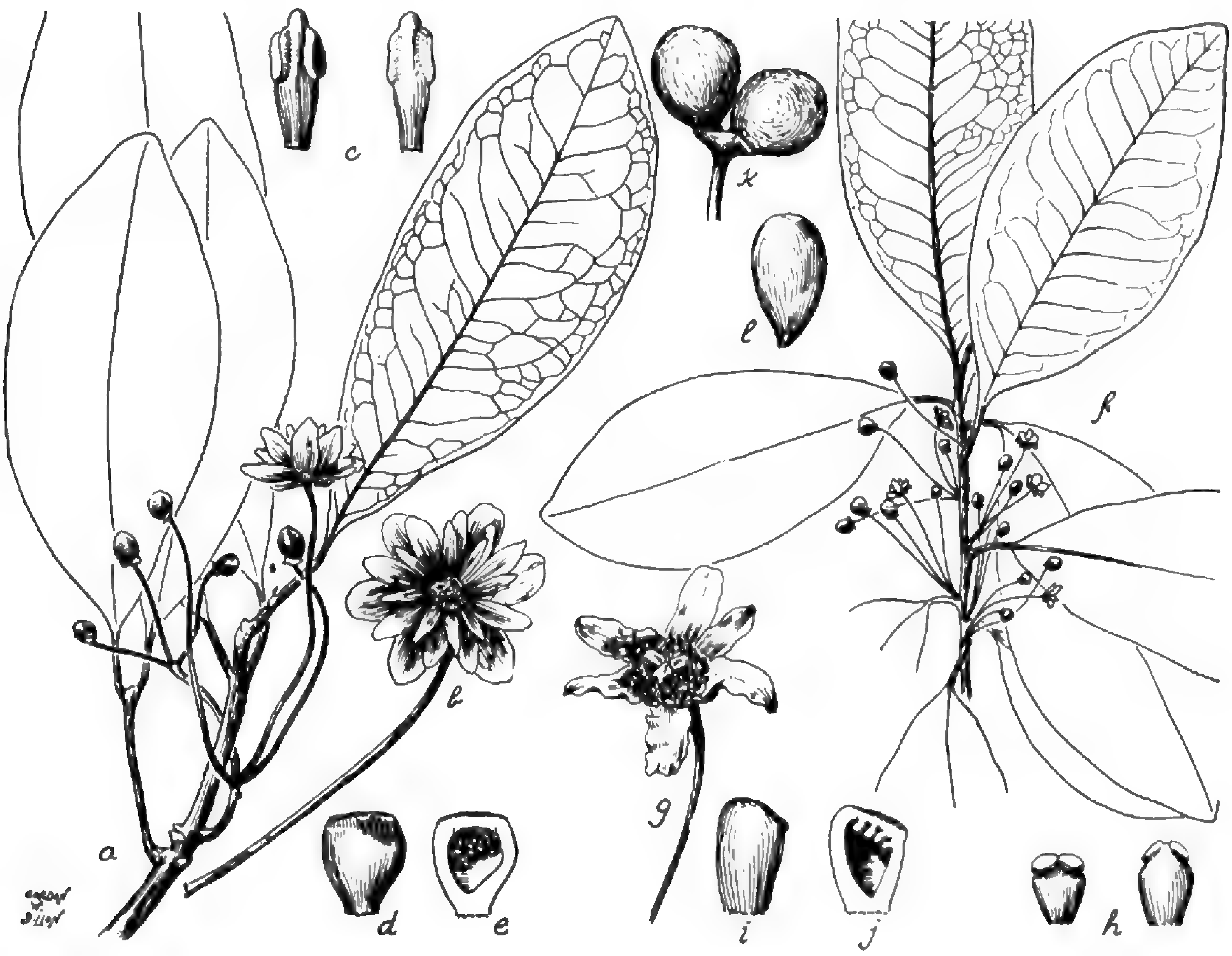

FIG. 5. *a-e. Belliolum Burttianum,* drawn from the type: *a.* flowering branchlet, × ½; *b.* flower, × ¾; *c.* stamens, extrorse and introrse views, × 5; *d.* carpel, × 3; *e.* carpel, longitudinal section, × 3. *f-j. Pseudowintera axillaris* var. *typica,* drawn from *Cheeseman* (Coromandel): *f.* flowering branchlet, × ½; *g.* flower, × 1½; *h.* stamens, extrorse and introrse views, × 5; *i.* carpel, × 5; *j.* carpel, longitudinal section, × 5. *k, l. Pseudowintera axillaris* var. *colorata,* drawn from *Cockayne 183: k.* fruit, with two mature carpels, × 1½; *l.* seed, × 3.

in part upon the New Zealand *D. axillaris,* but van Tieghem, who first definitely broke up the inclusive generic concept, took the Magellanic *D. Winteri* as the genotype, leaving the New Zealand *D. axillaris* without a generic name. The fact that De Candolle had earlier selected *D. axillaris* as representing *Drimys* Sect. *Drimys* (or Sect. *Eudrimys*) does not affect the typification of the genus. In 1786, the younger Forster, following Murray, apparently abandoned the generic name *Drimys* and took up the later *Wintera* Murr., applying it to the New Zealand species. In so doing, Forster did not propose *Wintera* as a new genus. However, van Tieghem applied to the generic concept based on *Drimys axillaris* the name "*Wintera* Forster, non Murray," remarking (6: 277) that: "Le nom de *Wintera* Murray n'existe pas." This curious conclusion does not alter the fact that *Wintera* is a direct synonym of *Drimys* and is applicable only to the concept based on *D. Winteri.* Dandy (2) has discussed the problem and has quite properly proposed the new generic name *Pseudowintera* for the New Zealand species, selecting *Drimys axillaris* as the type species.

Pseudowintera is not closely related to *Drimys,* having a type of calyx, stamen, and carpel much more suggestive of the genus *Bubbia,* which is certainly its closest ally. On floral characters it is difficult satisfactorily to separate these two genera, but the inflorescence of *Bubbia* is always terminal or pseudoterminal, the primary rays of the inflorescence (or the flowers, when these are single) being arranged around the growing point of the branchlets. When the growing point protrudes through the inflorescence, this may persist for a short while in a pseudolateral position, as in *Drimys,* but at its inception the inflorescence is essentially terminal. In *Pseudowintera,* on the other hand, the inflorescence is axillary at its inception, and flowers arise from a lateral position often on branchlets of several years' growth. Furthermore, the flowers are comparatively reduced in size and the inflorescence is greatly compacted, while the small leaves give a distinct facies to the New Zealand species. The wood-ray is of a different aspect, as will be discussed in a future consideration of intergeneric relationships.

Van Tieghem's two sections are based upon the supposed position of the inflorescence, which he states to be both axillary and terminal in Sect. *Euwintera* (as represented by *Wintera terminalis* v. Tiegh.) and only axillary in Sect. *Pleurowintera* (as represented by three other species). Dandy points out that *W. terminalis* is merely an inconsequential form of *Pseudowintera axillaris;* van Tieghem's sections have no real foundation.

Current opinion among students of this group recognizes three species, but I am unable to distinguish *Pseudowintera colorata* from *P. axillaris* as a species, and therefore I find the genus to consist of only two species, one of which has two varieties.

Key to the species

Erect bushy shrub or small tree 2–10 m. high, the branchlets cinereous or purplish or brownish; leaf-blades usually 3–11 cm. long; flowers in fascicles of 2–10, rarely solitary; petals 4–6.5 mm. long; stamens 10–18, rarely as few as 6; carpels usually 2 or 3 (rarely 1, 4, or 5) ....1. *P. axillaris.*

Compact shrub to 2 m. high, the branchlets reddish; leaves crowded, the petioles closely appressed to branchlets, the blades 2–3 cm. long; flowers often solitary, sometimes paired; petals about 3 mm. long; stamens 5 or 6; carpel solitary ..2. *P. Traversii.*

1. **Pseudowintera axillaris** (J. R. & G. Forst.) Dandy in Jour. Bot. **71:** 121. 1933.

Glabrous shrub or tree, up to 10 m. high, the branchlets subterete, rugulose, cinereous or purplish or brownish, slender, 1–3 mm. in diameter toward apices; petioles rugulose, shallowly canaliculate, 5–10 mm. long, 0.8–1.5 mm. in diameter; leaf-blades subcoriaceous, rarely subpapyraceous, olivaceous or dark brown above when dried, usually paler beneath and copiously white- or brownish-punctate, usually glaucous beneath in var. *colorata* and often coated with a smooth thin layer of wax, obovoid-elliptic or elliptic, (1.5–)3–11(–12.5) cm. long, (1–)1.5–5 cm. broad, acute at base and decurrent on the petiole, obtuse at apex, essentially plane or narrowly recurved at margin, the costa plane or slightly grooved above, prominent beneath, the secondary nerves 4–12 per side, erecto-patent, copiously anastomosing, prominulous or nearly plane above, prominulous beneath, the veinlets forming a fine reticulum, prominulous or obscure on both surfaces; inflorescences axillary or arising from defoliate branchlets, the flowers fasciculate in clusters of 2–10, rarely solitary, usually borne on pulvinate glomerules, subtended by minute deltoid subcoriaceous bracts; pedicels slender, 5–15(–21) mm. long; calyx papyraceous, essentially eglandular, rotate, 2.5–3.5 mm. in diameter, entire or irregularly crenate or shallowly 2-lobed, the lobes broadly ovate, up to 1.5 mm. long and 2.5 mm. broad, rounded or obtuse at apex, entire or slightly crenulate or shallowly 3-dentate; petals 5 or 6, submembranaceous or thin-carnose, copiously opaque-glandular, oblong or obovate-oblong, 4–6.5 mm. long, 2–3.5 mm. broad (inner ones sometimes reduced to 1–2 mm. in width), obtuse or rounded at apex; stamens (6–)10–18, often 2-seriate, oblong-obovate, flattened, carnose, 1.2–2 mm. long, the filaments narrowed at base, broadened to 0.5–1 mm. distally, yellow-glandular distally, the pollen-sacs oblique on the distal margin, ellipsoid, 0.3–0.5 mm. long, dehiscing by lateral-apical clefts, contiguous or slightly separated but not exceeded by the truncate apex of filament; carpels usually 2 or 3 (rarely 1, 4, or 5), obovoid, 1.3–2 mm. long at anthesis, rounded at apex, the stigmatic ridge short, linear-oblong, 0.2–0.5 mm. long, strictly apical or obliquely subapical, the ovary-wall densely glandular, the ovules 8–10, pendulous from short subapical or obliquely apical placentas; carpels in fruit usually reduced to 1, sometimes 2 or 3, subglobose, 5–6 mm. in diameter at maturity, rounded at base and apex, the stigmatic ridge essentially apical, inconspicuous, the pericarp subcarnose, densely glandular, rugulose without, the seeds (2–)3–6 at maturity, obovoid, 3–4 mm. long, 1.5–2.5 mm. broad, obtuse at base, rounded at apex.

In view of the difficulty one has in separating herbarium specimens of *Pseudowintera axillaris* and *P. colorata*, an examination of works on the New Zealand flora in which this problem is considered is of interest. Raoul, in 1846, described the new species *Drimys colorata* without comparing it with *D. axillaris*. Hooker, in 1852, merely remarks: "I cannot distinguish the *D. colorata* of Raoul from Forster's plant." Kirk, in 1889, reduced *Drimys colorata* to a variety of *D. axillaris*, pointing out that the former is essentially a southern plant in New Zealand and the latter essentially northern, although the two overlap in the Wellington region; he further remarks that "the characters stated above [var. *colorata*] pass into those of the typical form by almost imperceptible gradations." Cheeseman, in 1906, retains both species but remarks: "I have considerable hesitation in re-establishing this [*Drimys colorata*] as a species. It is certainly very close to the preceding [*D. axillaris*], and in the dried state it is often difficult to separate the two. But in the field it can always be readily distinguished, and all my correspondents regard it as distinct. The two species grow intermixed in many localities in the Wellington and Nelson Districts." Cockayne, in 1928, retains both species, pointing out the distributional differences and stating that *Drimys axillaris* is much taller than

D. colorata and has larger, glossy, dark green leaves, rather than yellowish green leaves, which are blotched red or purple and are glaucous beneath.

The prevalent modern opinion seems to be that the two species are distinguishable and are good entities, although it is admitted that hybridization occurs in the region where the two ranges overlap. Naturally, New Zealand botanists who have observed the genus in nature are best qualified to judge how distinct the two plants actually are, and for that reason I hesitate to go back to the earlier opinions and combine them. However, a careful examination of the cited specimens shows that there are absolutely no floral distinctions, with the possible exception of a slight and undependable tendency toward more entire calyces in *Pseudowintera colorata*. As to the differences in habit and foliage pointed out by various students, these are scarcely noticeable in herbarium material, although the extreme forms are of course easily distinguished. For instance, the leaf-blades of such specimens as *Colenso* and *Cockayne 183* are grayish white beneath, and one would have no hesitation in referring them to Raoul's species. But the leaf-blades of *Cockayne 3470* and the Setchell collection are only slightly paler beneath and sometimes nearly concolorous; yet these also doubtless represent Raoul's species. The best distinction one can make between the two groups, I believe, is based on tendencies toward a smaller habit, smaller leaves, and paler lower leaf-surfaces in *Pseudowintera colorata*. If these characters could be linked with any pertaining to the inflorescence, however inconspicuous, one would feel justified in retaining both species, but my present opinion is that only one specific entity can be admitted.

In view of the differences pertaining to habit and leaf color, however, I cannot altogether ignore the entity based on *Drimys colorata*, especially as this has a more or less distinct geographic range and is apparently readily recognized in a living condition. Therefore I propose varietal combinations for the two entities, one based on the Forsters' type and the other on Raoul's species. The description which I have given above is comprehensive, while the few points which differentiate the varieties are pointed out below.

1a. **Pseudowintera axillaris** var. **typica** nom. nov. FIG. 5, f j.

Drimys axillaris J. R. & G. Forst. Char. Gen. 84. *f. 42, a-l.* 1776; Forst. f. in Nova Acta Reg. Soc. Sci. Ups. **3:** 182. 1780; L. f. Suppl. 270. 1781; Lam. Encycl. **2:** 331. 1786; DC. Reg. Veg. Syst. Nat. **1:** 443. 1817, Prodr. **1:** 78. 1824; A. Rich. Bot. Voy. Astrolabe 290. 1832; Endl. Enchir. Bot. 430. 1841; Hook. f. in Hook. Ic. Pl. **6:** *pl. 576.* 1843; Raoul, Choix de Pl. Nouv.-Zél. 47. 1846; Hook. f. Fl. Nov. Zel. **1:** 12. 1852; Miers in Ann. Mag. Nat. Hist. III. **2:** 43. 1858, Contrib. Bot. **1:** 132. 1861; Hook. f. Handb. N. Zeal. Fl. 10. 1864; Baill. Hist. Pl. **1:** 158. *f. 203, 204.* 1867–69; Kirk, Forest Fl. N. Zeal. *pl. 1.* 1889; Featon, Art Alb. N. Zeal. Fl. 12. *pl. 5, f. 3.* 1889; Kirk, Students' Fl. N. Zeal. 22. 1899; Cheesem. Man. N. Zeal. Fl. 29. 1906, ed. 2. 456. 1925.

Wintera axillaris Forst. f. Fl. Ins. Austr. Prodr. 42. 1786; Willd. Sp. Pl. **2:** 1240. 1800; Pers. Syn. Pl. **2:** 84. 1806; v. Tiegh. in Jour. de Bot. **14:** 290. 1900; Pilger in E. & P. Nat. Pfl. Nachtr. **2:** 108. 1906; Cockayne in Bull. N. Zeal. State For. Serv. **4**(2): 43. 1928, in Engl. & Drude, Veg. der Erde ed. 2. **14:** 125. 1928.

Wintera terminalis v. Tiegh. in Jour. de Bot. **14:** 291. 1900; Pilger in E. & P. Nat. Pfl. Nachtr. **2:** 108. 1906.

Pseudowintera axillaris Dandy in Jour. Bot. **71:** 121. 1933.

Tree 4–10 m. high; leaf-blades (3–)4–11(–12.5) cm. long, often paler beneath but scarcely glaucous, the waxy layer inconspicuous, the secondary nerves usually 6–12, the veinlets usually prominulous but often obscure on both surfaces; calyx crenulate or bilobed, rarely entire.

DISTRIBUTION: North Island (from Ahipara and Bay of Islands [lat. about 35°] southward) and northern part of South Island, not occurring south of the Banks Peninsula (lat. about 43° 45′), at altitudes from sea-level to about 850 m.; apparently often occurring in mixed beech forest, or occasionally in pure beech forest (ex Cockayne). The type was collected by the Forsters, but no definite locality was noted.

NEW ZEALAND: North Island: Coromandel, *Cheeseman* (US); Mt. Egmont Ranges, *Tryon* (A); Ohakune, *Oliver* (UC); Wellington, *Travers* (GH); Hunua, *Kirk* (A, F, GH, M), *347* (GH, US); without definite locality: *Cheeseman* (F).

NATIVE NAME: *Horopito.*

Wintera terminalis v. Tiegh. is based on a specimen collected by Sinclair, without definite locality, which is said to differ from the other New Zealand species in having its inflorescences both axillary and terminal; upon this species van Tieghem based his Section *Euwintera.* Although the original description is quite inadequate, I cite this as a synonym of the Forsters' concept on the authority of Dandy.

1b. **Pseudowintera axillaris** var. **colorata** (Raoul) comb. nov. FIG. 5, k, l.

Drimys colorata Raoul in Ann. Sci. Nat. III. **2:** 121. 1844, Choix de Pl. Nouv.-Zél. 24. *pl. 23.* 1846; Parment. in Bull. Sci. Fr. & Belg. **27:** 227, 303. 1896; Cheesem. Man. N. Zeal. Fl. 30. 1906, ed. 2. 456. 1925.

Drimys axillaris var. *colorata* Kirk, Forest Fl. N. Zeal. *pl. 2.* 1889, Students' Fl. N. Zeal. 22. 1899.

Wintera colorata Raoul ex v. Tiegh. in Jour. de Bot. **14:** 290. 1900; Pilger in E. & P. Nat. Pfl. Nachtr. **2:** 108. 1906; Cockayne in Bull. N. Zeal. State For. Serv. **4**(2)**:** 43. 1928, in Engl. & Drude, Veg. der Erde ed. 2. **14:** 125. 1928.

Wintera monogyna v. Tiegh. in Jour. de Bot. **14:** 291. 1900; Pilger in E. & P. Nat. Pfl. Nachtr. **2:** 108. 1906.

Pseudowintera colorata Dandy in Jour. Bot. **71:** 121. 1933.

Erect bushy shrub or small tree, usually not exceeding 4 m. in height; leaf-blades (1.5–)3–9 cm. long, sometimes blotched with red or purple, usually glaucous beneath, often conspicuously so, the waxy layer often conspicuous, the secondary nerves usually 4–6, the veinlets usually obscure on both surfaces; calyx often entire, rarely crenulate or bilobed.

DISTRIBUTION: North, South, and Stewart Islands, said to occur from Patetere Plateau and Rotorua (lat. about 38°) southward, at altitudes of sea-level (toward the south and in Stewart Island, where it is reported as common) to about 1000 m.; usually subalpine or montane in North Island. The type is the Raoul collection cited below.

NEW ZEALAND: Poketitiri, *Meebold 5548* (NY); North Island: *Kirk* (GH); Wellington, *Travers* (GH); South Island: Otira Valley, *Cockayne 183* (GH), *3470* (NY); Akaroa, Banks Peninsula, *Raoul* (TYPE COLL., GH, US), *Kirk* (A, F, M); Mt. Sinclair, Banks Peninsula, *Meebold 4710* (NY); Hunter Hills, South Canterbury, *Anderson 213* (A, M, NY, UC, US); Lake Manipouri, *Setchell* (UC); without definite locality: *Colenso* (GH), *Védel* (US), *Oliver* (UC).

NATIVE NAMES: *Pepper-tree, craoutink* (ex Raoul). In discussing *Drimys axillaris,* Featon uses the names *pepper-tree* and *Maori painkiller,* which are more likely to refer to var. *colorata.*

Dandy has referred *Wintera monogyna* v. Tiegh. to the synonymy of *Pseudowintera Traversii,* but I am more inclined to believe that it represents the present variety. It is said to differ from Raoul's species in its smaller and more rounded leaves and especially in its single carpel. The latter character has been noted in some specimens of var. *colorata,* and the leaf-shape is too variable to be of much consequence. Van Tieghem does not mention the stamens as being exceptionally few in number, a point which he probably would have emphasized if his plant represented *P. Traversii.* Furthermore the type of *Wintera monogyna* was collected by Hombron at Akaroa (the type locality of Raoul's species), whereas *P. Traversii* has not been authentically reported from that part of the South Island.

2. **Pseudowintera Traversii** (Buchanan) Dandy in Jour. Bot. **71**: 122. 1933.
   Hymenanthera Traversii Buchanan in Trans. New Zeal. Inst. **15**: 339. *pl. 28, f. 1–1b.* 1883.
   Drimys Traversii Kirk in Trans. New Zeal. Inst. **30**: 379. 1898; Cheesem. Man. N. Zeal. Fl. 30. 1906, ed. 2. 456. 1925, Ill. N. Zeal. Fl. **1**: *pl. 8.* 1914.
   Wintera Traversii Cockayne in Bull. N. Zeal. State For. Serv. **4**(2): 43. 1928, in Engl. & Drude, Veg. der Erde ed. 2. **14**: 262. 1928.

DISTRIBUTION: South Island, apparently limited to the northwestern portion, from near the northern tip of the island southward to the Buller River region, probably not occurring much farther south than latitude 42°; altitude up to about 900 m. The type was collected by Travers in the Collingwood district.

Having seen no specimens referable to this species, I am acquainted with it only through the above references. The descriptions of Kirk and Cheeseman (in 1906) are quite adequate, and an excellent plate was published by Cheeseman in 1914. The species is characterized by its compact habit, being a shrub from 0.7 to 2 m. high, often straggling or semi-prostrate, with reddish branches and branchlets. The leaves are crowded and more or less imbricate, with petioles closely appressed to the branchlets and with coriaceous blades which are 2–3 cm. long, 0.8–1.3 cm. broad, and glaucous beneath. The pedicels are often solitary, sometimes paired; the calyx is entire, the petals 5 or 6 and about 3 mm. long, the stamens 5 or 6 and uniseriate, and the carpel solitary.

5. EXOSPERMUM

Exospermum v. Tiegh. in Jour. de Bot. **14**: 279, 333. 1900; Pilger in E. & P. Nat. Pfl. Nachtr. **2**: 109. 1906; Hutchinson in Kew Bull. **1921**: 190. 1921.

Exospermum is known only from the two New Caledonian species upon which it was originally founded; the type is *E. stipitatum.* Van Tieghem's classification (6: 354) has the genus most closely related to *Zygogynum,* with which it has in common "carpelles unis, à placentation médiane." In his discussion, however, van Tieghem points out that the carpels of *Exospermum* are only superficially united and not firmly concrescent as in *Zygogynum,* while the placentation of *E. Lecarti* (6: 339) is "en même temps marginale, latérale et médiane pour chaque carpelle . . ." In effect, the genus is more suggestive of *Bubbia* than of *Zygogynum* and might conceivably be combined with the former, although for the present I feel justified in retaining it as outlined by van Tieghem.

1. **Exospermum stipitatum** (Baill.) v. Tiegh. ex Pilger in E. & P. Nat. Pfl. Nachtr. **2:** 109. 1906; Hutchinson in Kew Bull. **1921:** 190. *fig.* 1921. FIG. 6, a-e.

Zygogynum stipitatum Baill. in Adansonia **10:** 334. 1873; Guillaumin in Ann. Mus. Col. Marseille II. **9:** 95. 1911.

Drimys neo-caledonicus Vieill. ex Baill. in Adansonia **10:** 335, as synonym. 1873.

Drimys Lenormandii Vieill. ex Parment. in Bull. Sci. Fr. & Belg. **27:** 231, 308. *pl. 10, f. 35, pl. 11, f. 42, 43, nomen subnudum.* 1896; Vieill. ex v. Tiegh. in Jour. de Bot. **14:** 333, as synonym. 1900; Vieill. ex Guillaumin in Ann. Mus. Col. Marseille II. **9:** 95, *nomen.* 1911.

Drimys austro-caledonicus Vieill. (pro parte) ex v. Tiegh. in Jour. de Bot. **14:** 333, as synonym. 1900.

DISTRIBUTION: New Caledonia; the type was collected by Vieillard at Wagap (ex Baillon), or "dans les montagnes de Ti-Ouaka près de Wagape" (ex van Tieghem); a single leaf of this is available (A). Van Tieghem also cites *Vieillard 2281* (GH), the source of the name *Drimys Lenormandii;* from a comparison of the foliage, one may suspect that this is the same collection as the type, which was unnumbered.

Van Tieghem's description of this species is very detailed and accurate, although my observations of the gynaecium lead me to believe that he attaches too much importance to the regularity of the carpel-arrangement. In one flower available to me there are 6 carpels in a single whorl, in a second flower there are 7 carpels, of which one has apparently been pushed into the center by pressure. Van Tieghem reports the carpels as occurring in two whorls of 3–5 carpels each. No petals are available on our material, but van Tieghem describes these as occurring in three tetramerous whorls, implying a degree of regularity which is not found in the related genera. In this species the placentation is said to be limited to the external face of the carpels, but actually the ovules also occupy a portion of the distal lateral faces and the apical-ventral angle.

In his treatment of the plant, van Tieghem neglected to make the actual combination *Exospermum stipitatum,* apparently through an oversight, for he repeatedly mentions "Exosperme stipité" and gives *Zygogynum stipitatum* as a synonym. It appears that Pilger was the first to use the correct Latin binomial.

2. **Exospermum Lecarti** v. Tiegh. in Jour. de Bot. **14:** 334. 1900; Pilger in E. & P. Nat. Pfl. Nachtr. **2:** 109. 1906.

DISTRIBUTION: New Caledonia, reported only from the type collection, *Lécart 141,* without definite locality; probably a detached leaf (A) under this name, but labelled *Lécart 144,* is actually from the same collection.

Van Tieghem mentions that this is similar in foliage to the preceding, but differs from it by its usually solitary and short-pedicellate flowers, fewer carpels, and more extensive placental surface. The ovules are said to be situated at the internal angle of the carpel, on the lateral faces, and also on the external face. This is interpreted, by van Tieghem, as a transitional stage between the carpel of *Bubbia* and *Belliolum* (which he supposes always to have the ovulation along the ventral angle) and that of *Exospermum stipitatum,* in which the ovules are supposedly situated only on the external face of the carpel. The carpels of *E. Lecarti* are only weakly united, and in this respect the species is similar to some species of *Bubbia,* i.e. *B. montana* (Lauterb.) A. C. Sm. and *B. pachyantha* A. C. Sm. It appears that the ovulation in *Bubbia* and *Belliolum* is more diverse than supposed by van Tieghem, and the placental surface is not always restricted to the ventral angle of the carpel in those genera. Consequently, the primary characters upon which *Exospermum* is founded do not sharply distinguish the genus from *Bubbia* and *Belliolum,* although the stamens amply separate it from the latter. However, I do not propose to unite *Exospermum* with *Bubbia;* although it doubtless represents an extreme trend from a *Bubbia*-like ancestor, it seems to be sufficiently characterized by its ovulation to merit generic status. However, I believe that its closest alliance is with *Bubbia* rather than with *Zygogynum.*

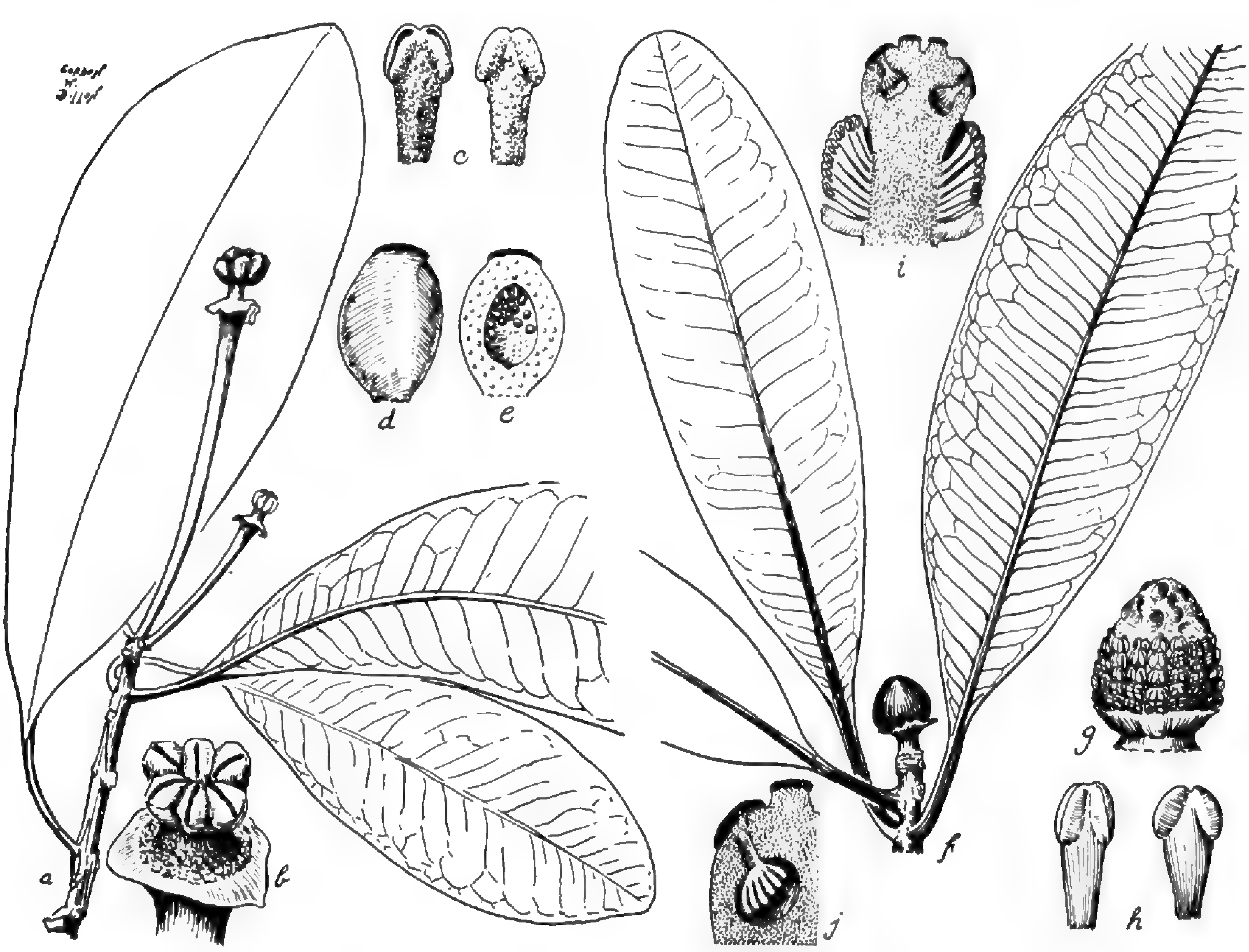

FIG. 6. *a-e. Exospermum stipitatum,* drawn from *Vieillard 2281: a.* branchlet with two flowers past anthesis, × ½; *b.* flower, past anthesis, the petals and stamens having fallen, × 2; *c.* stamens, extrorse and introrse views, × 5; *d.* carpel, × 2; *e.* carpel, longitudinal section, showing the glandular wall and the scattered ovules, × 2. *f-j. Zygogynum Vieillardi,* drawn from *Franc 1740: f.* branchlet with solitary terminal young flower, × ½; *g.* flower with calyx and petals removed, × 1½; *h.* stamens, extrorse and introrse views, × 5; *i.* longitudinal section of young flower, showing torus with stamens and fused carpels, × 2; *j.* enlarged section of *i,* showing two stigmas, one locule (with one row of ovules removed), and the connecting canal, × 4.

6. ZYGOGYNUM

Zygogynum Baill. in Adansonia **7:** 298. 1867, Hist. Pl. **1:** 160, 190. 1867–69; Prantl in E. & P. Nat. Pfl. III. **2:** 19. 1891; v. Tiegh. in Jour. de Bot. **14:** 279, 340. 1900; Pilger in E. & P. Nat. Pfl. Nachtr. **2:** 109. 1906; Hutchinson in Kew Bull. **1921:** 191. 1921.

Zygogynum Sect. *Monanthum* v. Tiegh. in Jour. de Bot. **14:** 341. 1900; Pilger in E. & P. Nat. Pfl. Nachtr. **2:** 109. 1906.

Zygogynum Sect. *Pleianthum* v. Tiegh. in Jour. de Bot. **14:** 341. 1900; Pilger in E. & P. Nat. Pfl. Nachtr. **2:** 109. 1906.

Zygogynum has been generally accepted by workers on the New Caledonian flora as a good genus. It is indeed the most distinct genus of the family in many respects, with a unique type of carpellary specialization. No species have been added to *Zygogynum* since it was amplified by van Tieghem to include six species. In *Zygogynum* the carpels are firmly concrescent and the ovules are limited to the external face of the locule; van Tieghem interprets these facts as a continuation of the trend begun in *Exospermum,* which may indeed be true, although the remarkable syncarpy of *Zygogynum* is only faintly suggested by the loosely coherent carpels of *Exospermum.* The two genera have a common aspect in their reduced inflorescences, the flowers being either solitary and terminal or few in a terminal umbel (perhaps more properly described as single and clustered around the growing point).

The two sections proposed by van Tieghem are based on solitary versus aggregated flowers, a division which seems arbitrary and not very useful, since the flowers in the second group are often reduced to one soon after anthesis. The principal basis of speciation may eventually be found to occur in the gynaecium, as suggested by van Tieghem (6: 347–348), the number and disposition of the carpels varying from species to species.

Baillon's paper discussing his new species does not include a formal generic description, nor does the generic name appear as an independent entity in the text, being first mentioned as such in a brief summary (op. cit. 372). However, the description of *Zygogynum Vieillardi* may be taken as a *descriptio generico-specifica.*

The species are here briefly discussed in the order proposed by van Tieghem.

1. **Zygogynum Vieillardi** Baill. in Adansonia **7:** 298. *pl. 4.* 1867, Hist. Pl. **1:** 161. *f. 208–210.* 1867–69; Parment. in Bull. Sci. Fr. & Belg. **27:** 232. 1896; v. Tiegh. in Jour. de Bot. **14:** 340. 1900; Pilger in E. & P. Nat. Pfl. Nachtr. **2:** 109, as *Z. Vieillardii.* 1906; Guillaumin in Ann. Mus. Col. Marseille II. **9:** 95. 1911. FIG. 6, f-j.

DISTRIBUTION: New Caledonia; the type collection is *Vieillard 187,* from mountains near Balade. Guillaumin adds citations of *Pancher 17* and *283* from Mt. Koghi, neither of which I have seen, and *Balansa 2763* from Mt. Mou, of which a fragment (A) seems very possibly to represent this species, although it is also suggestive of *Z. Bailloni.* The only specimen in American herbaria which I can positively refer to *Z. Vieillardi* is *Franc 1740* (A, UC), from Prony.

The species is well described and figured by Baillon; it is characterized by its 10–12 concrescent carpels with elliptic or subcapitate stigmas.

2. **Zygogynum Bailloni** v. Tiegh. in Jour. de Bot. **14:** 340. 1900; Pilger in E. & P. Nat. Pfl. Nachtr. **2:** 109, as *Z. Baillonii.* 1906.

DISTRIBUTION: New Caledonia; the type was collected by Pancher in 1870, apparently without number or definite locality, and is represented by a leaf (A) which is essentially identical to those of *Franc* (A), from Mt. Mou, a sterile specimen which may be referred to *Z. Bailloni* with reasonable certainty.

Zygogynum Bailloni is compared by van Tieghem to *Z. Viellardi,* from which it differs in having its leaf-blades more coriaceous and glossy, and in having 4 carpels with sessile linear stigmas rather than 10–12 carpels with elliptic stigmas. This is the only species of the genus elaborated in detail by van Tieghem (6: 341–345); it is said to have a very short and stout pedicel, 8 petals in two whorls, and carpels concrescent except at the apices. The difference in stigmatic characters between this species and the remaining species of *Zygogynum* causes van Tieghem (6: 348) to speculate on its generic status. On the basis of his discussion, one might assume that *Z. Bailloni* is the most primitive species of the genus in its retention of a linear stigmatic ridge.

3. **Zygogynum bicolor** v. Tiegh. in Jour. de Bot. **14:** 341. 1900; Pilger in E. & P. Nat. Pfl. Nachtr. **2:** 109. 1906.

DISTRIBUTION: New Caledonia; reported only from the type collection, *Lécart 41* (A, leaf), without definite locality.

Zygogynum bicolor is said by van Tieghem to resemble *Z. Vieillardi* in its solitary flower on a short stout pedicel, but it is distinguished by having its leaf-blades very pale beneath and is further characterized by its very numerous stamens, 147–168 in 7 or 8 whorls (6: 346).

4. **Zygogynum pomiferum** Baill. in Adansonia **10:** 334. 1873; v. Tiegh. in Jour. de Bot. **14:** 340. 1900; Pilger in E. & P. Nat. Pfl. Nachtr. **2:** 109. 1906; Guillaumin in Ann. Mus. Col. Marseille II. **9:** 95. 1911.

DISTRIBUTION: New Caledonia; the species was originally based by Baillon on two collections, *Balansa 2328* (A, TYPE COLL.), from Kanala (alt. 800 m.), and *2804,* from Mt. Mou. Van Tieghem did not believe these to be conspecific and took the first as the type, referring the second to his *Z. Balansae.* Guillaumin cites a collection of Lecard from Bourail as representing *Z. pomiferum.*

The original description is ample, the species being distinguishable from all others except the following by its comparatively broad leaf-blades. The type collection is in fruit only.

5. **Zygogynum Balansae** v. Tiegh. in Jour. de Bot. **14:** 340. 1900; Pilger in E. & P. Nat. Pfl. Nachtr. **2:** 109. 1906; Bak. f. in Jour. Linn. Soc. Bot. **45:** 268. 1921.

DISTRIBUTION: New Caledonia; the type collection is *Balansa 2804,* from Mt. Mou, alt. 700 m. Baker cites *Compton 1776,* from Mt. Panié, as representing the species.

Zygogynum Balansae is compared by van Tieghem with *Z. pomiferum;* it has similarly large leaves and flowers grouped in a simple sessile umbel, but it is said to differ in having the leaf-blades less coriaceous, longer, narrower, distally attenuate, and with the lateral nerves more distant and "plus reticulées." It is further characterized by its very numerous carpels and large fruits, these being up to 4 cm. in diameter, according to van Tieghem (6: 348).

6. **Zygogynum spathulatum** v. Tiegh. in Jour. de Bot. **14:** 341, as *Z. spatulatum.* 1900; Pilger in E. & P. Nat. Pfl. Nachtr. **2:** 109. 1906.

Drimys austro-caledonicus Vieill. (pro parte) ex v. Tiegh. in Jour. de Bot. **14:** 341, as synonym. 1900.

DISTRIBUTION: New Caledonia; reported only from the original collection, *Vieillard 2266* (GH, TYPE COLL.) from Wagape.

Zygogynum spathulatum resembles *Z. pomiferum* and *Z. Balansae* in having its flowers aggregated, but it is distinguished by its narrow spatulate leaf-blades, which are rounded at apex and attenuate at base. The carpels are about 20 in number.

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NOVELTIES IN AMERICAN EUPHORBIACEAE

LEON CROIZAT

THE new species, trinomials, and records in this work have accumulated with few exceptions in the herbarium of the Arnold Arboretum of Harvard University in the course of routine determinations. They are published primarily to validate the manuscript names under which many of them have been cited in letters to various correspondents. Some of the entities dealt with here belong to critical groups which are worthy of more detailed consideration, or which should be critically revised. Unless otherwise stated, all the types are deposited in the herbarium of the Arnold Arboretum.

Ditaxis Vahl ex A. de Jussieu

Ditaxis breviramea (Muell.-Arg.) Pax & Hoffm. in Pflanzenr. 57 (IV. **147.** vi): 65. 1912; O'Donnel & Lourt. in Lilloa **8**: 67. 1942.

Argythamnia breviramea Muell.-Arg. in Linnaea **34**: 146. 1865, in DC. Prodr. **15**(2): 737. 1866.

PARAGUAY: Fortin Lopez de Filippis, *Rojas 8438;* Fortin Tte. Montania, *Rojas 8479.*

The record is apparently new for Paraguay. The material cited agrees with a photograph of the Herzog specimen from Bolivia identified as *Ditaxis breviramea* by Pax, in Med. Rijks. Herb. **40**: 22. 1921, and reproduced as plate 1 in the excellent monograph by O'Donnel & Lourteig.

Bernardia Adanson

Bernardia Gentryana sp. nov.

Arbuscula ad 5 m. alta, innovationibus strictis stellato- vel fasciculato-puberulis. Foliis tenuiter membranaceis ovatis vel ovato-lanceolatis parcius stellato-puberulis vel glabratis margine inaequaliter dentato-serratis, 3.5–5 cm. longis, 1.5–2.5 cm. latis, nervis adscendentibus ca. 7-jugis gracilibus, glandulis cicatricoso-crateriformibus in basi laminae 2, petiolo ca. 3–5 mm. longo. Floribus ♂ ignotis. Floribus ♀ subsolitariis brevissime pedicellatis, perianthii squamulis 8–10 in serie duplici, ovatis puberulis costulatis ad 1.5 mm. longis latisque, ovario globuloso depresso ad 2 mm. lato fere totidem longo pallide luteo-tomentello, stylis 3 quove lunulato apice in laciniis 3(–6) partito ad 1.5 mm. longo; capsula submatura ca. 5 mm. magna, semine cordiformi 5 mm. longo, 3.5–4 mm. lato, pallide brunneo-marmorato.

MEXICO: Sinaloa: Nuevo Mundo, *Gentry 5372* (TYPE in Gray Herb.).

This cannot be *Bernardia aspera* Pax & Hoffm., *B. incana* Mort., *B. mexicana* Muell.-Arg. (at least as illustrated by *Pringle 3700*), *B. obovata* Johnst., or *B. viridis* Millsp., as it disagrees with each one of them in its thinly membranous, ovate to ovate-lanceolate leaves, which are ultimately larger in size. *Bernardia Brandegei* Millsp. ex Brandeg., in Proc. Cal. Acad. Sci. II. **3**: 172. 1891, is a *nomen nudum* replaced by *B. viridis* at publication, as shown by the notes that appear on the photograph of the type of *B. viridis* Millsp. preserved in the Gray Herbarium.

Bernardia amazonica sp. nov.

Fruticulus vel frutex ad 1 m. altus, ramulis strictis puberulis. Foliis lanceolatis vel obovato-lanceolatis firme chartaceis vel subcoriaceis 5–10 cm. longis 1.75–2.5 cm. latis, brunneis vel olivaceis subconcoloribus, supra subtusque fere glabratis, margine saepius glanduloso-serratis, nervis adscendentibus 7–10-jugis, lamina subtus ad petioli radicem potius cicatricosa quam glandulosa, cicatricibus 2, petiolo hispidulo vix 0.5 cm. longo vel minore, stipulis setaceis vix 2 mm. longis. Floribus ♂ haud visis. Floribus ♀ in cymulis sessilibus axillaribus, perianthii squamulis in serie duplici 9 vel 10 ovatis margine integro hispidis, 2 mm. longis, 1–2 mm. latis, ovario vix 1 mm. longo latoque cum stylis confluente, stylis 3 ad 1 mm. longis apice divaricato-partitis.

VENEZUELA: Amazonas: Puerto Ayacucho, *Williams 13142*.

This was distributed as representing *B. Jacquiniana* Muell.-Arg., which is a very different species. It suggests *B. axillaris* (Spreng.) Muell.-Arg. in habit and foliage, but manifestly differs from that species in the venation, the texture of the leaf, and in its indumentum. As shown by a Brazilian specimen collected by Riedel, in our herbarium, *B. axillaris* has glabrous leaves with an immersed venation and differently shaped marginal teeth.

Alchornea Swartz

Alchornea cyclophylla sp. nov.

Arbor videtur glabra vel glabrescens. Foliis subcoriaceis brunneis utrinque glabratis in axillis nervorum barbulatis late rotundato-ovatis, apice breviter apiculato-acuminatis, basi leviter cordatis, margine obscure crenato-serratis, ca. 15 cm. longis, 12–13 cm. latis, nervis ca. 4- vel 5-jugis adscendentibus, primo jugo laminae tertium superum attingente caeteris penninerviis, glandulis in lamina hic inde sparsis parvis, petiolo 5.5–8 cm. longo, stipulis subglandulosis minimis deciduis. Inflorescentiis ♂ ignotis. Inflorescentiis ♀ spicatis puberulis vel glabratis, floribus solitariis vel binis subsessilibus bracteolatis, calycis lobis triangulari-acuminatis 4(–5), vix 1 mm. longis latisque, ovario ovoideo glabrescente, tenello vix stellato-puberulo demum glabro, 2-cocco, stylis 2 integerrimis carnosis epapillosis ad 8 mm. longis ad basim ipsissimam liberis.

COSTA RICA: Alajuela: Palmira, *Austin Smith 2876*.

This differs from *A. latifolia* Sw. in the styles being cleft to the base and in its foliage. The Central American species are much in need of a critical study.

Cleidion Blume

Cleidion denticulatum Standl. in Field Mus. Publ. Bot. **4**: 218. 1929.

The holotype, *Cooper 12239,* is poor. Its crowded malpighiaceous hairs and the large, easily separable bundles of the columella are strongly reminiscent of *Bernardia*. The loose seeds on the type-sheet, however, have the characters of *Cleidion*. Better material is needed to determine the correct generic position of this species.

Cleidion oblongifolium (Standl.) comb. nov.

Alchornea oblongifolia Standl. in Carnegie Inst. Wash. Publ. **461**: 66. 1935.

The ♀ flower ending the rachis of the inflorescence has manifestly cleft styles, such as characterize *Cleidion*. The comparatively long and narrow leaves conform to those of this genus. If generic value is denied to the nature of the style, this being entire in *Alchornea*, and cleft in *Cleidion*, it becomes impossible to separate the two groups which both tradition and an aggregate of characters have rightly maintained as distinct genera. This plant is endemic to British Honduras.

Cleidion prealtum sp. nov.

Arbor ad 30–35 m. alta, innovationibus parcius puberulis citissime glabratis vel glabris, cortice pallide brunneo sat lenticellato. Foliis 7–14 cm. longis, 2–5 cm. latis, obovato-oblongis vel ellipticis, apice breviter acuminatis, basi plus minusve rotundatis, junioribus membranaceis brunneis vel olivaceis, adultis (e folio singulo) forsan coriaceis, subtus pallidioribus, in venis leviter puberulis glabratisve supra glabratis vel glabris secus costam hic inde pustulato-glandulosis, venis gracilibus ca. 6-jugis, petiolis herbaceis puberulis 2–4 cm. longis, stipulis setaceis ad 3–4 mm. longis. Inflorescentiis ♂ spicatis gracillimis 8–10 cm. longis, floribus in cymulis saepius paucifloris secus rhachem dissitis; perianthio subsessili 3- vel 4-lobo valde delicato puberulo ca. 3.5 mm. lato totidemque longo vel minore, staminibus ca. 50, antheris lateraliter dehiscentibus, filamentis ca. 2 mm. longis; pistillodio, glandulis nullis. Inflorescentiis ♀ spicis simplicibus ad 3 cm. longis, subtus bracteis ca. 2 vel 3, linearibus vel subsetaceis, 2 mm. longis, in axillis inferioribus semper flore evoluto carentibus, apice flore terminatis; perianthio ca. 3–4.5 mm. lato, lobis 5 vel 6 interdum 2 plus minusve inter se adnatis, lineari-lanceolatis, ad 2 mm. longis, basi etsi disco nullo tumido-saccatis; ovario ovoideo ca. 3 mm. longo et 2 mm. lato, luteo-tomentello, stylis 3 quove bipartito intus longe grosseque papilloso, papillis haud processiformibus.

BRAZIL: Amazonas: Municipality of Humayta, near Tres Casas, *Krukoff 6458* ♀ (TYPE), *6357* ♂, *6391* ♂.

Also here probably belong *Krukoff 6602, 6649,* and *6570,* all from the Municipality of Humayta near Livramento on the Rio Livramento. The material cited was distributed as representing *Alchornea Hilariana* Baill. and *A. brachygyne* Pax & Hoffm., the misdeterminations being probably suggested by photographs illustrating plants with similar foliage. The ♀ flower and the leaves of *C. prealtum* are strongly reminiscent of *Epiprinus* Griff. from tropical Asia, a genus which stands out as a natural unit of few species but is otherwise closely allied with *Cleidion*.

Cleidion Woodsonianum sp. nov.

Arbuscula 4–5-metralis, pilis brevissimis in innovationibus exceptis glabra. Foliis utrinque acuminatis ellipticis, 7–11 cm. longis, 1.5–4 cm. latis, apice breviter acuminato-caudatis, basi truncatis vel vix subauriculatis, hic inde in lamina ipsa glandulosis, pallide olivaceis, supra sub lente minute papillosis glabris, subtus pilis perpaucis exceptis glabris, margine serrato-denticulatis, venis adscendentibus utrinque ca. 7-jugis, petiolo 0.5–1.5 cm. longo. Inflorescentia ♂ ignota. Inflorescentia ♀ ad 15 cm. longa, gracillima, floribus 3 vel 4 tantum, bracteis minutissimis lineari-triangularibus fultis; perianthii lobis (videtur) 5 minimis lineari-subulatis, petalis glandulisque nullis, ovario puberulo ovoideo ca. 3 mm. longo totidemque lato, stylis 3 ca. 8 mm. longis quove fere ad basim partito; fructu capsulari, columella gracili delapsa ad 4–5 mm. longa, epicarpio sublevi olivaceo sub lente puberulo, semine ovoideo subquadrangulo ca. 4 mm. magno apice acutato.

PANAMA: Canal Zone: Vicinity of the Salamanca Hydrographic Station, Río Pequeni, *Woodson, Allen & Seibert 1587.*

This suggests certain species of the Old World, such as *C. leptostachyum* Pax & Hoffm. from the Fiji Islands. The type-material was originally distributed with doubt as representing *Alchornea costaricensis* Pax & Hoffm.

Jatropha Linnaeus

Jatropha hippocastanifolia sp. nov.

Frutex fere metralis. Foliis fere ad basim partitis, 5–7-lobis, margine duplicato-dentatis vel denticulatis vel dentato-serratis longiuscule ciliato-glandulosis, pallide olivaceis utrinque pilis albidis simplicibus sat longis mollisque indutis, 15 cm. longis, 18 cm. latis, juvenilibus multo minoribus, lobo medio maximo cum lateralibus imbricante 12 cm. longo 6 cm. lato ca. 12-nervio, lobis caeteris minoribus externis ca. 4–5 cm. longis 2.5 cm. latis vel minoribus, petiolo herbaceo ad 17 cm. longo aeque ac lamina induto, hic inde glandulis fasciculatis capitulatisve ornato, basi stipulis glandulosis dissectis insignito. Inflorescentiis cymosis gracilibus velutinosis ad 15 cm. longis, bracteis longe piloso-glandulosis vix 1 cm. longis 2 mm. latis onustis. Floribus ♂ albo-hispidis pubescentibusve, sepalis ca. 2–3 mm. longis 1 mm. latis integris vel margine denticulis perpaucis glandulosis vel eglandulosis notatis, petalis atro-purpureis ca. 5 mm. longis 3 mm. latis basi abrupte coarctatis vel angustatis pilosulis, staminibus 10 in acie duplici filamentis breviter liberis demum in columnam connatis, submaturis ad 6 mm. longis, glandulis rotundatis discretis 5 oppositisepalis. Floribus ♀ ut ♂, sepalis semper neque raro tantum ciliato-glandulosis, ovario globuloso costulato hic inde pilis albidis simplicibus ornato, levi, ca. 2 mm. longo latoque, disco irregulariter interrupto subintegrove margine hic inde bilabiato vix 0.75 mm. alto, stylis pro more gracilibus glabris ad 2.5 mm. longis, stigmatibus primum partitis dein crure quove iterum 2- vel 3-lobulato.

PARAGUAY: Chaco Paraguayo: Oruro, *Rojas 8559.*

To discuss this new species with finality, a critical consideration should be given of several species, including *J. gossypiifolia* L. My new species suggests the entity called *J. intercedens* by Pax but differs from it in three characters that, considered jointly, have specific significance. These characters are: (1) the style, which has bipartite, usually suberect stigmas in *J. gossypiifolia* and its allies, has here spreading, 2- or 3-lobulate stigmas; (2) the foliage; the leaf-lobes of *J. hippocastanifolia* are much narrowed at the base and enlarged at the apex, the shape of the leaf being accordingly unlike that of *J. gossypiifolia* and its allies; (3) the dark-purplish petals.

Jatropha Paxii nom. nov.

Jatropha flabellifolia Pax & Hoffm. in Pflanzenr. 42 (IV. **147**): 52. 1910, non Steud. 1840.

A new name is needed, as *J. flabellifolia* Pax & Hoffm. is a later homonym of *J. flabellifolia* (Pohl) Steud., Nomencl. ed. 2, **1**: 799. 1840.

Jatropha Hoffmanniae nom. nov.

Jatropha longipedunculata Pax & Hoffm. in Pflanzenr. 85 (IV. **147**): 191. 1924, non Brandeg. 1920.

Brandegee's *J. longepedunculata,* in Univ. Cal. Publ. Bot. **7:** 328. 1920, is a mere orthographic variant of *J. longipedunculata* Pax & Hoffm., which, consequently, is a later homonym.

Micrandra Bentham

Micrandra Benth. (1854) has been proposed for conservation by Mansfeld, in Kew Bull. 434. 1935, against *Micrandra* Benn. (1844).

Micrandra santanderensis sp. nov.

Arbor in sylvis primaevis, innovationibus glabratis glabrisve. Foliis ellipticis apice plus minusve breviter acuminatis basi cuneato-rotundatis vel rotundatis firme chartaceis, 7–14 cm. longis, 2.5–6 cm. latis, brunneis vel obscure olivaceis, margine integris, totis graciliter nervosis, nervis utrinque ca. 8-jugis anastomosantibus obscuris, primo jugo adscendente caeteris latius patentibus, in axillis conferte penicillatis, petiolo 2–7 cm. longo, apice sub lamina glandulis 2 pustulosis ornato, stipulis triangularibus minimis. Inflorescentiis racemosis ut videtur polygamis ad 25–35 cm. longis. Floribus ♂ : sepalis 5 puberulis triangulari-rotundatis vix 1 mm. longis, petalis 5 in sicco brunnescentibus quam sepalis duplo longioribus, staminibus ca. 5. Floribus ♀ post anthesim tantum visis, involucris floralibus illis ♂ (ut videtur) similibus, staminodiis ca. 5 setaceis nigricantibus, disco minimo parcissime glanduloso, ovario truncato-ovoideo ca. 3 mm. longo et 2 mm. lato, stylis in ovarium confluentibus brevissimis apice vix bilobis.

COLOMBIA: Santander: Vicinity of Puerto Berrio, between Carare and Magdalena Rivers, alt. 100–700 m., *Haught 2189* (TYPE); vicinity of Barranca Bermeja, Magdalena Valley, between Sogamoso and Carare Rivers, alt. 100–500 m., *Haught 2011.*

The two specimens here cited appear to differ at first on account of their differently colored foliage, but there are no floral or other differences. The conspicuous axillary tufts of hairs on the leaves of this new species are not found on *M. elata* Muell.-Arg., which is endemic to southern Brazil, or on *M. siphonioides* Benth., to judge from the photographs of the type-specimens which I have seen through the kindness of Mr. B. A. Krukoff.

Manihot Miller

Manihot orinocensis sp. nov.

Specimen suppeditat valde mancum quam frustulum vix melius totum glaberrimum cortice tenello griseo subnitido elenticellato. Foliis pro more generis parvis ca. 6 cm. latis, 5–6 cm. longis, 3-lobatis, lobis margine integris revolutisve, mediano elliptico-lanceolato ca. 3 cm. longo et 1.5 cm. lato, lateralibus basi plus minusve anisophyllis caeterum lanceolatis, medio sat dilatatis, ca. 2.5–3 cm. longis et 1.5 cm. latis, subtus glaucescentibus, supra ruguloso-impressis, membranaceis, nervis ca. 8–10-jugis patentibus, petiolo ca. 2.5–3 cm. longo, stipulis ut videtur subnullis vel nullis. Perianthio ♂ primum inflato, in anthesi plena tubuloso ca. 10 cm. longo fere totidem lato pallido, lobis late lanceolatis ad 3 mm. longis, disco bene lobulato, staminibus ca. 5–7 mm. longis, plus minusve 10. Caetera desunt.

VENEZUELA: Amazonas: Upper Orinoco, Puerto Ayacucho, "a tree 4 m. high, growing on granitic rocks around Pto. Ayacucho," *Williams 13132.*

The type specimen, hardly better than a scrap, was sent by Mr. H. Pittier with the suggestion that the species may be new. I deferred its publication, wishing to check it against material representing *M. saxicola* Lanj., the description of which suggested that it was uncomfortably close to the presumed new entity. *Stahel 107,* "cultivated from cuttings in the Agricultural Experiment Garden in Paramaribo, Surinam," identified at distribution as *M. saxicola,* is certainly not *M. orinocensis,* which differs in the texture and lobing of its leaves.

Tetrorchidium Poeppig

Poeppig & Endlicher are said to have published this genus in 1842 (see Pax & Hoffmann in Engl. & Prantl, Nat. Pflanzenfam. ed. 2. **19C:** 184. 1931), which is erroneous. The genus was actually published in 1845 by Poeppig alone, which is fully established by the title-page of the third volume of the Nova Genera ac Species Plantarum and associated data.

Tetrorchidium gorgonae sp. nov.

Arbuscula vel frutex 3–4 m. altus, innovationibus puberulis indumento brevissimo adpresso simplici demum glabrescentibus griseis. Foliis 10–22 cm. longis, 2.5–6.5 cm. latis, utrinque parce pubescentibus vel glabratis, supra viridibus, subtus pallide viridibus subnitidis, oblanceolatis sat abrupte caudato-acuminatis obvie distanterque serrato-dentatis, dentibus subcallosis utrinque ca. 4 vel 5, nervis ascendentibus vel patulis utrinque ca. 6-jugis, sub margine anastomosatis, trabeculis conspicuis, petiolo 1–2 cm. longo apice utrinque glandulis baculiformibus luteis insignito parcius hispido; stipulis late triangularibus, vix ultra 1 mm. longis totidemque latis. Inflorescentia in fructu tantum visa gracili ad 5 cm. longa; perianthio subintegro vix 2–2.5 mm. lato, pedicello ca. 2 mm. longo, columella acuminata ad 5 mm. longa, semine lenticulari ca. 5 mm. magno, testa nigra profundius lacunoso-foveolata, in arillo sat tenui roseato immersa; epicarpio immaturo (ut videtur) levi.

COLOMBIA: Nariño: Island of Gorgona, *Killip & Garcia 33214* (TYPE in U. S. Nat. Herb.).

A very distinct species, with comparatively narrow, small leaves, their margins with sharp teeth. In these characters it may be at once distinguished from *T. macrophyllum* Muell.-Arg., *T. rubrivenium* Poepp., and the species next described.

Tetrorchidium boyacanum sp. nov.

Arbuscula glaberrima, innovationibus subherbaceis. Foliis utrinque viridibus, 9–12 cm. longis, 4.5–5.5 cm. latis, obovatis vel elliptico-obovatis, apice breviter apiculatis, basi longiuscule cuneatis, firme chartaceis, nervis utrinque 6- vel 7-jugis jugo basali valde adscendente caeteris plus minusve patulis sub margine obscure anastomosatis, laminae margine glandulis pustulosis paucioribus in quarto supero praesertim insignito quapropter folii apice primo intuitu plus minusve profunde dentato-serrato, petiolo canaliculato glandulis 2 pustulosis anticis ornato 1–1.5 cm. longo. Inflorescentia ♂ tantum visa, ad 15 cm. longa, gracili, ramosa, glaberrima; floribus ca. 3–6 in axilla bracteae minutae utrinque glandulis luteis notata, calyce subsessili ca. 2.5 mm. lato, lobis 3 rotundato-ovatis subcucullatis ca. 1–1.5 mm. longis totidemque latis, staminibus 3, pistillodio (?).

COLOMBIA: Boyacá: El Umbo, 130 miles north of Bogotá, "in high thick forest, tree 12–16 ft., 4–6 inch. diam.," *Lawrance 547.*

This somewhat suggests *T. rubrivenium* Poepp., but it is altogether unlike that species in its leaf-margins.

Tetrorchidium popayanense sp. nov.

Arbuscula videtur, innovationibus subherbaceis, strigulosis, indumento perbrevi luteo valde adpresso. Foliis pallide olivaceis, 16–23 cm. longis, 7–9 cm. latis, longe obovatis vel oblanceolato-ellipticis, apice breviter acuminatis, basi longe cuneatis, firme chartaceis subtus sub lente vix pubescentibus, supra glabratis vel glabris subnitidis, nervis manifestis ca. 7–9-jugis, inferioribus adscendentibus, superioribus patulis bene anastomosatis trabeculis inconspicuis, laminae margine integro revoluto utrinque glandulis tubulosis estipitatis brevibus 5 vel 6 ornato, petiolo valde canaliculato eglanduloso pubescente 2–3 cm. longo. Inflorescentia gracili pubescente 7–10 cm. longa parcius ramosa, ♂ tanto visa. Floribus subsolitariis, calyce ca. 2.5 mm. lato pubescente pedicello ca. 1.5–2 mm. longo fulto, lobis 3 ovato-acuminatis, ca. 1–1.25 mm. longis, 1 mm. basi latis, staminibus 3 oppositilobis sessilibus vel subsessilibus ligulam centralem minutam (an pistillodium?) circumdantibus; bractea sub pedicello subtriangulari ca. 1.5 mm. lata glandulis insignita cum illis in lamina congruentibus.

COLOMBIA: El Cauca: Highlands of Popayán, (?) Río Huangubio, *Lehmann B7664*.

The type locality is not better indicated. The characters of the foliage suggest those of *T. euriphyllum* Standl. of Central America, but the primary nerves are less numerous and the leaf-blade is differently shaped, more markedly cuneate at the base, and with different marginal glands; the glands on the floral bracts are also different.

Tetrorchidium jamaicense sp. nov.

Arbor ad 8 m. alta glaberrima. Foliis integris primum tenuiter membranaceis demum firme subcoriaceis ellipticis vel elliptico-obovatis, 7–12 cm. longis, 3–4.5 cm. latis, apice brevius rotundato-acuminatis, basi longe cuneatis olivaceis subconcoloribus, nervis in sicco gracilibus at conspicuis ca. 7-jugis adscendentibus, petiolo carnosulo 1–2.5 cm. longo utrinque glandulis cicatricosis ornato, stipulis minimis vel subnullis. Inflorescentia ♂ tantum visa more generis gracili, effusa glabra parcius ramosa ad 18 cm. longa; floribus glomerulatis ad 4–8, glomerulis sat distantibus (proximis in rhachi inferiore 1–2 cm. remotis), perianthio ca. 5 mm. lato, lobis 3 ellipticis vel obovato-ellipticis margine intus subplicatis, staminibus sessilibus 3(–4), antheris more generis sat magnis.

JAMAICA: Road to Holly Mount, *Harris 8991*.

This new species is certainly the plant which Fawcett & Rendle (Fl. Jam. **4**(2): 317. *f. 105.* 1920) and Pax & Hoffmann (in Engl. & Prantl, Nat. Pflanzenfam. ed. 2. **19C**: 186. 1931) identify as representing *T. rubrivenium* Poepp. It differs from Poeppig's species, however, as represented by *Poeppig 1915* and *Klug 3713*, in having glabrous inflorescences, elliptic rather than triangular perianth-lobes, and entire leaves which are more coriaceous.

Sapium P. Browne

Sapium Bourgeaui sp. nov.

Arbor vel frutex glaberrimus. Foliis ellipticis, apice recurvatim glanduloso-cucullatis utrinque fere aequo jure rotundato-acuminatis, supra obscure subtus pallide olivaceis, margine sat conferte aristato-serratis, aristulis nigricantibus marcescentibus, hic inde glandulis pustulosis ornatis, ca. 15 cm. longis, 3–4 cm. latis, nervis delicatis at perspicuis latius adscendentibus ca. 15-jugis, petiolo 3–4 cm. longo apice glandulis 2 patentibus conicis onusto, stipulis late rotundato-auriculatis margine valde coriaceo-scariosis. Capsulae coccis delapsis (an revera hujus loci? soluti tantum adsunt) duris, ca. 10 mm. longis, semine arillo secedibili rubro induto ca. 7 mm. longo latoque.

MEXICO: Veracruz: Orizaba, Santa Aña, *Bourgeau 3020.*

This collection is mentioned by Hemsley in the notes under *S. mexicanum*, in Hook. Ic. **27:** sub *pl. 2680,* p. 2. 1901. Hemsley states that it is neither that species nor *S. lateriflorum* Hemsl. It is certainly not *S. macrocarpum* Muell.-Arg. (*S. mexicanum* Hemsl.), *S. appendiculatum* Pax & Hoffm., or *S. pedicellatum* Huber. The reflexed glandular tip of the leaf is a distinctive character.

Sapium Cuatrecasasii sp. nov.

Arbor magna, innovationibus cicatricosis glabris saltem sub apice stipulis cucullato-glandulosis magnis ornatis. Foliis 7–15 cm. longis, 2.5–5.5 cm. latis, subcoriaceis, apice fere planis vix emarginatis, venulosis, supra pallide olivaceis, subtus brunneo-lutescentibus, ellipticis utrinque sat obtuse acuminatis glaberrimis, margine totis crenato-glandulosis crenis haud profundis glandulis marginalibus hic inde obviis, nervis gracilibus patentibus saepius haud anastomosantibus utrinque ca. 20 ultimis vix perspicuis, petiolo rigidulo 2.5–4 cm. longo glandulis 2 vel 3 conicis anticis insignito. Inflorescentia spicata 2-sexuali sat crassa. Floribus ♂ ca. 12 in axilla squamulae cujusvis glandula utrinque valde carnosa ad 4–5 mm. longa, perianthio longe campanulato ca. 2–3 mm. longo et 2 mm. lato, lobo antico apiculato, staminibus 2 ad 3 mm. longis. Floribus ♀ in anthesi ignotis submaturis ad 10 mm. longis 5 mm. latis, ovario glaberrimo nigro ovoideo stylorum cicatrice subproducta notato, perianthii lobis 3 ovatis subscariosis intus medio crasse costatis, glandula utrinque ellipsoidea sat magna.

COLOMBIA: Putumayo: Valle de Sibundoy, alt. 2200 m., *Cuatrecasas 11671.*

This does not agree with any other species known to me from the region. The comparatively short petioles, the robust spikes, and the produced scars left by the fallen style on the ovaries are characteristic.

Sapium myrmecophilum sp. nov.

Arbuscula semimetralis. Foliis 5–8 cm. longis, 1–3 cm. latis, ellipticis subcoriaceis, apice subplanis vel retusis, utrinque brevius acuminatis, obscure conferteque crenulatis raro hic inde glandulosis, nervis patentibus ca. 15-jugis, petiolo vix 1 cm. longo vel minore glandulis 2 conicis patentibus pustulosis, stipulis auriculatis. Inflorescentia spicata bisexuali ad 10–15 cm. longa. Floribus ♂ ca. 9 vel 10 in axilla bracteolae latae parvae, perianthio aperiente vix 1–1.5 mm. longo, staminibus 2. Floribus ♀ subsessilibus in anthesi haud visis: perianthii lobis scariosis (videtur) 3, ovario maturescente globuloso depresso ca. 0.5 cm. magno, apice cicatrice minima haud producta notato.

COLOMBIA: El Vichada: 60 km. south of Orocué, *Haught 2772.*

This is described as a spreading shrub growing on ant-hills in the open llanos. It is characterized by the close leaf-crenation and the very short petioles.

Sapium Poeppigii Hemsl. in Hook. Ic. **27:** *pl. 2678.* 1901; Huber in Bull. Herb. Boiss. II. **6:** 439. *f. 32.* 1906.

Sapium hamatum (Muell.-Arg.) Pax & Hoffm. in Pflanzenr. 52 (IV. **147.** v): *229. fig. 43 D,E.* 1912. Syn. Nov.

Sapium biglandulosum var. *hamatum* Muell.-Arg. in Linnaea **32:** 116. 1863.

PERU: Huánuco: Between Huánuco and Pampayacu, *Kanehira 12;* Pampayacu, *Kanehira 28;* San Martín: Zepelacio, *Klug 3374;* Loreto: Lower Río Huallága, *Williams 4771.*

This is another of the entities which have been confused under the loosely applied name *S. Hippomane.* The identifications are made on the strength of the illustrations and the descriptions. The leaves are longer, narrower and thinner than are those of *S. Marmieri.* A specimen from Colombia, collected by Cuatrecasas along the Río Guamues, Putumayo, may belong here, but it lacks ♀ flowers and fruits. Pax & Hoffmann err in replacing *S. Poeppigii* Hemsl. (1901) by *S. hamatum* (Muell.-Arg.) Pax & Hoffm. (1912). The name which is published first in a given rank has priority, and cannot be replaced by a later combination even though the basinym, in this case a trinomial, happens to be the oldest name.

Sapium aereum Kl. ex Muell.-Arg. in Linnaea **32:** 119. 1863; Pax & Hoffm. in Pflanzenr. 52 (IV. **147.** v): 233. 1912.

BRAZIL: Amazonas: Humayta, *Krukoff 6158, 6296, 6307;* São Paulo de Olivença, *Krukoff 8311.*

This is an exceptionally critical entity which it would be desirable to compare with Klotzsch's own specimen. Only the last of the collections cited was distributed as *S. aereum,* all others being referred to *S. Hippomane.* While it seems quite likely that *S. glandulosum* (L.) Morong (*S. Hippomane* G. F. W. Mey. et auct.) and *S. aereum* are close, they appear to differ in the texture of the leaf and, to judge from the fruits of *Pittier 11832* and *Krukoff 8311,* also in the fruit, this being possibly larger in *S. aereum* and somewhat differently shaped. In a very definite sense *S. aereum* connects *S. glandulosum* and *S. Marmieri,* differing from the latter primarily in its leaves on the whole being smaller and narrower. Good fruiting material is essential to a final elaboration of all these entities.

The vernacular name "Tapuru" appears on the label of *Krukoff 6158.* A specimen which might belong here and strongly suggests the characters described and illustrated for *S. Taburu* Ule (in Tropenfl. **9:** Beih. 6:13. *fig. 3 D, E.* 1905) is *Klug 1668,* Colombia, Putumayo, Umbría. I strongly suspect that eventually it may be shown that *S. aereum* and *S. Taburu* are uncomfortably close if not identical. Pax & Hoffmann express the belief, Pflanzenr. 52 (IV. **147.** v): *232.* 1912, that *S. Taburu* is hardly separable from the entity they identify as *S. Hippomane.* In my opinion, this is the result of the two authors lacking a clear understanding of the ranges of these species. Unquestionably, a great simplification of the taxonomy of this group follows if *S. glandulosum* (*S. Hippomane*) is excluded from the Amazonian ranges of Brazil, Colombia and Peru.

Sapium Marmieri Huber in Bol. Mus. Goeldi **3:** 367. 1902, in Bull. Herb. Boiss. II. **6:** 354. 1906; Pax & Hoffm. in Pflanzenr. 52 (IV. **147.** v): 256. 1912.

Sapium Leitera Gleason in Bull. Torrey Club **60:** 364. 1933. Syn. Nov.

PERU: Loreto: Alto Río Itaya, *Williams 3490;* Lower Río Huallága, *Williams 4904, Killip & Smith 29265.* BRAZIL: Matto Grosso: source of the Jatuarana River, *Krukoff 1656* (type collection of *S. Leitera* Gleason); Acre: Rio Purus, *Krukoff 5717;* Amazonas: São Paulo de Olivença, *Krukoff 8098, 8428.* COLOMBIA: Putumayo: Puerto Ospina, *Cuatrecasas 10784;* Tolima: Curvas de Gualanday (Ibagué-Girardot), *Pérez-Arbeláez & Cuatrecasas 6490.*

This species is of economic importance as a potential source of rubber, for which it has been tapped in the past. The type was collected in the region of the Río Ucayali and the Río Huallága in Amazonian Peru. I match the descriptions with *Williams 3490* and *4904,* which I accept as representing this species. The leaf is essentially oblong to elliptic and more or less obtusely rounded at the tip in these two specimens which, once again to judge from the descriptions and the figures (see for instance Hemsley in Hook. Ic. **29:** *pl. 2899.* 1909), can hardly be separated from *S. eglandulosum* Ule in Tropenfl. **9:** Beih. 6: 14. 1905. The foliage of *Killip & Smith 29265* differs from that of the Williams specimens in being distinctly rounded to short round-elliptic, with the tip of the blade often retuse, but the remaining characters agree so well that, the range being in common, it must be considered that all these specimens are conspecific. As is well-known, considerable foliar differences are apt to occur in the same species of *Sapium* depending upon conditions of growth.

All the collections cited from Brazil have leaves that tend to match those of *Killip & Smith 29265,* but leaves of a pattern intermediate between those of this specimen and the Williams material are present in *Krukoff 8428.* The Colombian collections well match those from Peru, the record from Tolima being interesting as an extension of the range, heretofore supposedly restricted to the Andean regions of Peru, Brazil, and Colombia. *Sapium utile* Preuss, to judge from Hemsley's plate (in Hook. Ic. **29:** *pl. 2896.* 1909), is represented in our herbarium by a *Lehmann* specimen from Colombia, forests of Chocó-Micay and Timbiquí, which differs from *S. Marmieri* in the more or less evidently serrulate leaf-margins as well as its longer and narrower leaves. It is altogether likely that the records of *S. Hippomane* from Peru, Brazil, and Colombia are based to a large extent on misdeterminations of *S. Marmieri* and its allies.

Sapium aucuparium Jacq. Enum. Pl. Carib. 31. 1760, p. p. typ., excl. syn. Plumier.

Sapium jamaicense Sw. Adn. Bot. 62. 1829. Syn. Nov.

Jacquin's binomial has been extensively misapplied, the discussion of Hemsley, in Hook, Ic. **27:** *pl. 2650.* 1901, and the treatment of Pax & Hoffmann, in Pflanzenr. 52 (IV. **147.** v): 229. 1912, merely adding to the confusion.

The original publication reads as follows: "*aucuparium.* I. SAPIUM. *Plum. ic. 171. f. 2. Brown.* Jam. 1. p. 338.," the generic name being followed by the conventional abbreviation to designate a woody perennial. At the time when this publication was issued, one of its synonyms, "Plum. ic. 171.

f. 2.," had already been cited by Linnaeus under *Hippomane glandulosa*, Sp. Pl. 1191. 1753, which leaves Jacquin's binomial standing solely upon Browne's "Sapium 1. Arboreum foliis ellipticis glabris, petiolis biglandulis, floribus spicatis." (Hist. Jam. 338. 1756). This synonym has been overlooked by most authors, but not by Fawcett & Rendle, Fl. Jam. **4** (2): 325. 1920, who place it in the synonmy of *S. jamaicense* Sw. This binomial, consequently, falls under *S. aucuparium* Jacq.

Three years after the publication of *S. aucuparium*, as quoted, Jacquin again dealt with the same binomial, Select. Amer. Hist. 249. *pl. 158*. 1763, repeating the original references but adding *Hippomane glandulosa* Linn. and Plukenet's "*Tithymalus* arbor americana, mali medicae folio . . . " Jacquin's illustration and description here apply to a very different plant than the one he identified in 1760 as *S. aucuparium*. Naturally, this plant cannot bear the binomial which was misapplied to it by Jacquin and very numerous other authors. I discuss it as *S. biglandulosum* (L.) Muell.-Arg. below.

Sapium biglandulosum (L.) Muell.-Arg. in Linnaea **32:** 116. 1863, excl. var. fere omn.

Hippomane biglandulosa L. Sp. Pl. ed. 2. 1431. 1763, p. p. typ., quoad syn. Jacq.

Sapium aucuparium Jacq. Select. Amer. Hist. 249. *pl. 158*. 1763, quoad ic. descr. excl. syn. omn., non *S. aucuparium* Jacq. Enum. Pl. Carib. 31. 1760.

Sapium salicifolium H. B. K. Nov. Gen. & Sp. **2:** 52. 1817. Syn. Nov.

Sapium Moritzianum Kl. in Seem. Bot. Voy. Herald 100. 1852; Huber in Bull. Herb. Boiss. II. **6:** 358. *f. 19*. 1906; Pax & Hoffm. in Pflanzenr. 52 (IV. **147.** v): 230. 1912. Syn. Nov.

PANAMA: Coclé: El Valle de Antón, Las Uvas, *Allen 2575;* Perlas Islands, Pedro Gonzales, *Allen 2583*. COLOMBIA: Magdalena: Santa Marta, *H. H. Smith 1916;* Boyacá: Orocué, *Haught 2826*. VENEZUELA: Aragua: Carbanchito, *Pittier 11802;* Cagua, *Pittier 12291;* Distrito Federál: Cotiza, *Pittier 12401*.

Linnaeus is the author of both *Hippomane glandulosa*, 1753, and *Hippomane biglandulosa*, 1763. Although the latter epithet might have been mistakenly applied for the former, it proves impossible to treat it as a clear unintentional error under the current Rules of Nomenclature, particularly so in that it has been extensively used in botanical literature under different generic names. The correct application of *S. glandulosum* (L.) Morong is discussed below.

The original publication of *H. biglandulosa* reads as follows: "*Hippomane biglandulosa* foliis ovato-oblongis basi biglandulosis. Sapium arboreum, foliis ellipticis glabris, petiolis biglandulis, floribus spicatis. *Brown. jam. 338.* Sapium aucuparium. *Jacq. amer. 31. t. 158.* Mancanilla lauri foliis oblongis. *Plum. gen. 50. ic. 171. f. 2.* Tithymalus arbor americana, mali medicae foliis amplioribus tenuissime crenatis succo maxime venenoso. *Pluk. alm. 369. t. 229. f. 8. Habitat* in America *calidiore*." The synonyms from Browne, Plumier, and Plukenet are discussed under *S. glandulosum* and *S. aucuparium*, to which they belong. Since no specimen of *H. glandulosa* or *H. biglandulosa* is extant in the Linnaean herbarium (see Jacks. Ind. Linn. Herb. 86. 1912), *H. biglandulosa* rests solely upon the plate and description of *S. aucuparium* Jacq., 1763 non 1760. It is fortunate that

Jacquin's misapplication can easily be corrected by the reinstatement of *S. biglandulosum* (L.) Muell.-Arg. in the sense here proposed.

Mueller-Argoviensis followed *S. biglandulosum* with a trinomial α *Meyerianum*, essentially based upon Meyer's *S. Hippomane*. This is taxonomically not correct, but, as is well-known, a new combination stands (Art. 54, Amsterdam Rules 1935) even if it involves a misapplied specimen. Accordingly, the type of *S. biglandulosum* is the plant figured by Jacquin, growing near Cartagena in Colombia, "inque ipso suburbio Xiximani ante macellum." The type-variety, on the contrary, is *S. biglandulosum* var. *Meyerianum*.

Sapium salicifolium H. B. K. has generally been treated as a doubtful synonym of *S. Moritzianum*. The type material was collected at Morales on the banks of the Río Magdalena, and is without ♀ flowers or fruits. Its description so closely agrees with the material I have seen that I do not hesitate to accept it as representing *S. biglandulosum*. The existence of some varieties under this binomial is likely. The Venezuelan plant, for instance, would seem to have slightly different leaves on the whole, as noted by Huber, in Bull. Herb. Boiss. II. **6:** 358. 1906, in his discussion of *S. aucuparium*.

Sapium glandulosum (L.) Morong in Britt. & Mor. in Ann. N. Y. Acad. Sci. **7:** *227*. 1893.

Hippomane glandulosa L. Sp. Pl. 1191. 1753, p. p. typ., quoad syn. Pluk., Raj.

Sapium Hippomane G. F. W. Mey. Prim. Fl. Esseq. *275*. 1818; Huber in Bull. Herb. Boiss. II. **6:** *360*. *f. 21*. 1906; Pax & Hoffm. in Pflanzenr. 52 (IV. **147.** v): *231*. 1912, p. p. Syn. Nov.

Sapium suberosum Muell.-Arg. in Linnaea **34:** *217*. 1865; Hemsl. in Hook. Ic. **27:** *pl. 2650*. 1900. Syn. Nov.

Sapium Hemsleyanum Huber in Bull. Herb. Boiss. II. **6:** *362*. *f. 22*. 1906. Syn. Nov.

BARBADOS: Forester's Hall Wood, *Eggers 7238*. VENEZUELA: Distrito Federál: Naiguatá, *Pittier 11832*.

Hippomane glandulosa L. rests exclusively upon two synonyms, "Mancanilla lauri foliis oblongis. *Plum. gen. 50*" and "Tithymalus arbor americana, mali medicae foliis amplioribus tenuissime crenatis, succo maxime venenoso. *Pluk. alm 369. t. 229. f. 8. Raj. suppl. 428.*" Urban used one of these polynomials, Plumier's *Mancanilla*, in the synonymy of his own *S. caribeum*, Symb. Ant. **3:** 309. 1902, and referred the other, op. cit. 306, to *S. Hippomane* G. F. W. Meyer. *Sapium Hippomane* Meyer was a new name for *Hippomane biglandulosa* L., the Linnaean binomial being cited by Meyer under his own.

Under the current Rules, the correct transfer of *Hippomane biglandulosa* to *Sapium* can be effected only by publishing *S. biglandulosum*, which was done by Mueller-Argoviensis but not by Meyer. Meyer's name, consequently, is illegitimate, and falls now under *S. glandulosum* (L.) Morong, which is typified by Plukenet's *Tithymalus* as interpreted by Urban. Here also belong *S. suberosum* Muell.-Arg., based on a diseased condition of the entity under discussion. Huber comments that the entities he understands as *S. Hemsleyanum* and *S. Hippomane* are not certainly distinct as species, but might easily prove to be varieties. This is possible, but the material

I have seen so far is too scanty to justify the publication of trinomials in this difficult group; *Eggers 7238,* from Barbados, cited by Pax & Hoffmann, is certainly very close to *Pittier 11832* from the coast of Venezuela.

I cannot follow Pax & Hoffmann in accepting *S. glandulosum* (which they call *S. Hippomane*) for the Amazonian forms of Brazil and Peru. Everything indicates that Pax & Hoffmann confuse *S. glandulosum* with *S. Marmieri.* The former would seem to have an essentially coastal range, restricted to the Guianas, Venezuela, and some of the West Indian islands, while the latter, as noticed elsewhere in this paper, is primarily an Amazonian type.

Index Kewensis lists *S. glandulosum* Morong as an error for *S. biglandulosum* Muell.-Arg. and accepts as valid the combination of Druce in Rep. Bot. Exch. Club Brit. Isl. 1913, **3:** 423. 1914. I cannot accept this interpretation. It is true that Morong treats *H. glandulosa* and *H. biglandulosa* as synonymous, but the combination he made conforms with the requirements of Art. 44[2] of the current Rules of Nomenclature in being followed by a full reference to *Hippomane glandulosa* L.; the remaining two citations can be excluded as misapplications without affecting in the slightest the validity of the new combination. The fact that Morong's transfer was effected for a misapplied specimen does not make this transfer illegitimate.

I have not seen authentic material of *S. obtusilobum* Muell.-Arg., but Huber's illustration, in Bull. Herb. Boiss. II. **6:** 357. *f. 17.* 1906, suggests that this species might fall here as a trinomial if not as a straight synonym.

Sebastiania Sprengel

Sebastiania huallagensis sp. nov.

Arbuscula ca. 6-metralis innovationibus glaberrimis. Foliis elliptico-lanceolatis, apice sat abrupte acuminatis, basi cuneatis, margine integris, 6–9 cm. longis, 2.5–3.5 cm. latis, nervis gracilibus ca. 10–14-jugis, petiolo ca. 1.5 cm. longo apice glandulis 2 nigricantibus pustulosis sat magnis ornato. Inflorescentia gracili bisexuali ad 8 cm. longa. Floribus ♂ ca. 6–8 in axilla squamulae ca. 1.5 mm. lata, perianthio minuto subsessili 3-lobato, staminibus alternilobis 3 basi connatis. Floribus ♀ singulis pedicello ca. 0.5 cm. longo, ovario levissimo ca. 4 mm. longo et 1.5 mm. lato, basi squamis imbricatis 3–5 circumdato, in stylis 2–3 crassiusculis divergentibus abeunte.

PERU: San Martín: Juan Jui, Alto Río Huallága, *Klug 4243.*

Distributed as representing *Alchornea* sp. ?, which it is certainly not. The sum of the characters suggests *Sebastiania,* but better material is needed to confirm this disposition of it.

Sebastiania anisandra (Griseb.) Lillo in Seg. Contr. Conoc. Arbol. Argent. 16. 1917.
Actinostemon anisandrus Pax in Pflanzenr. 52 (IV. **147.** v): 79. 1912.
Dactylostemon anisandrus Griseb. in Abh. Ges. Wiss. Götting. **24:** 61. 1879.

PARAGUAY: Alto Paraguay: San Lázaro, *Rojas 5490.*

The *Rojas* specimen, collected "entre rocas calcáreas semi-sombrias," is a good match for an Argentine specimen, *Venturi 1350,* from Tucumán, Famaillá, originally distributed as representing *S. anisandra*. A younger state of the same species is apparently represented by *Venturi 5349*, identified by Lillo himself. This record seems to be a new one for the flora of Paraguay.

Euphorbia Linnaeus (excl. Chamaesyce)

Euphorbia insulana Vell. Fl. Flum. **5**: *pl. 14*. 1827; Muell.-Arg. in Mart. Fl. Bras. **11**(2): 688. 1874.

Euphorbia insulana minor Muell.-Arg. op. cit. 689. Syn. Nov.

Euphorbia anomala Salzm. ex Boiss. in DC. Prodr. **15**(2): 59. 1862; Boiss. Ic. Euph. 15. *pl. 38*. 1866.

This is a widespread species, very close to *E. lancifolia* Schlect. of Mexico and Central America. It is convenient to break it up in three subspecies with a broad geographical background.

Euphorbia insulana subsp. **typica** subsp. nov.

Cyathiis ca. 2.5 mm. longis, inflorescentiis saepissime abbreviatis bracteis subfoliaceis.

BRAZIL: Ceará: Maranguapé, *Drouet 2594;* Paraná: Guaratuba, *Dusén 13518;* São Paulo: Ilha Queimada, *Gehrt 4579*.

The type is Vellozo's figure. *Gehrt 4579* is altogether true to Mueller's description of *minor,* but impresses me as having been taken from a weak shoot of the plant.

Euphorbia insulana subsp. **tovarensis** (Boiss.) comb. nov.

Euphorbia tovarensis Boiss. Cent. Euph. 19. 1860; in DC. Prodr. **15**(2): 59. 1862.

COLOMBIA: Santander: Between El Roble and Tona, *Killip & Smith 19427*.

This trinomial is very near *E. lancifolia,* resembling it in the rather diffuse and robust inflorescence and in the comparatively large cyathia. *Bang 2208,* collected at an unrecorded locality in Bolivia, also belongs here; this specimen is erroneously listed as *E. geniculata* in Bull. N. Y. Bot. Gard. **4**: 441. 1907.

Euphorbia insulana subsp. **pilcomayensis** subsp. nov.

A formis totis foliis bractealibus discedit saepius longe ellipticis, cyathiis minoribus, inflorescentiis magis delicatis.

PARAGUAY: Pilcomayo River, *Morong 867* (TYPE); Between Río Apa and Río Aquidabán, *Fiebrig 4393*. ARGENTINA: Formosa, (?) *Jörgensen 3081;* Chaco (Argentina ?): Fontana, *Meyer 2320*.

The habit sets this new subspecies rather sharply apart from the others, but a broad concept of specific limits, necessary in this case, forbids its being treated as a full-fledged species. *Euphorbia Mandoniana* Boiss., of which I have seen only the meagerest scraps, may prove to be an extreme alpine form of this complex.

Euphorbia Huanchahana (Kl. & Garcke) Boiss. in DC. Prodr. **15**(2): 103. 1862.

Tithymalus huanchahanus Kl. & Garcke in Abhandl. Akad. Wiss. Berlin 71. 1860.

As in many species of this genus in the South American range, it proves to be impossible to adopt for this entity a narrow concept of specific limits. The material I have at hand indicates the existence of two main aggregates, one localized in Peru, the other in southern Bolivia and northern

Argentina. In addition, the aggregate of Peru and Bolivia is divided into two forms, one glabrous, the other rather pubescent, which bear to each other a varietal relationship.

Euphorbia Huanchahana subsp. **typica** subsp. nov.

Foliis minutis saepissime margine serratis glabris.

I have seen a photograph of the type, collected in "Canta Prov. Peru." This material is to all appearances well matched by a Peruvian specimen from Matucana, Dept. Lima, *Savatier 1356.*

Euphorbia Huanchahana subsp. **penazuelensis** subsp. nov.

Foliis carnosulis margine integris subintegrisve indumento sat conferto a subsp. *typica* discedit.

ARGENTINA: Tucumán: Sierra Calchaquies, Peñas Azules, 3400 m., *Burkart 5306* (TYPE); Catamarca: Andalgalá, Cerro Negro, alt. 3500 m., *Jörgensen 1232.*

The habit is that of an alpine plant, the branches being rosulate and the rootstock much thickened.

Euphorbia Huanchahana var. **peperomioides** var. nov.

Pusilla, plus minusve rosulata a subsp. *penazuelensi,* cujus est, quacumque notis caeteris totis optime convenit glabritie primo intuitu recedit.

BOLIVIA: *Mandon 1068.*

This variety belongs to subsp. *penazuelensis,* with which it agrees in habit and foliage, differing only in indumentum. The Mandon material I have seen is probably identical with the Weddell specimen from Bolivia cited by Boissier.

Euphorbia caespitosa Lam. Enc. Méth. **2**: 421. 1788; Boiss. in DC. Prodr. **15**(2): 103. 1862; Muell.-Arg. in Mart. Fl. Bras. **11**(2): 701. 1874.

This species is closely allied to *E. portulacoides* L. emend. Spreng., which ranges throughout Argentina and Chile. It is restricted in its range to the regions immediately adjacent to the mouth of the Río de la Plata in Uruguay and Argentina. It falls into two readily separable groups.

Euphorbia caespitosa subsp. **typica** subsp. nov.

Foliis obovato-ellipticis vel spathulatis, apice rotundatis.

URUGUAY: Vicinity of Montevideo, *Fruchard 182, Arechevaleta 5194a.*

The cited material agrees perfectly with Lamarck's type in the herbarium of the Paris Museum.

Euphorbia caespitosa subsp. **ventanicola** subsp. nov.

Cum subsp. *typica* in floralibus optime convenit, sed foliis apice bene acuminatis, loco natali alieno primo intuitu distincta.

ARGENTINA: Buenos Aires: Cerro Naposta, Sierra de la Ventana, *Von Rentzell 1082* (TYPE); Pigüé, *Burkart 4706.*

This is a well-marked form, readily recognizable by the characters of the foliage and by the range, which centers in the Sierra de la Ventana. It is likely that this plant is included in part by Boissier in his concept of *E. portulacoides acutifolia* Boiss., in DC. Prodr. **15**(2): 103. 1862, and is the one not altogether correctly identified as *E. caespitosa* by Spegazzini, Contr. Fl. Sierra Vent. 54. 1896; Contr. Fl. Tandil 47. 1901. *E. portula-*

codes Spr. [sic] *normalis* O. Ktze. is based upon a plant collected in the Tandil, O. Kuntze, Rev. Gen. **3:** 286. 1898, which I have not seen but which most likely belongs here. This trinomial is validly published and must be used for the typical form of *E. portulacoides* L. emend. Spreng., despite Kuntze's probable misapplication.

Euphorbia sciadophila Boiss. in DC. Prodr. **15**(2): 57. 1862; Muell.-Arg. in Mart. Fl. Bras. **11**(2): 687. *pl. 97.* 1874.

ARGENTINA: Tucumán: La Criolla, *Rodriguez 502.*

This species is common in southeastern Brazil and in Paraguay, but I have seen only the specimen cited from Argentina. The record seems to be new. The affinities of *E. sciadophila* with the Peruvian *E. adianthoides* Lam. require careful study.

Euphorbia spathulata Lam. Enc. Méth. **2:** 428. 1788; Boiss. in DC. Prodr. **15**(2): 136. 1862; Muell.-Arg. in Mart. Fl. Bras. **11**(2): 701. 1874; Croiz. in Torreya **42:** 16. 1942, *in nota.*

Euphorbia dictyosperma Fisch. & Mey. in Ind. Sem. Hort. Petrop. **2:** 37. 1836; Boiss. in DC. Prodr. **15**(2): 135. 1862; Nort. in Missouri Bot. Gard. Rept. **11:** 106. *pl. 22, 23.* 1900; Wheeler in Kearn. & Peebl. Fl. Pl. Arizona 539. 1942. Syn. Nov.

The suspicion I have already voiced that *E. spathulata* is merely an introduced weed in the regions of the La Plata and that it is the same as *E. dictyosperma* Fisch. & Mey. of the southeastern United States is confirmed. No differences can be found to separate such specimens, for instance, as *Culwell & Timmons 3065* (Central North Texas) and *Lombardo 3903* (Montevideo), *Scala 90,* and *Burkart 3747* (Mouth of the Paraná).

Euphorbia invaginata sp. nov.

Herbacea, glabra, caulibus fistulosis striatis hic inde ceraceis. Foliis carnosulis ligulatis vel longius elliptico-obovatis subeveniis, margine integris, apice mucronatis, basi longe acuminatis, epetiolatis, 5–6 cm. longis, 1–1.75 cm. latis, nervo medio validiusculo, stipulis petiolaribus subnullis vel nullis. Inflorescentiis terminalibus effusis ad 15 cm. longis bracteato-vaginatis, primo internodio ad 4 cm. longo caeteris 0.75–1 cm. tantum longis, bracteis subpetaloideis pallidis hic inde albicantibus tenuissime venulosis late ovato-cordatis ad 2 cm. longis totidemque latis mucronulatis. Cyathiis verosimiliter singulis bracteis occultatis invaginatisque, ad 4 mm. longis et 2 mm. latis, cylindrico-campanulatis, nectariis 4 vel 5 stipitatis carnosulis margine corrugatis parvis appendice petaloidea nulla, pedicello ca. 1.5–2 mm. longo; capsula glabra levi, coccis delapsis ad 7 mm. longis angustis, semine valde elongato angusto ambitu tetragono, vix 1.5 mm. crasso, 6 mm. longo, arillo albicante hic inde granulato-leproso, caruncula rotundata bene umbonata stipitataque.

PARAGUAY: Chaco: Picuyba, *Rojas 7268.*

This new species belongs to Boissier's Sect. *Stachydium,* which includes *E. comosa* Vell., *E. lupulina* Boiss., *E. Gollmeriana* Boiss., *E. foliiflua* Ule, and the African *E. phylloclada* Boiss. From all the American species *E. invaginata* differs in the length of the seed. In foliage it most closely resembles *E. Gollmeriana* Boiss. and *E. foliiflua* Ule.

Euphorbia aureocincta sp. nov.

Herbacea hirta fistulosa, serius glabrata. Foliis (ut videtur) miro modo ludentibus, nunc more *Amaranthi* ssp. obcuneatis vel grosse quadrangulis, margine profundius irregulariter lobulato-dentatis, 3–6 cm. longis, 2–3 cm. latis, tum exquisite elliptico-lanceolatis margine integris 5–12 cm. longis 0.5–1.5 cm. latis, apice acutis, basi breviter cuneato-angustatis, petiolo semper brevi vix 1.5 cm. longo hirtulo. Inflorescentiis coarctato-capitulatis, bracteis lineari-lanceolatis acutis, 3–7 cm. longis, 0.5–1 cm. latis, integerrimis, basi pulchre aureis; cyathio ca. 3 mm. longo fauce 2.5–3.5 mm. lato, lobis lacerato-ciliatis, nectario unico sat plano, ovario in anthesi subincluso, capsula depresse rotundato-trigona ca. 5 mm. longa et lata, stylis vix 1.5 mm. longis ad tertium inferum partitis; semine 3.5 mm. longo, 2 mm. lato, quadrangulo, arillo albicante vel pallide brunneo toto induto, basi truncato, apice longiuscule acuminato, sub apicem atque ad medium leviter constricto-zonato, hic inde verruculoso-lineato.

PARAGUAY: Carapeguá, Callistro, *Rojas 3379* (TYPE). ARGENTINA: Jujuy: Quebrada del Chañi, *Schreiter 10990*.

This is a well-marked form, but its ultimate rank, whether binomial or trinomial, is a matter of speculation. It belongs to the group of *E. elliptica* Lam. (*E. geniculata* Ort.; *E. prunifolia* Jacq.), and its taxonomic status would seem to match exactly that of *E. zonosperma* Muell.-Arg. Unlike that species, which is widely distributed, *E. aureocincta* appears to be restricted to Paraguay, Argentina, and possibly Bolivia. The Schreiter specimen cited above requires verification, for it represents a state with leaves of amaranthoid pattern not resembling, at a glance, the typical form, *Rojas 3379,* which has only narrowly lanceolate leaves. However, both in *Rojas 3379* and *Schreiter 10990* the floral parts are identical, and some of the leaves are very similar. *Euphorbia heterophylla* L. *β elliptica* f. *hirticaulis* O. Kuntze, Rev. Gen. **3:** 286. 1891, probably belongs here.

Euphorbia acerensis Boiss. in DC. Prodr. **15**(2): 55. 1862.

ARGENTINA: Tucumán: Villa Lujan, *Venturi 524* (*? 324*); Salta: Río Toro y Río Blanco, *Vattuone 17*.

The cited material was misdetermined as representing *E. adianthoides* Lam. All the species in this group are closely related, and the existence of intermediates between *E. acerensis* Boiss. and *E. Poeppigi* Boiss., which ranges from the Amazonian regions of Peru to Bolivia, is probable.

Euphorbia pentadactyla Griseb. in Abhandl. Gesell. Wiss. Goettingen **24:** 63. 1879.

PARAGUAY: Gran Chaco: Carandaity, *Rojas 7287*.

This species resembles *E. aureocincta* Croiz. but is easily recognized as distinct on account of its long filiform simple styles. The record seems to be new for Paraguay. Earlier records are all from Argentina.

Euphorbia Milii Des Moul. in Bull. Hist. Nat. Soc. Linn. Bordeaux **1:** 27. *pl. 1.* 1826; Desf. Cat. Hort. Paris. ed. 3. 475. 1829; Croiz. in Jour. Arnold Arb. **21:** 506. 1940.

Euphorbia splendens Boj. ex Hook. in Bot. Mag. **56:** *pl. 2902.* 1829; Denis, Euph. Iles Austr. Afr. 82. 1922.

PARAGUAY: Asunción, cultivated in the Botanical Gardens, *Rojas 1264*.

The reasons calling for the reinstatement of Des Moulins' neglected name have been given in my paper cited above.

Euphorbia Hinkleyorum I. M. Johnst. in Contr. Gray Herb. n. s. **70**: 72. 1924.

ARGENTINA: Jujuy: Tilcara, Cerro Peña Alta, *Venturi 4916*.

The classical locality is Mt. Chachani, near Arequipa, Peru. This is a new record for Argentina, and the species may be expected from Bolivia. The forms in this group bear an interesting relationship to *E. claytonioides* N. E. Br. of Angola in West Africa.

Euphorbia pampeana Speg. in Rev. Jard. Zool. Buenos-Aires **1**: 30. 1893.

URUGUAY: Canelones: Las Brujas, *Lombardo 1959*.

This is probably a new record for Uruguay. The polymorphism of this species under conditions of experimental cultivation is hardly credible; the leaves vary from obovate to narrow-linear and from manifestly pubescent to fully glabrous, as I have observed the species in cultivation.

Euphorbia phosphorea Mart. in Spix & Mart. Reise Brasil **2**: 612. 1828, *in nota;* Boiss. in DC. Prodr. **15**(2): 176. 1862; Muell.-Arg. in Mart. Fl. Bras. **11**(2): 692. pl. 95. 1874; Mansf. in Monatschr. Kakt.-Gesell. **3**: 244. 1931.

Euphorbia rhipsaloides Glaz. in Bull. Soc. Bot. France **59**(Mém. 3g): 638. 1912, nec alior. Syn. Nov.

BRAZIL: Bahia: Queimadas, *Rose & Russell 19848* (in herb. N. Y. Bot. Gard.).

The peculiar phosphorescent sap of this plant, noted by Martius and by Glaziou, is often mentioned in the literature, but I have seen only the cited specimen which may belong here. The place of publication of the binomial is variously reported, but I am satisfied that the reference given above is correct, for the Latin description is given in the footnote cited; "p. 726," cited by Boissier, Index Kewensis, and most authors, merely contains Martius's comments on the phosphorescent properties of the latex. Mansfeld puts this species in the Sect. *Pteroneurae* together with *E. Weberbaueri* Mansf., *E. Sipolisii* N. E. Br., and *E. pteroneura* Berger. My understanding, on the contrary, is that *E. phosphorea* has a distinct position of its own.

Euphorbia orizabae Boiss. in DC. Prodr. **15**(2): 147. 1862.

GUATEMALA: Quiché: Nebaj, 6400 ft., *Skutch 1734;* Chimaltenango: Cerro de Tecpám, alt. 2400–2700 m., *Standley 61046;* Quezaltenango: Ostuncalco, alt. 2700 m., *Standley 66410*.

The record is apparently new for Central America. The peculiar velutinous indumentum of the branchlets and floral parts immediately separates this species from the forms around *E. campestris* Cham. & Schlecht.

Chamaesyce S. Gray emend. Croizat

The difference in habit between *Chamaesyce* and *Euphorbia* in a narrow sense is said by Wheeler, in Rhodora **43**: 99. 1941, to have been caused by a process of reduction in the main axis, as follows, "When by progressive reduction of the main axis subg. *Chamaesyce* finally arrived at the habit of branching after the first pair of true leaves appeared, the plant was obviously too small to produce all the elaborate foods necessary for a production of a cyathium with its reproductive structures requiring abundant protein, fats, and carbohydrates; so we find that the cyathium which would otherwise terminate the main axis is omitted."

This account does not require explicit refutation for the benefit of anybody acquainted with plant physiology. The ultimate destination of food is ruled in living organisms by highly complex metabolic equations, and no plant is ever so bereft of "abundant protein, fats, and carbohydrates" as to be incapable of yielding one flower, or cyathium, in lieu of one or several vegetative buds. The *Chamaesyce* which, according to the explanation just quoted, is so weak (let us notice: phylogenetically) as to deny itself the luxury of an apical reproductive structure, is vital enough to produce up to five or six buds set around the portion of the stem which ought to bear the apical cyathium but is said to be incapable of doing so. These buds, in their turn, may yield an internode which is immediately floriferous, so that several cyathia may be brought forth immediately above the point at which not a single one could arise on account of the lack of proteins, fats, and carbohydrates, if the explanation of Wheeler were to be accepted.

This is not all; *Chamaesyce* includes at least one-third of the species commonly treated as *Euphorbia* and is the most widespread of the Euphorbiaceae, with the exception, perhaps, of *Euphorbia* Sect. *Tithymalus* in the sense of Boissier. Its vitality is astounding, and its morphologic range exceedingly varied, including fugacious annuals barely a few inches long, and trees in which a true woody trunk appears formed by the ultimate fusion of the internodal growth peculiar to the group. There is not the slightest evidence to favor the belief that this group has been derived in evolution from some other aggregate already differentiated as *Euphorbia* in the modern sense; its range, morphology, and physiology point to its being one of the archetypes of the Euphorbiaceae, certainly not a moribund offshoot of some "Section" of the Linnaean genus. The interpetiolar stipules of *Chamaesyce* do not seem to be homologous with ordinary stipules but to have arisen in evolution by the reduction and specialization of a quaternate foliar verticil, this in itself being an indication that the theory of progressive reduction advanced by Wheeler neglects the fact that specialization and differential growth, rather than reduction, are involved in the shortening of the axes of *Chamaesyce*. It will be obvious that, treated as a section, a subgenus, or a genus, *Chamaesyce* is not to be interpreted as suggested by Wheeler; for its phylogeny, morphology, and life-history contradict this interpretation on the strength of factors which have nothing to do with the taxonomic and nomenclatural preferences of an author.

Chamaesyce may be treated in subordination under *Euphorbia* by any botanist who accepts traditional values as absolute, and it is not my intention to dispute the legitimacy of such a point of view so long as it is knowingly held. I accept *Chamaesyce* as a genus for the following reasons: (1) it includes not less than 600 species and manifestly stands for one of the largest aggregates in the Euphorbiaceae; (2) the difference is fully as great between *Euphorbia* and *Chamaesyce* as it is between *Mallotus* and *Macaranga, Glochidion* and *Phyllanthus, Alchornea* and *Cleidion, Cnidoscolus* and *Jatropha,* and the like (this vital fact is generally unknown to local students of *Euphorbia*); (3) the peculiarities of the stem-abortion of *Chamaesyce,* so far dismissed as "habit," are of far-reaching phylogenetic and morphological significance; (4) the species under *Chamaesyce* with few exceptions (probably not more than 10–15 species in the group called by Boissier *Euphorbia* sect. *Zygophyllidium*) are readily identifiable in the herbarium; (5) the characters of the nectaries on the cyathium, which are currently used to segregate from *Euphorbia* about 50 species of *Monadenium* and *Synadenium* and a single species of *Diplocyathium* (see Pax & Hoffm. in Engl. & Prantl, Nat. Pflanzenfam. ed. 2. **19c:** 43–44. 1931), could consistently be used to break up the Linnaean genus into many genera (*Dactylanthes,* for instance), thus reintroducing in its classification the confusion which Boissier sought to eliminate. To reject spurious "floral characters," full of unwelcome possibilities for classification, and to take up in their stead broad morphologic and phylogenetic concepts is sound and conservative taxonomy.

Chamaesyce chamaerrhodos (Boiss.) comb. nov.

Euphorbia chamaerrhodos Boiss. Cent. Euph. 2. 1860, in DC. Prodr. **15**(*2*): 51. 1862, Ic. Euph. 13. *pl. 25.* 1866.[1]

PARAGUAY: Carapeguá, *Rojas 3352.*

The collection cited is excellent evidence of the dimorphism of this species, the crowded short florigerous axes being unlike the long and sterile shoots. The former strongly suggest the growth of **Chamaesyce potentilloides** (Boiss.) comb. nov. (*Euphorbia potentilloides* Boiss.), the latter that of *C. hirta* (L.) Millspaugh.

Chamaesyce Selloi (Boiss.) comb. nov.

Euphorbia Selloi Boiss. in DC. Prodr. **15**(*2*): 50. 1862, Ic. Euph. 13. *pl. 22.* 1866.

This is a collective species with numerous forms. The one described below differs from the type, illustrated by *Sello 170,* in the characters of the seed.

Chamaesyce Selloi var. **brevisemina** var. nov.

Semine ovoideo potius quam trigono-acuminato in faciebus inter costulas leviusculo potius quam impresso a formis typicis recedit.

ARGENTINA: Entre Ríos: Concordia, *Burkart 822.*

Chamaesyce Meyeniana (Kl.) comb. nov.

Euphorbia Meyeniana Kl. in Nova Acta Acad. Leop.-Carol. Nat. Cur. **19:** Suppl. 1: 414. 1843 (Meyen. Obs. Bot.); Boiss. in DC. Prodr. **15**(2): 42. 1862.

PARAGUAY: Chaco Paraguayo: Puerto Casado, *Rojas 2171;* Isla Poi, *Rojas 7070.*

The former specimen particularly is an excellent match for such Bolivian

[1]See Briquet, in Bull. Soc. Bot. Suisse **50a:** 57, footn. 1. 1940, for the date of this work. Pritzel errs in both editions of the "Thesaurus," giving the date for the Icones as 1856. The "Centuria Euphorbiarum" is overlooked by Pritzel and by most bibliographers.

collections as *Pentland* (?) *109* and *D'Orbigny 1207*. This is a new record for Paraguay.

Chamaesyce Eichleri (Muell.-Arg.) comb. nov.

Euphorbia Eichleri Muell.-Arg. in Jour. Bot. **12:** 232. 1874.

PARAGUAY: Chaco: Puerto Casado, *Rojas 2170;* Loma Porá, *Rojas 2969.* ARGENTINA: Tucumán: Tapia, *Venturi 2320;* Salta: Orán, *Schreiter 10991.*

This appears to be a new record for Paraguay. The identifications were made on the basis of a photograph of *Lorentz 301,* in the Delessert herbarium, and the description.

Chamaesyce Lorentzii (Muell.-Arg.) comb. nov.

Euphorbia Lorentzii Muell.-Arg. in Jour. Bot. **12:** 231. 1874.

URUGUAY: locality ?, *Arechevaleta 5192 a.* ARGENTINA: Buenos Aires: Belgrano, *Parodi 9879;* Tigre, *Parodi 11095, Hicken 441, Burkart 5711;* Los Talas, *Marelli 39;* Belgrano Bajo, *Burkart 3632;* Delta Paraná, *Burkart 8357.*

The record for Uruguay is new, I believe. The determinations were based on a photograph of *Lorentz 466,* from the Berlin herbarium, and the description. This species tends to be restricted to very moist habitats.

Chamaesyce emarginata (Kl. & Garcke) comb. nov.

Anisophyllum emarginatum Kl. & Garcke in Abhandl. Akad. Berlin 24. 1860.

Euphorbia emarginata Boiss. in DC. Prodr. **15**(2): 32. 1862; Muell.-Arg. in Mart. Fl. Bras. **11**(2): 681. 1874.

URUGUAY: Río Negro: Isla del Pedion, *Rosengutt B 1472.* ARGENTINA: Entre Ríos: Gualeguaychú, *Burkart 4146.*

The Burkart record requires confirmation, as the determination was effected from fragmentary material. The identifications were made from the descriptions and on the basis of a photograph of *Sellow,* the type specimen in the Berlin herbarium.

Chamaesyce hirtella (Boiss.) comb. nov.

Euphorbia hirtella Boiss. Cent. Euph. 7. 1860, in DC. Prodr. **15**(2): 24. 1862.

URUGUAY: Canelones: Las Brujas, *Lombardo 1958.*

This is an exceedingly critical entity which probably connects two or three species that may be discussed later. The record is apparently new for Uruguay.

Chamaesyce Duckei sp. nov.

Perennis basi lignosa, caulibus stricte adscendentibus ultrapedalibus, innovationibus molliter albo-lanulosis citius glabratis. Foliis novellis membranaceis parcius albo-lanulosis vel glabratis, manifeste petiolatis, lamina ad 1.5 cm. longa, ca. 0.3 cm. lata, lanceolata vel elliptico-lanceolata vel anisophylla, margine subintegra, petiolo gracillimo ca. 2–3 mm. longo, stipulis linearibus vel triangularibus minutis. Cyathiis subsolitariis longe campanulatis ad 1–1.5 mm. longis, fauce ca. 1 mm. latis, nectariis ellipsoideis centro impressis, appendicibus petaloideis plus minusve profunde laciniato-sectis albicantibus, flore ♀ obpyriformi albicante tomentello vel lanuloso, capsula submatura glabrescente ovoideo-trigona ad 2 mm. longa et 1.5 mm. lata, stylis gracilibus ad 1.5 mm. longis ut videtur integris.

BRAZIL: Pará: Furnas, on the Middle Tapajoz, *Ducke 18534.*

The characters of this plant are outstanding, and that it represents a new species seems to be obvious. The material, however, is hardly satisfactory for a generalized description, because it shows a stage in which the new growth is barely beginning, but the old branchlets have already lost their leaves. It is altogether likely that the leaves and stipules of a free grown shoot will not be found to agree closely with those here described.

Chamaesyce Barberiana sp. nov.

Herba annua vel potius perennans vix ultra pedalis suberecta multicaulis, caulibus in sicco stramineis vel pallide brunneis crispule albido-puberulis, internodiis ipsis maximis vix 3.5–4 cm. longis, stipulis interpetiolaribus in laciniis subintegris acutatis 3 vel 4 dissectis; foliis more generis basi anisophyllis, apice obtuse acuminatis vel rotundatis, membranaceis, 0.5–2 cm. longis, 0.5–1 cm. latis, ellipticis vel rotundato-ellipticis nequaquam linearibus vel rotundato-linearibus, glabratis vel puberulis, margine cartilagineo sat obtuse distanterque serrato. Inflorescentiis apicalibus capituliformibus ca. 1–1.5 cm. longis fere totidem latis, confertis minutissime bracteolatis saepius dichotomis dein iterum 2- vel 3-partitis; cyathio hirtulo vel puberulo longiuscule campanulato raro subinflato ca. 1.5 mm. longo 1 mm. lato, nectariis diminutis appendice rotundata albicante circumdatis lobis minutissimis subtruncatis, floribus ♂ paucis; capsula evidenter longiore quam lata ca. 2 mm. longa, basi ca. 1.25 mm. lata, stylis vix 1 mm. longis, partitis, coccis crispule puberulis vel glabratis dorso lineato-constrictis, columella gracili ca. 1.5 mm. longa, semine acutissime trigono rubello ca. 1–1.25 mm. longo, 0.4–0.6 mm. basi lato, faciebus transverse ruguloso-insculptis.

PARAGUAY: Chaco Paraguayo: Irendagué, *Rojas 7213* (TYPE). ARGENTINA: Santiago del Estero: C. Pellegrini, *Venturi 5663, 5956;* Tucumán: Burruyaco, *Venturi 7690;* Entre Ríos: Paraná, *Burkart 439;* San Luís: Sierra del Gigante, *Pastore 67;* Córdoba: Casquin (?), *Rodrigo 251.*

This in the main is the entity which I have mistaken, in Lilloa **6:** 299. 1941, for *C. indica* (Lam.) Croizat. My error is not entirely unaccountable, because the vegetative parts of these plants are practically identical. However, the seeds of the two species, which only recently I have had the opportunity of studying to my satisfaction, are altogether unlike. Seeds of *C. indica* are more or less ovoid and dark in color, while those of *C. Barberiana* are narrow, pointed, and reddish brown.

Chamaesyce Barberiana is a strong species which closely resembles no other of its range. In Boissier's monograph it would take its place immediately next to *C. Berteriana* (Balb.) Millsp. of the West Indies. The specific name honors Dr. Andrés Barbero, President of the Sociedad Científica del Paraguay, to whom so much is owed by all students of the natural history of that Republic.

Chamaesyce portucasadiana sp. nov.

Planta certissime perennis e caudice lignoso ramos plures duros repentes brevissime albicanti-tomentellos vel rarius glabratos edens ad 30 cm. longos et ultra, stipulis setaceis triangularibus inconspicuis. Foliis saepius valide costatis ellipticis vel ovato-ellipticis, brevissime petiolulatis, 0.4–1 cm. longis, 0.2–0.7 cm. latis, plus minusve profundius serratis adpresse setulosis. Cyathiis cupuliformibus in axillis singulis vel subsingulis, ca. 2 mm. longis et latis, puberulis, nectariis late albo-appendiculatis, ovario rotundato-trigono albicante tomentello vix 1.5 mm. longo latoque, stylis brevibus apice bilobis.

PARAGUAY: Chaco Paraguayo: Puerto Casado, *Rojas 2152.*

This plant was originally identified as representing *Euphorbia thymifolia* L., a determination probably influenced by Chodat & Hassler's earlier acceptance of this species for the region. A full discussion of *E. thymifolia* is here impossible, but on the basis of *Metz 67,* an Asiatic specimen which Boissier cites under that binomial, in DC. Prodr. **15**(2): 47. 1862, it is obvious that *C. portucasadiana* has characters wholly incompatible with those of Linnaeus' species as represented by the Metz collection. The description of *E. argillicola* Chod. & Hassl., if at all correct, cannot apply here.

Chamaesyce oranensis sp. nov.

Perennans lignescens, rosulata vel repens suberecta, tota hispidulo-velutinosa pallide olivacea vel grisea, internodiis pro more nec ultra 0.5 cm. longis, maximis 1–2 cm. longis. Foliis rotundato-ellipticis, 0.5–1 cm. longis, 1–6 mm. latis, velutino-puberulis, margine sat grosse serratis, subsessilibus, stipulis setaceis minutis deciduis. Cyathiis in axillis pluribus aggregatis campanulatis valde tomentellis ca. 1.5 mm. longis, nectariis rotundatis minimis appendice petaloidea subnulla, flore ♀ canescente stylis brevissimis glabris partitis; capsula ovato-trigona ca. 1.25 mm. longa 1 mm. basi plus minusve lata, semine ellipsoideo griseo-rubello transverse ruguloso ca. 1–1.25 mm. longo et 0.75 mm. lato.

ARGENTINA: Salta: Orán, *Venturi 5555* (TYPE). PARAGUAY: Chaco Paraguayo: Chamachini, *Rojas 7224.*

The floral characters of this new species are not outstanding, but the habit is distinctive and is immediately recognizable. The internodes are usually only 0.5 cm. long, and the stems become manifestly woody with age.

Chamaesyce catamarcensis sp. nov.

Humilis glaberrima, caules verosimiliter annuos e radice perenni edens. Foliis crassiusculis integerrimis linearibus, apice obtuse rotundato-apiculatis, 7–14 mm. longis, 1–1.5 mm. latis, petiolo vix 1–2 mm. longo, stipulis interpetiolaribus fimbriatis minutis. Cyathiis in axillis singulis ob internodiorum brevitatem in pseudocymulis apicalibus congestis vix 1 mm. longis, nectariis 4 vel 5 exappendiculatis vel parcissime appendiculatis in involucrum longe decurrentibus, staminibus paucis; flore ♀ elongato trigono glaberrimo, stylis 3 brevissimis partitis; capsula matura ca. 2 mm. longa et 1.25 mm. lata, gynophoro 1.5–2 mm. longo, semine quadrangulo apice valde acuminato basi truncato, in lateribus rugis profundis horizontalibus ad 6–10 ornato, arillo albicante, testa rubrobrunnea.

ARGENTINA: Catamarca: Andalgalá, *Jörgensen 1621.*

This resembles *C. caecorum* but has blunter leaves and a different seed.

Chamaesyce caecorum (Boiss.) comb. nov.

Euphorbia caecorum Mart. ex Boiss. in DC. Prodr. **15**(2): 51. 1862; Muell.-Arg. in Mart. Fl. Bras. **11**(2): 675. *pl. 92.* 1874; Boiss. Ic. Euph. 13. *pl. 23.* 1866; Chod. & Hassl. in Bull. Herb. Boiss. II. **5**: 681. 1905.

The spelling *caecorum* is to be retained as the one used by Boissier in the original publication. Mueller's reference to the place of publication is garbled, confusing as it does the unpublished "Pl. Med. Bras. t. 73 ined.," cited by Boissier, and the "Icones Euphorbiarum."

This species is frequent in Brazil and probably not rare in Paraguay, witness: *Rojas 6339,* Sierra de Amambay. I have so far not seen it from Argentina. The ternate and quaternate verticils, illustrated by Mueller and Boissier, on the lower nodes suggest a theoretical primitive condition, antedating the transformation of two leaves of the verticil into interpetiolar stipules.

Chamaesyce hirta (L.) Millsp. in Field Mus. Publ. Bot. **2**: 303. 1909.

Euphorbia hirta L. Sp. Pl. 454. 1753; Boiss. in DC. Prodr. **15**(2): 21. 1862 (as *E. pilulifera*); Wheel. in Contr. Gray Herb. **127**: 67. 1939, in Rhodora **43**: 169. 1941.

This widespread weed has been confused both in herbaria and in the literature with *C. pilulifera* (L.) Small. This confusion arose through accepting a concept of *E. pilulifera* L. based on the plant described in the Amoenitates Academicae **3**: 114. 1756, rather than on that of the Species Plantarum (1753), which has priority. As Boissier points out (op. cit. 20), the plant originally determined as *E. pilulifera* in the Linnaean herbarium actually represents *E. parviflora* L., which was not published until 1759. To *E. pilulifera* L. and the combinations based upon it, *E. parviflora* L. must be added as a synonym.

Chamaesyce hirta L. subsp. **procumbens** (Boiss.) Croiz. in Lilloa **6**: 299. 1941.

Chamaesyce hirta L. var. *procumbens* (Boiss.) Mold. in Rev. Sudam. Bot. **6**: 178. 1940.

ARGENTINA: Buenos Aires: Villa Ortuzar, *Parodi 12819;* Tucumán: Villa Luján, *Venturi 167,* Trancas, *Venturi 4386,* Tapia, *Rodriguez 526;* Salta: Orán, *Rodriguez 96,* Candelaria, *Venturi 3659;* Cordoba: Unquillo, *Bruch 5005.* CULTIVATED: *Croizat s. n.*

This characteristic form is weaker and smaller than the typical plant and has a fairly thickly arillate seed, the testa of which is dusty-grayish rather than brick-colored. It is particularly abundant in Argentina, the collections cited being representative. In some of its most diffuse states (for instance, *Rodriguez 526, Bruch 5005,* and *Croizat s.n.*) this entity is close to **Chamaesyce microcephala** (Boiss.) comb. nov. (*Euphorbia microcephala* Boiss. in DC. Prodr. **15**(2): 1262. 1866), which in its turn does not seem to differ enough from the form called by Wheeler *E. hirta* var. *destituta,* in Contr. Gray Herb. **127**: 70. *pl. 4, C 1.* 1929).

Chamaesyce hirta var. **laeticincta** var. nov.

Nectariis saepius appendicibus petaloideis albicantibus sat magnis insignitis, foliis saepius sub apicem rhombeo-dilatatis.

PARAGUAY: Chaco Paraguayo: Puerto Casado, *Rojas 2819.*

I have not seen material representing *Euphorbia Karwinskyi* Boiss., which, according to Wheeler, in Contr. Gray Herb. **127**: 71. 1939, should not be far remote from *E. hirta* var. *nocens* Wheel. and somewhat suggests this new variety in the descriptions. In its most characteristic state this variety is easily recognizable by the white petaloid appendages of the nectaries on the cyathium.

Chamaesyce serpens (H. B. K.) Small, Fl. Southeast. U. S. 709, 1333. 1903.

Euphorbia serpens H. B. K. Nov. Gen. & Sp. **2:** 41 [*folio*], 52 [*quarto*]. 1817; Boiss. in DC. Prodr. **15**(2): 29. 1862; Wheel. in Contr. Gray Herb. **136:** 198. 1941.

PARAGUAY: Chaco Paraguayo: Lopez de Filippis, *Rojas 8278;* Puerto Casado, *Rojas 2161.*

The first of these specimens is an absolute match of the typical plant collected at Cumaná. In this plant the stipules definitely tend to be triangular-truncate, not laciniate-partite. *Rojas 2161* is a microphyllous state and evidently a perennial from a comparatively thick rootstock. This suggests that the species is annual only where conditions are unfavorable.

Chamaesyce serpens var. **montevidensis** (Boiss.) comb. nov.

Euphorbia ovalifolia montevidensis Boiss. in DC. Prodr. **15**(2): 43. 1862.

Euphorbia serpens var. *fissistipula* Thell. in Bull. Herb. Boiss. II. **7:** 755. 1907. Syn. Nov.

URUGUAY: Montevideo, *Casaretto 453* (type number); *Arechevaleta 5204, Lombardo 222, Legrand 394.* ARGENTINA: Buenos Aires: Mar de la Plata, *Hicken 642;* Loberia, *Scala* (*Alboff*) *s. n.*

It is possible that *C. serpens* and *C. ovalifolia* cannot be distinguished with finality as separate species, but it seems clear that the var. *montevidensis* rather agrees with the former than with the latter on account of the habit and foliage and the less evolute petaloid appendages.

Lombardo 222 bears the local name "Yerba Meona." This same name is given by Larrañaga, Escr. D. A. Larrañaga, Inst. Geogr. Uruguay **2:** 165. 1923, to his *E. diuretica,* which is described altogether too briefly but is said to be "pubescens." Clearly, *E. diuretica* is not *E. serpens* or any of its forms, for these are glabrous. The binomials of Larrañaga are published with descriptions so sketchy that, in this group, it proves impossible to place them without access to authentic material for study and comparison.

EXCLUDED FROM THE EUPHORBIACEAE

Ayenia pusilla L. Syst. ed. 10. 1247. 1759.

Tragia Mansfeldiana Hert. in Rev. Sudam. Bot. **3:** 166. 1936, *nomen;* op. cit. **5**:34. *fig. 6.* 1937. Syn. Nov.

I am indebted to Señor A. Lombardo for data, drawings and notes which provide definite proof that Herter's species is not euphorbiaceous but is a well-known sterculiaceous plant, *Ayenia pusilla* L. The reduction here made is based on *Chebataroff 6352* in our herbarium, bearing the original sketches and comments of Señor Lombardo.

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THE FAMILY HIMANTANDRACEAE

I. W. Bailey, Charlotte G. Nast, and A. C. Smith

With six plates

The present paper is the second of a proposed series discussing the interrelationships of the families of woody Ranales. We have already briefly discussed the position of the Himantandraceae as a relative of the Magnoliaceae and the Degeneriaceae (1). These three families form a compact group within the Ranales, being more closely related to each other, on the basis of important morphological details, than any one of them is to other families.

The most important contributions to our knowledge of the Himantandraceae were made by Diels (3, 4, 5), with whose conclusions (5: 134) that the closest relative of the group is the Magnoliaceae we are in essential agreement. Diels has discussed *Himantandra* in considerable detail, and therefore we shall emphasize those points which he was unable fully to observe, and especially those characteristics of *Himantandra* which we interpret differently.

The first part of this paper presents a diagnosis of the technical characters of *Himantandra,* the sole genus of the family, and the two known species. Only the essential citations to literature are given, as fuller citations were recently listed (7) and the status of the generic name was discussed. In the second part of this paper we shall examine the internal morphological features of the genus, with special reference to points not made entirely clear by Diels. Specimens cited in this treatment are deposited in the herbarium of the Arnold Arboretum. The morphological and anatomical portions of this study have been prepared by the first two authors, the taxonomic portion by the third author, while the conclusions are the result of collaborative discussions.

I

Himantandra F. v. Muell. Pap. Pl. **2:** 54. 1890.

Galbulimima F. M. Bailey in Queensl. Dept. Agr. Bot. Bull. **9:** 5. 1894.

Trees, the branchlets slender, subterete or faintly angled distally, densely lepidote; scales covering the young branchlets, petioles, lower surface of leaf-blades, and external parts of inflorescence (except stamens and staminodes), these scales peltate, membranaceous, castaneous, dark at center, paler toward margin, the stalk very minute, the body composed of 30–56 radiating flattened laterally coalescent hairs; stipules none; leaves alternate, simple, pinnate-nerved; petioles slender, rugulose; leaf-blades coriaceous or thin-coriaceous, entire and faintly recurved or plane at margin, the costa prominent beneath, the secondary nerves 7–16 per side (interspersed with other similar but weaker or obscure laterals), spreading, anastomosing toward margin (either freely or obscurely so); flowering shoots axillary, customarily with 1 terminal flower, with 2 (sometimes 3) alternating bracts, the bracts subcoriaceous, oblong, 1–3 mm. long, occasionally foliaceous, with obscure axillary buds, these buds rarely developing into subsidiary flowering axes with two scales and an apical flower; pedicel similar to the flowering shoot in texture; calyx subcoriaceous, ovoid-conical, obtuse or umbonate at apex, calyptrate, rupturing along an irregular line near base and leaving a small undulate or irregularly lobed calycine remnant attached to the torus, glabrous within, densely and uniformly lepidote without; corolla similar to calyx in texture, shape, and indument, slightly smaller than and closely enveloped by the calyx, similarly calyptrate; torus carnose, flaring to the attachment of the calyx and corolla, thence columnar and copiously staminiferous, concave on the distal surface and giving rise to a conical carpel-bearing apex; outer staminodes about 7–23, 1- or 2-seriate, castaneous, carnose, sharply reflexed after anthesis; stamens numerous, several-seriate, closely appressed, similar to outer staminodes in texture and shape, rapidly elongating and reflexed after dehiscence of the perianth, the pollen-sacs 4, paired, extrorse, immersed in the sporophyll-tissue, linear, obtuse at base and apex, dehiscing longitudinally; inner staminodes about 13–20, 1–3-seriate, similar in texture to the outer staminodes, linear-subulate, gradually narrowed to an acute apex, usually erect and more or less coherent at base; carpels spirally arranged on the conical apical portion of the torus, free but laterally appressed and soon concrescent, the ovary ovoid or oblong-ellipsoid, densely lepidote on the thick outer surface, glabrous on the thinner lateral surfaces, gradually narrowed distally into a subulate style, the styles plume-like, soft and glandular in texture, sometimes cohering in a gelatinous mass, the locule 1, the ovule 1 (rarely 2, but the second seldom developing), anatropous, attached to the ventral margin at various levels in different carpels; fruit an ellipsoid or subglobose syncarp, up to 25 mm. in diameter at maturity, rounded or obtuse at base and apex, the pericarp coriaceous, 0.5–1.5 mm. thick, red, rugulose when dried, lepidote without, the scales long persistent, the carpels completely coalesced, often imbricate and superposed in 2 or 3 ranks, the exterior ones appearing shorter than the interior, the dissepiments coriaceous, persistent, the endocarp cartilaginous, the seeds solitary (or possibly rarely 2), with oily endosperm and small embryo near the hilum.

KEY TO THE SPECIES

Leaf-blades usually oblong-elliptic, (6–)7–15 cm. long, (3–)4–7 cm. broad (2–2.5 times as long as broad), obtuse to acute at base, rounded to acute at apex; scales on lower surface of mature leaf-blades 0.15–0.4 mm. in diameter, crowded, usually completely obscuring the surface, the margins of adjacent scales often imbricate, at least contiguous, only rarely not touching; outer staminodes about 12–23; stamens 90–130, 6–25 mm. long; inner staminodes 15–20; carpels 9–15; New Guinea (and probably North Moluccas). . . . . 1. *H. Belgraveana.*

Leaf-blades oblong-lanceolate, 7–11.5 cm. long, 2–4 cm. broad (about 3 times longer than broad), acute to attenuate at base, subacute to short-acuminate at apex; scales on lower surface of mature leaf-blades 0.13–0.17 mm. in diameter, comparatively scattered, the margins of adjacent scales not imbricate, rarely contiguous; outer staminodes about 7; stamens about 40, 6–9 mm. long; inner staminodes about 13; carpels 7–10; Queensland. . . . . 2. *H. baccata.*

1. **Himantandra Belgraveana** (F. v. Muell.) F. v. Muell. Pap. Pl. **2**: 54. 1890.
Eupomatia Belgraveana F. v. Muell. in Austral. Jour. Pharm. **2**: 4. 1887, in Bot. Centralbl. **30**: 325. 1887.
Galbulimima Belgraveana Sprague in Jour. Bot. **60**: 138. 1922.
Himantandra nitida Bak. f. & Norman in Jour. Bot. **61**: Suppl. 2. 1923.
Galbulimima nitida Sprague in Jour. Bot. **61**: 200. 1923.

Tall tree, up to 25 m. or more high; branchlets straight or subflexuose, 2–4 mm. in diameter toward apices, pale brown or castaneous or at length fusco-cinereous; scales 0.15–0.4 mm. in diameter, crowded, usually completely obscuring the surface, the margins of adjacent scales often imbricate; petioles 1–2 mm. in diameter, 8–24 mm. long, deeply or shallowly canaliculate; leaf-blades coriaceous, brown or dark olivaceous, smooth or densely and minutely papillose, and shining or dull above when dried, castaneous- or fuscous-lepidote beneath, oblong(rarely ovate- or obovate-)-elliptic, (6–)7–15 cm. long, (3–)4–7 cm. broad, obtuse to acute at base, rounded to acute and sometimes inconspicuously mucronulate at apex, the costa impressed or deeply canaliculate above, the secondary nerves 8–16 per side, straight, sharply raised or prominulous or immersed above, faintly prominulous or immersed beneath, the veinlets immersed, occasionally forming a faintly prominulous reticulum above and rarely beneath; flowering shoots 1.5–6 cm. long inclusive of flower or fruit, the vegetative portion slender, rugulose, 1–2 mm. in diameter, up to 25 mm. long, the pedicel gradually swollen distally to 3 mm. in diameter, 8–16 mm. long at anthesis, up to 20 mm. long in fruit; calyx 9–16 mm. long and 8–13 mm. in diameter at anthesis; outer staminodes about 12–23, 1- or 2-seriate, oblong-ligulate, 5–11 mm. long at anthesis and probably often longer, 1.5–2 mm. broad near base, gradually narrowed to a sharp and often unequally apiculate or rostrate apex, sometimes sparsely pellucid-glandular; stamens 90–130, usually 6- or 7-seriate, 6–25 mm. long, 1.5–2 mm. broad near base, often with numerous and obvious sclereids and obscurely or obviously striate, the pollen-sacs 0.8–1.8 mm. long, the lower edge 0.6–3 mm. distant from the base of the sporophyll; inner staminodes 15–20, 1–3-seriate, 5–7 mm. long, 0.5–1.3 mm. broad near base; carpels 9–15, 4–6 mm. long at anthesis, the ovary 1.5–2 mm. long; fruit with seeds (in all our specimens) solitary, flattened, submembranaceous, suborbicular, 3–4 mm. in diameter, apparently sterile.

DISTRIBUTION: New Guinea, and probably also some of the islands to the west. Diels (5: 131) reports that Warburg (no. *17770*) collected loose flowers which are probably referable to the species at Sibela, on Batjan, an island south of Halmahera; extension of typical New Guinean elements to this region is frequent.

NETHERLANDS NEW GUINEA: Biak I., Seroei, alt. about 50 m., *Neth. Ind. For. Serv. 30722, 30898;* Japen I., Seroei, alt. about 370 m., *Neth. Ind. For. Serv. 30406;* 6–15 km. southwest of Bernhard Camp, Idenburg River, alt. 1300–1800 m., *Brass & Versteegh 11195* (tree 25 m. high, frequent in primary forest on slopes of a ridge, the trunk 34 cm. diam., the crown not wide-spreading; bark 5 mm. thick, dark brown, fairly smooth; wood white; fruits red), *Brass 12103* (tree to 25 m. high, abundant in mossy-forest; flowers white; fruits orange-brown), *Brass & Versteegh 12572* (tree 21 m. high, occasional in primary forest on slopes of a ridge, the trunk 51 cm. diam., the crown fairly small; bark 9 mm. thick, gray, smooth; wood light brown; flowers yellow; fruits green). NORTHEASTERN NEW GUINEA: Sepik River region, Hauptlager Malu, alt. 50–100 m., *Ledermann 10884a* (frag.); Morobe District: Yunzaing, alt. 1200–1350 m., *Clemens 3586, 3678, 6498, 6503* (large trees, the trunk to 1 m. diam.; fruit red); Ogeramnang, alt. 1750–1800 m., *Clemens 4991, 5538;* between

Ogeramnang and Tobou, alt. 1500–1800 m., *Clemens 6584a;* Matap, alt. 1500–1800 m., *Clemens 11100, 41200* (tall trees; "inflorescence" brown; flowers russet-green). BRITISH NEW GUINEA: Central Division, Mt. Tafa, alt. 2400 m., *Brass 4916* (tall tree, plentiful in valley forests, with slender trunk and thinly foliaged crown; staminodes and stamens cream-colored; fruit brown).

In studying the above-cited specimens, we have noted certain differences which we have tried to correlate with the different geographic areas, thinking that more than one nomenclatural division of the genus might be discernible in New Guinea. However, our attempts to divide the New Guinean population have not succeeded, and we have reached the conclusion that only one species is represented.

The material from the Morobe District has the upper surface of the leaves usually dull and conspicuously rugulose-papillose, while the remaining collections have this surface comparatively shining and essentially smooth. However, there are exceptions to this generalization, and the texture of the upper surface appears to be subject to individual variation, possibly being dependent upon the size and distribution of stone-cells. The degree to which the secondary nerves are immersed is also subject to great individual variation, although in general the Morobe collections have more completely immersed nerves. When young, the leaves are infolded with the two halves of the upper surface closely appressed. Although mature leaves are always strictly glabrous on the upper surface, these young folded leaves sometimes bear small many-branched stellate hairs before they open. Such hairs are often found in material from the Morobe District, but they are apparently always lacking in the other specimens cited.

On the basis of size and number of floral parts, no important differences are found among the available collections, the species being very variable in this respect. The greatest variability is found in the size of the stamens and outer staminodes, which elongate rapidly after the dehiscence of the corolla. The longest stamens we have observed are 18 mm. long, but Diels (4) portrays the stamens of the type collection as about 25 mm. long, and we have no reason to doubt the accuracy of this observation.

From our study of the available material and the earlier descriptions, therefore, we are inclined to believe that *Himantandra* is represented in New Guinea by only one species.

Himantandra Belgraveana has as its type a specimen collected by Forbes (no. *759* according to Mueller, no. *795* according to Diels [4] and Baker [2]), collected in the vicinity of Sogere, British New Guinea. The original description does not give dimensions, but Diels' description in 1912 (4) is adequate. *Himantandra nitida* is based upon *Forbes 828a* from the same region; according to Baker and Norman this differs from the earlier species "by the shining broader coriaceous leaves and much longer stamens." A comparison of the description of *H. nitida* with our concept of *H. Belgraveana* does not demonstrate differences of any consequence.

2. **Himantandra baccata** (F. M. Bailey) Diels in Bot. Jahrb. **55:** 128. 1917.
Galbulimima baccata F. M. Bailey in Queensl. Dept. Agr. Bot. Bull. **9:** 5. 1894.

Tree up to 17 m. high, the branchlets 1.5–3 mm. in diameter toward apices, brownish; scales 0.13–0.17 mm. in diameter, comparatively scattered, the margins of adjacent scales not imbricate, rarely contiguous; petioles 0.7–1 mm. in diameter, 8–20 mm. long, shallowly canaliculate; leaf-blades thin-coriaceous, dark brown and shining above when dried, castaneous-lepidote beneath, oblong-lanceolate, 7–11.5 cm. long, 2–4 cm. broad, acute to attenuate at base, subacute to short-acuminate at apex, the costa shallowly impressed or slightly raised above, the secondary nerves 7–10 per side, prominulous above, less conspicuously so beneath, the veinlets immersed or faintly prominulous above; flowering shoots up to 2 cm. long at anthesis, the vegetative portion angled, 5–13 mm. long, the pedicel shorter; calyx up to 10 mm. long and slightly less in diameter at anthesis; outer staminodes about 7, 1-seriate, lanceolate, 4–6 mm. long or probably longer after anthesis, acute; stamens about 40, several-seriate, 6–9 mm. long, the pollen-sacs 1.5–2 mm. long; inner staminodes about 13, 6–8 mm. long, narrowed at base; carpels 7–10, about 2 mm. long at anthesis; fruit with seeds "with a loose outer ragged coat; testa smooth, cartilaginous; albumen copious, oily. Embryo not particularly small near the hilum, apical with reference to the position of the seed in the berry." (ex F. M. Bailey).

DISTRIBUTION: Queensland, Australia.

AUSTRALIA: Queensland: North Queensland, Gadgarra, Peeramon, Atherton, *White 1561*. In addition to the preceding specimen, which is the only one we have seen, the following are cited by other writers, all from Queensland: Eumundi, *Arundell* (TYPE); Boar Pocket and Evelyn, Heberton District, *J. F. Bailey;* Kin Kin, North Coast Line, *Francis*.

Our description is based primarily upon the White collection, which is in fruit; we have also incorporated the characters and dimensions recorded by F. M. Bailey and Sprague (see Smith [7] for citations).

INADEQUATELY KNOWN SPECIES

HIMANTANDRA PARVIFOLIA Bak. f. & Norman in Jour. Bot. **61**: Suppl. 2. 1923.
Galbulimima parvifolia Sprague in Jour. Bot. **61**: 200. 1923.

This species, known to us only from the original description, is based on *Forbes 355*, from Meroka, British New Guinea. The leaves described seem closer to those of *H. baccata* than to those of *H. Belgraveana*, but they are even smaller than any described for *H. baccata*, being similar in proportions. The species is said to differ from *H. baccata* in its smaller leaves and flowers, but the dimensions given for the flowers do not indicate this to be the case. No numbers of floral parts are given.

From the locality, one would expect this to be a depauperate form of *H. Belgraveana*, but the leaf-proportions do not suggest this. If it represents *H. baccata*, the occurrence of this species in New Guinea will be noteworthy. *Himantandra parvifolia* may quite possibly be a good third species of the genus, but for the time being we are inclined to believe it an extreme variation of *H. Belgraveana*, which, as illustrated by the specimens cited above, seems best interpreted as a very variable species.

II

As indicated above, we are much better acquainted with the New

Guinean species than with the Australian, and consequently the following notes are based primarily upon *H. Belgraveana,* of which we have ample recently collected material. The Australian species and *H. Belgraveana* are very closely related and show only minor differences, and for this reason we do not doubt that remarks on the morphology of one species apply equally well to the other.

STEM. In *Himantandra baccata* and *H. Belgraveana,* as in *Degeneria* and the Magnoliaceae,[1] the primary vascular cylinder is a dictyostele, being constituted of discrete bundles that are separated by relatively wide gaps. Each bundle is capped externally by slender thick-walled fibers and is subtended internally by vertically elongated, thin-walled parenchyma. During the earlier stages of the formation of the secondary body, the external arcs of fibers tend to become united into a continuous ring of sclerenchyma by the sclerification of the intervening arcs of parenchyma. The bulk of the pith is composed of large comparatively thin-walled cells, but nests and transversely oriented plates of sclereids are of common occurrence, particularly in the nodal parts of the stem. The cortex is characterized by having numerous spherical secretory cells and more or less abundant sclereids. Crystalliferous parenchyma occurs in the cortex, phloem, and pith, usually in close association with the sclerenchyma. Each small crystal-bearing cell or chamber contains a single rhombohedral crystal of calcium oxalate that is jacketed by a thick sheath of lignified cellulose. As noted by Diels (5), the origin of the cork is superficial, probably hypodermal.

The rays of the first-formed secondary xylem are narrow, with a high ratio of uniseriate to biseriate, and are markedly heterogeneous. On the contrary, in wood from large stems (*fig. 10*), there is a high ratio of fusiform, nearly homogeneous triseriate and tetraseriate rays, and uniseriate rays are much reduced in size and number. The vessels of the first-formed secondary xylem are smaller, more numerous, and occur in more extensive radial seriations than they do in the later-formed wood (*fig. 9*). Furthermore, the vessels of the metaxylem and of the first-formed secondary xylem commonly exhibit a higher ratio of scalariform to porous perforations and of scalariform and opposite to alternate lateral pitting than do the vessels of the later-formed wood, where scalariform perforations and transitional types of lateral pitting are evanescent or vestigial. It should be noted in this connection that the discrepancies in Diels' (5) and McLaughlin's (6) descriptions of the wood of *Himantandra* may have been due in part to differences in the type of material examined by them. The wood fibers of *Himantandra* are comparatively thin-walled fiber tracheids, having small circular bordered pits. The wood parenchyma is of a broad banded apotracheal type (*fig. 9*). More or less numerous strands of crystal-bearing cells occur in association with the wood parenchyma.

[1]Whenever mentioned in the following pages, the family Magnoliaceae is intended in the restricted sense of Dandy, Hutchinson, and others, viz. exclusive of the Winteraceae, *Illicium,* Schizandraceae, and *Tetracentron.*

In herbarium specimens of *Himantandra*, there is less conspicuous flaring of the rays in the secondary phloem than in comparable material of *Degeneria* and of most Magnoliaceae, and stratified hard and soft bast are less precociously developed. It is significant, however, that in larger stems the phloem is distinctly stratified and has flaring rays. Furthermore, the sieve tubes are of the same structural type as in the Magnoliaceae and *Degeneria*. Crystalliferous parenchyma occurs along the surfaces of the hard bast.

LEAF AND NODAL ANATOMY. In *Himantandra Belgraveana* and *H. baccata*, three traces enter the base of the petiole, leaving three gaps in the cauline vascular cylinder, i. e. the stems have typically *trilacunar* nodes. The three traces divide forming 6–8 vascular bundles that become oriented into a more or less cylindrical foliar dictyostele (*fig. 8*). As in *Degeneria* and the Magnoliaceae, the vascular strands that branch outward from the median trace are segregated in opposite sides of the foliar dictyostele. In other words, one or more of them retain a normal orientation of xylem and phloem and form part of the abaxial surface of the foliar stele, whereas the remaining ones develop an inverted orientation of xylem and phloem and form part of the adaxial surface of the foliar vascular cylinder. Thus, the vascularization of the petiole and midrib is of a fundamentally different type than that which occurs in such ranalian plants as *Tetracentron*, where a medullated foliar dictyostele is formed by the closure of an adaxially expanding arc of vascular tissue.

The young leaves of *Himantandra* are adaxially folded, i. e. conduplicate (*fig. 3*). They do not unfold until they have attained a considerable size, not infrequently a length of 8 centimeters or more in the case of the larger-leaved specimens. The exposed abaxial surfaces of the conduplicate leaves, from very early stages of their development, are provided with a dense coating of peltate scales (*fig. 3*). These scales are persistent on the unfolded mature leaves (*fig. 1*), but are smaller and less crowded in *H. baccata* than in *H. Belgraveana*. The adaxial or upper surfaces of mature leaves of all investigated specimens of *Himantandra* are glabrous, but the immature leaves of certain collections of *H. Belgraveana*, viz. *Clemens 3586, 3678, 4991, 5538, 6498, 6503*, and *6584a*, bears scales or stellate hairs on their ventral surface during certain stages of their conduplicate development. The ray cells of these scales or stellate hairs are not firmly coherent and drop off during subsequent development of the leaf. However, the basal cells or stalks are persistent and are more or less widely scattered among the epidermal cells of the upper surface of the mature leaf.

The stomata of both *H. baccata* and *H. Belgraveana* have a very peculiar and highly characteristic distribution. As shown in *fig. 2*, they occur in discrete, nearly circular clusters that subtend each of the peltate scales on the lower surface of the leaf. Crystal-bearing cells, of the same morphological type as in the stem, are more or less abundant in the leaf. They tend to occur characteristically in pairs or small clusters in the lower epidermis (*fig. 1*), and in strands along the sclerenchymatous sheaths of the veins and veinlets. Numerous clusters or nests of sclereids are scattered throughout the mesophyll of all the Clemens collections of *H. Belgraveana,* but they are absent or of less frequent occurrence in other material examined by us. Spherical secretory cells are abundantly developed in the leaf, as in the other organs of the plant.

FLOWERING SHOOTS. The solitary bisexual flowers of *Himantandra,* as of *Degeneria* and certain genera of the Magnoliaceae, e. g. *Michelia* and *Elmerrillia,* are borne at the apex of axillary shoots. These flowering axillary shoots are provided with two (occasionally three) scales which have more or less rudimentary buds in their axils. Since the scales frequently develop into typical leaves, they may be interpreted as reduced foliar organs. In exceptional instances, one of the buds develops a subsidiary flowering axis bearing two scales and an apical flower. The flowers are separated from the upper scale or leaf by an internode of considerable length, which may be designated as the pedicel in contrast to the essentially vegetative nodes and internodes that subtend it. The pedicel flares toward the base of the torus, forming a circular flange (*figs. 11, 12*), to which the calyptrate calyx is attached. A second internal flange provides an attachment for the calyptrate corolla. The carpel-bearing, cone-like apex of the torus (*fig. 12*) projects from the concave upper surface of the broadly columnar part of the receptacle, to which the stamens and staminodes are attached.

The axillary flowering shoot contains a dictyostele of many small bundles (*figs. 15–18*) similar to that of a typical vegetative branch, except for a short distance in the basal part of the pedicel. Here the bundles are constricted into four large vascular strands (*fig. 17*). Three traces (*figs. 15, 16*) enter[1] the first bract, leaving three gaps in the stele, just as in the case of the leaves of ordinary vegetative shoots. The three traces of the second bract (or leaf) initiate their departure at a slightly higher level and from the opposite half of the stele. Although these traces fluctuate considerably in their subsequent behavior, two of them (commonly the median and one lateral) tend to divide, forming two additional traces that extend upward through the cortex of the pedicel (*figs. 15–18*). A third set of three traces departs from the stele just above the level of the first node (*fig. 16*). These traces are detached from the same half of the stele as the three traces of the first scale and extend upward through the cortex of the second internode, the second node, and the pedicel (*figs. 16–18*). Thus, there are five cortical bundles in the base of the pedicel, to which is soon added a sixth bundle which departs from the same side of the stele as the median trace of the second scale (*figs. 16, 17*). As will be shown subsequently, these six cortical bundles of the pedicel vascularize the outer calyptra.

Since the foliar appendages of *Himantandra* have a ½ phyllotaxy and are attached to trilacunar nodes, it is evident that the flowering shoot and

[1]The terminology used is purely descriptive and bears no ontogenetic implications regarding downward or upward development of procambium, phloem, and xylem.

pedicel have four distinct sets of three traces, each set attached alternately to opposite sides of the stele. The lateral traces of the fourth set exhibit more or less conspicuous fusion to the traces of the second set. Therefore, the outer calyptra of the flower represents a pair of fused appendages, either bracts or sepals. It should be emphasized in this connection, however, that if the homologous appendages of *Degeneria* are typical sepals, the outer calyptra of *Himantandra* should similarly be designated as calyx. Furthermore, the calyptrate calyx of *Drimys* is obviously composed of two fused sepals.

The vascularization of the torus is extremely complex and variable. There is a network of variously oriented bundles which divide, anastomose, redivide, reanastomose, and shift position throughout the torus. The number and arrangement of the bundles varies to a certain extent in different flowers, indicating a lack of stabilization within the genus. A basic or average condition is, therefore, illustrated in *figs. 18–23*. The six cortical bundles of the pedicel (*fig. 18*) either bifurcate or break up into several branches (*fig. 19*). These branches divide laterally into smaller strands (*fig. 20*) and internally into strands which extend upward through the base of the torus (*fig. 21*). The lateral strands may divide or anastomose in the base of the outer calyptra, but eventually they enter its free part as numerous small strands variable in size and number (*fig. 21*). The internally directed branches are usually eight in number, exhibiting considerable diversity in their relations to the branches of the six cortical bundles of the pedicels. For example, cortical bundle no. 1 in *figs. 18–20* bifurcates laterally, one branch of which forms an internal strand. Cortical bundle no. 2 divides laterally and produces two internally directed strands, whereas cortical bundle no. 3 gives rise to no internal strands. To these eight peripheral strands, four additional strands are added from the central stele (blackened strands of *figs. 19–21*), making an outer ring of twelve strands in the part of the torus subtending the inner calyptra (*fig. 21*). These twelve bundles divide laterally (*fig. 22*), and some of them may be joined by a few tracheal elements to an average of five smaller internal bundles (unstippled strands of *figs. 20–22*) which depart from the stele at a higher level than the four bundles referred to above. The five smaller internal strands, however, are only feebly and temporarily attached to the vascular system of the inner calyptra and subsequently extend upward through the torus (*fig. 23*). The lateral branches of the twelve bundles of the inner calyptra divide and anastomose laterally, giving rise to an indefinite number of small strands which enter the free part of the inner calyptra (*fig. 23*). Simultaneously with the lateral divisions, a few internally and upwardly directed branches are formed. Thus, at the bases of both the outer and the inner calyptras, a certain amount of vascular tissue remains in the torus to become traces or parts of traces for the succeeding appendages.

The basic pattern in the vascularization of the inner calyptra evidently consists of four sets of three traces. There are apparently four median traces that are attached to the central dictyostele and four pairs of lateral traces that are joined to the cortical system of calycine bundles. Such an interpretation is strengthened by comparisons with the flowering axis of *Magnolia, Liriodendron,* and other Magnoliaceae, where complex systems of cortical bundles are characteristically present. In these magnoliaceous plants, the dorsal trace of the 3-veined carpels is attached to the central dictyostele, whereas the two lateral traces tie into the cortical system of vascular bundles. This indicates that the inner calyptra of *Himantandra* is composed of four fused appendages, and comparisons with homologous members of *Degeneria* demonstrate that it is a corolla. We are unable to follow Diels (5) in homologizing the calyptras of *Himantandra* with the bud-scales of *Michelia Figo* (Lour.) Spreng., since the scales of both vegetative buds and flower-buds are clearly of stipular origin in the Magnoliaceae.

In a former comparison between the floral axes of Degeneriaceae, Magnoliaceae, and Himantandraceae (Bailey and Smith, 1), we failed to recognize fully the vascular complexities of *Himantandra.* Subsequent detailed investigations of more abundant and adequate material have shown that this genus resembles the Magnoliaceae rather than *Degeneria,* although its vascular complexities appear to be less stereotyped and stable than in many Magnoliaceae. The flowering shoots and pedicels of *Degeneria* do not have complicating systems of cortical bundles.

Stamens and staminodes. The columnar region of the torus upon which the stamens and staminodes are borne contains the terminus of the increasingly complex network of vascular strands. The strands in this region of the torus comprise (1) upward extensions of the inwardly directed branches of the corollaceous vascularization (*figs. 22, 23*), (2) upward extensions of the bundles which become temporarily attached to this system, and (3) additional traces detached from the central dictyostele, which loses its identity as a cylinder by the branching, rebranching, and dispersal of its constituent bundles. Traces from the strands in the peripheral regions vascularize the outer staminodes and lower stamens. The upper stamens and inner staminodes have traces that arise from the dispersed bundles of the dictyostele. Three traces from three separate strands enter the base of each fertile microsporophyll and likewise a majority of the sterile ones. In the case of the broad outermost staminodes and the innermost awl-shaped ones, the traces are sometimes reduced to two or one.

The stamens of *Himantandra* are not differentiated into filament, anther, and connective, and are best described as much elongated, narrowly lanceolate sporophylls (*fig. 25*). This was recognized by Diels, who states (5: 129): "Es ist unangebracht, bei diesen Sporophyllen überhaupt von Konnektiv oder Anthere zu reden. Denn der Blattcharakter ist kaum gestört, . . . " Each microsporophyll bears two pairs of vertically elongated sporangia that are immersed beneath the abaxial surface of the sporophyll. Dehiscence is longitudinal and extrorse. In transverse sections cut at the level of the sporangia (*fig. 5*), the microsporophylls of *Himantandra* exhibit close similarities to those of *Degeneria,* not only as regards their general topographical features, but also concerning specific peculiarities of their endothecia. Three veins enter the base of the microsporophylls as in *Degeneria,* but there is more extensive branching of the veins in the sporophylls of the Himantandraceae than in the much shorter microsporophylls of the Degeneriaceae. Although the details of the vascularization fluctuate considerably from flower to flower of different collections and from stamen to stamen of the same flower, the marginal veins rarely extend beyond the lower third of the sporophylls of *Himantandra* (*fig. 25*) and tend to anastomose with the median vein or its branches just above the level of the sporangia. The paired sporangia are situated between the median and marginal veins and thus, as in *Degeneria,* cannot be regarded as slightly displaced marginal, or terminal, structures. Furthermore, in the Himantandraceae, as in the Degeneriaceae, the veins and veinlets are not directed toward the sporangia and do not establish connections with the endothecia.

The staminodes of *Himantandra* resemble the microsporophylls in general form and texture (*figs. 24, 26*), but their median and lateral veins commonly exhibit less extensive branching. Furthermore, in the outermost broad sterile sporophylls and the innermost awl-shaped ones, the lateral veins frequently are much reduced in length or are absent. The sterile sporophylls resemble the fertile ones in having numerous spherical secretory cells, more or less abundant nests of sclereids, and in being devoid of peltate scales, which are such characteristic features of the other organs of the plant.

The occurrence of staminodes within the fertile microsporophylls has been noted in *Degeneria,* which, like *Himantandra,* differs from the Magnoliaceae in this respect (Bailey and Smith, 1). The fact that in *Himantandra* sterile microsporophylls occur outside, as well as inside, the fertile ones does not appear to be of great significance, as in all respects except their sterility these staminodes are similar to the stamens. To interpret the outer staminodes as petals, Sprague (7) seems to have no justification. Therefore, we are in agreement with Diels (5: 129) in interpreting these outer appendages as sterile microsporophylls.

The pollen of *Himantandra* is provided with a single germinal furrow and therefore is of the monocolpate type. As in the Magnoliaceae, the form and the dimensions of the pollen fluctuate during expansion and contraction of the grains. When fully expanded the pollen tends to be nearly spherical, with diameters of from 30 to 38 microns. As the tenuous floor of the furrow invaginates during contraction, the grains become ellipsoidal, whereas when it evaginates the outlines of the grains become triangular in certain planes of orientation. The exine is thin and comparatively homogeneous, but, as in the case of many of the so-called smooth exines of Magnoliaceae, it exhibits minute pits or granulations when examined under high magnification in lactic acid.

CARPELS. The young carpels, like the young leaves, of *Himantandra* are adaxially folded, viz. conduplicate, but the margins and the ventral surfaces of the free parts of the carpels (*fig. 6*) commonly are less closely approximated than those of the immature leaves (*fig. 3*). The adaxially oriented margins at the base of the carpels are adnate to the cone-shaped apex of the torus (*fig. 7*). At this level of the floral axis, there is more or less lateral concrescence of carpels, a tendency which becomes markedly intensified during the development of the fruits. The free parts of the carpels between the level of adnation and the base of the style not infrequently remain open at anthesis (*fig. 4*). The glandular cells of the plume-like style (*figs. 13, 14*) extend downward along the free margins and adjacent ventral surfaces of the carpel to the level of attachment of the large, much flattened, anatropous ovule. A transverse section of this free open part of the carpel (*fig. 4*) resembles a transverse section of the megasporophyll of *Degeneria* except that the ovule is attached closer to the margins of the conduplicate carpels than are the numerous ovules of *Degeneria*. In the Degeneriaceae, one is concerned with a seemingly primitive, conduplicate, 3-veined megasporophyll of comparatively unmodified form, bearing numerous ovules on its adaxial or ventral surface and having stigmatic structures along its margins and adjacent parts of its free ventral surfaces. With the reduction in the number of ovules to a single one (rarely two) in *Himantandra,* there appears to have been a concomitant narrowing of the sterilized upper $\frac{3}{5}$ to $\frac{5}{7}$ of the megasporophyll. This style-like projection beyond the broader base of the sporophyll still exhibits a conduplicate structure in transverse sections and retains its stigmatic margins. It should be noted in this connection that the styles of the Magnoliaceae likewise exhibit a conduplicate structure.

The free dorsal surfaces of the carpels of *Himantandra* are coated below the level of the style with numerous dark brown peltate scales (*figs. 4, 7, 11, 13, 14*). The abaxial parts of the carpels contain more or less numerous nests of sclereids, such as occur in the tissue of the torus (*fig. 7*). Spherical secretory cells are of common occurrence in the carpels, as in other parts of the flower. The level of attachment and the orientation of the large, much flattened, anatropous ovule fluctuate considerably from carpel to carpel and from flower to flower of different collections of *H. Belgraveana*. Thus, the ovule may be attached at a higher level where the carpel is open (*fig. 4*), or at a lower one where the carpel is adnate to the torus.

The vascular system in the cone-shaped, carpel-bearing, apical part of the torus is simple in contrast to its complexity in subtending regions. The vascular strands remaining after departure of traces to fertile and sterile microsporophylls briefly reassemble at the top of the columnar part of the torus into a weakly defined cylinder of bundles, most of which are dorsal bundles of carpels. The dorsal traces of all of the carpels, except the 2 or 3 distal ones, enter the megasporophylls without branching. A variable number of bundles (4–8) left in the center of the torus divide in various ways to form two (rarely one) small ventral traces for each of the carpels. The dorsal bundles of the 2 or 3 uppermost carpels arise also from these central strands, but these dorsals first give off ventral traces to lower carpels of the same orthostichies. The carpel of *Himantandra,* therefore, is a modified 3-veined megasporophyll having a well-developed dorsal vein and two more or less reduced ventral ones. The dorsal vein extends upward as far as the middle or lower third of the style. It is much enlarged for a short distance in the region of the junction of the style and ovary. The ventral veins occasionally terminate in the ovule (especially when one ventral only is present), but usually they continue short distances in the margins of the carpels above the attachment of the ovule (*fig. 14*). However, the ventral veins rarely if ever extend upward into the style.

FRUIT. Soon after anthesis, the styles apparently atrophy and the basal portions of the carpels become increasingly concrescent. The mature fruit is a subglobose or somewhat elongated syncarp, upon the surface of which the outlines of the outermost imbricate carpels can be only indistinctly, if at all, perceived. The whole exterior surface is more or less persistently lepidote. The lower carpels appear shorter than those at the apex of the fruit, the constituent carpels being irregular in shape and apparently often distorted by mutual pressure. The original conical apical portion of the torus elongates, carrying the distal carpels upward and thus somewhat distorting the spiral arrangement. Sometimes the carpels are 2- or 3-ranked and strictly superposed.

All of the fruits available to us are dried, in which condition they are hard and coriaceous; according to Diels (5: 129) they are fleshy when fresh and somewhat suggestive of the syncarps of *Annona.* The inner walls of the carpels thicken after anthesis and in dried fruits form coriaceous dissepiments. During development of the fruit the carpels are apparently under lateral pressure, and the locules eventually appear as mere slits, much narrower in proportion than they are in the flower (*fig. 7*). The seeds, in all specimens examined by us, are solitary, greatly flattened, submembranous and suborbicular. In dried material we have not been able to perceive whether such seeds are fertile, and for the present we can neither add to nor verify Diels' statements (5: 130).

RELATIONSHIPS OF THE HIMANTANDRACEAE. In studying the relationships of families, it is essential to weigh evidence from all organs and parts of the plants. In the past, excessive emphasis has not infrequently been placed upon similarities between one or two morphological features without regard to outstanding differences in other parts of the plants, or conversely to stress differences in one organ or tissue without allowing for similarities in other organs or tissues. It should be noted in this connection that certain of the morphological similarities within the Ranales appear to be due to retentions of structures that characterized the primitive ranalian stock, whereas others represent parallel specializations from a common ancestry. Thus, the retention of vesselless xylem, in itself, does not provide adequate evidence for combining *Trochodendron, Tetracentron,* and the Winteraceae in an independent order, viz. Homoxylées of van Tieghem (9). Nor are the specialized calyptrate structures of *Drimys,* *Eupomatia*, and *Himantandra* necessarily indicative of close relationship. Furthermore, certain superficial similarities or differences between specific organs prove to have been misleading when the ontogeny and the internal structure of these organs are carefully investigated.

There are numerous similarities between the Degeneriaceae, Magnoliaceae, and Himantandraceae. Many of these similarities (e. g. presence of spherical secretory cells, sclerenchymatous medullary diaphragms, stratified phloem, wood fibers with small bordered pits, superficial origin of periderm, monocolpate pollen, stomata with subsidiary cells oriented parallel to the guard cells, etc.), taken independently, are not necessarily indicative of close relationships, since they occur in other representatives of the Ranales. However, the *totality* of the similarities does indicate that the three families are more closely related to one another than to other ranalian families. In fact, the three families form a compact group within the Ranales comparable to that composed of the Monimiaceae, Lauraceae, Gomortegaceae, and Hernandiaceae.

The structure of the stem, including the cortex, pith, and vascular tissues, is of a basically similar type in the Degeneriaceae, Magnoliaceae, and Himantandraceae, and differs markedly from that which occurs in other ranalian families, with the possible exception of the Annonaceae. The wood of *Degeneria* is of a comparatively primitive type, whereas that of *Himantandra*, with its transitions to porous perforations and alternate lateral pitting of the vessels, is obviously more highly specialized. The woods of the numerous representatives of the Magnoliaceae provide a graded series of transitions between these structural extremes. However, the range of morphological variability of the stem is no greater than in single families or even genera of the dicotyledons and therefore, by itself, does not provide cogent arguments for differentiating the plants into three families or even for excluding them from close relationship to the Annonaceae.

The vascularization of the leaf in the Degeneriaceae, Magnoliaceae, and Himantandraceae is of a characteristic and basically similar type and serves to differentiate the three families from other ranalian families (including the Annonaceae) which have secretory cells and monocolpate pollen. Throughout the Magnoliaceae the vascularization of the foliar organs is complicated by the presence of stipules and provides a reliable means for differentiating the vegetative shoots of magnoliaceous plants from those of *Degeneria* and *Himantandra*. The peltate scales, crystalliferous parenchyma, and peculiar stomatal arrangements of *Himantandra* differentiate its vegetative organs from those of *Degeneria* and the Magnoliaceae. It should be admitted, however, that such differences in the vegetative organs, by themselves, do not afford a thoroughly reliable argument for segregating the plants into separate families rather than into tribes of a single family. Only when combined with outstanding differences in the reproductive organs is there a summation of evidence in favor of separate families.

The flowers of *Degeneria* and *Himantandra*, as of *Michelia* and *Elmer-*

rillia, are borne at the apex of axillary shoots. These shoots, as the terminal flowering ones of *Magnolia* and *Liriodendron*, are essentially vegetative, since they exhibit various stages in the reduction of typical leaves to scales (*Himantandra*) or to stipular bud-scales (Magnoliaceae). The flowers of *Degeneria* and *Himantandra* have clearly differentiated pedicels, whereas those of the Magnoliaceae are sessile on the last vegetative node. The flowers of *Degeneria* are provided with distinct sepals and petals, those of *Himantandra* with a calyptrate corolla enclosed within a calyptrate calyx, and those of the Magnoliaceae with tepals or subsimilar sepals and petals. The tepals of the Magnoliaceae usually have a conspicuously petaloid texture and internal structure, whereas the homologous parts of *Degeneria* and *Himantandra* are coriaceous and provided with very numerous nests of sclereids. The immature flowers of the latter genera are not enclosed within a bud, whereas those of the Magnoliaceae are enveloped within one or more pairs of stipular bud-scales.

There are no staminodes in the flowers of Magnoliaceae, whereas *Degeneria* has numerous inner staminodes and *Himantandra* both inner and outer ones. The microsporophylls of *Degeneria* and *Himantandra* are not differentiated into filament, anther, and connective, and their sporangia are immersed beneath the abaxial surface of the sporophyll. On the contrary, the microsporophylls of the Magnoliaceae are typical stamens with conspicuous protuberant anthers, but they tend to retain the 3-veined type of vascularization that characterizes both the fertile and sterile sporophylls of *Degeneria* and *Himantandra*.

The floral axis of the Degeneriaceae and Himantandraceae, unlike that of most Magnoliaceae, is short, and the torus is characterized by having a conspicuous concavity. In *Himantandra* the cone-shaped, carpel-bearing apex of the torus projects beyond this concavity, whereas in *Degeneria* the solitary carpel is attached within it. In the latter genus, the carpel is a 3-veined, conduplicate megasporophyll of relatively unmodified form, bearing numerous ovules on its morphologically adaxial surface. The attachment of the ovules is remote from the free stigmatic margins of the sporophyll. The numerous (rarely reduced to two, e. g. *Pachylarnax*) carpels of *Himantandra* and the Magnoliaceae have well-differentiated styles, which are plume-like in *Himantandra* and commonly provided with more or less decurrent stigmatic surfaces in Magnoliaceae. As contrasted with *Degeneria*, the ovules are reduced in number, commonly to one in *Himantandra* or to two in many representatives of the Magnoliaceae. Such morphological divergences are impressive, but a detailed study of the carpels of *Himantandra* indicates that they probably represent specializations of the 3-veined, conduplicate type of carpel encountered in *Degeneria*. With reduction in the number of ovules to one or a few more or less basally attached ones, there appears to have been a concomitant narrowing of the upper sterilized part of the conduplicate megasporophyll, forming styles which retain a conduplicate structure and stigmatic margins. Reduction of the "decurrent" stigmatic surfaces in certain of the Magnoliaceae leads to the formation of a style with a nearly apical stigmatic surface. In *Himantandra,* as in many Magnoliaceae, there is more or less adnation and concrescence of carpels both preceding and following anthesis. In *Degeneria,* part of the maturing seeds are attached by slender much elongated funicles, suggestive of the suspended seeds of certain Magnoliaceae. The pollen of the Degeneriaceae, Magnoliaceae, and Himantandraceae is of a similar monocolpate type, that of *Himantandra* more closely resembling the pollen of certain Magnoliaceae than of *Degeneria.*

Outstanding differences in the carpel, calyx, and corolla render difficult the inclusion of *Degeneria* and *Himantandra* in a single family, in spite of obvious similarities in the form of the floral axis, the stamens, and the staminodes. Furthermore, numerous floral differences form a serious obstacle to including these genera in the Magnoliaceae. Aside from certain similarities in the pollen, in the vascularization of the stamens, and in the carpels of *Himantandra,* there is scant floral evidence for inferring close relationship to the Magnoliaceae. Such evidence is amply provided, however, by the vegetative organs. Thus, the summation of evidence from both vegetative and reproductive organs indicates that in the Degeneriaceae, Himantandraceae, and Magnoliaceae we are concerned with three distinct but closely related families. As will be shown in subsequent papers, similar summations of evidence indicate that such ranalian plants as the Winteraceae, *Illicium,* the Schizandraceae, and *Tetracentron* are only remotely related to this compact group of three families. To include them within the Magnoliaceae, as some investigators have done, broadens this family even beyond the limits of a natural sub-order.

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EXPLANATION OF PLATES

All plates illustrate *Himantandra Belgraveana* (F. v. Muell.) F. v. Muell. The figures are photographed from or drawn from various specimens, these being indicated in each case.

PLATE I

FIG. 1. *Clemens 6584a.* Dorsal surface of partially cleared leaf, showing peltate scales and crystal-bearing cells of the epidermis, × 260. FIG. 2. *Brass & Versteegh 11195.* Lower epidermis of fully cleared leaf, showing circular clusters of stomata, × 260.

PLATE II

FIG. 3. *Clemens 5538.* Transverse section of young conduplicate leaf, × 34. FIG. 4. *Clemens 11100.* Transverse section of flower above the level of adnation of the conduplicate carpels, showing free stigmatic margins and the attachment of an ovule, × 100. FIG. 5. *Brass & Versteegh 11195.* Transverse section of a fertile microsporophyll, showing embedded sporangia and four short arcs of endothecia, × 100.

PLATE III

FIG. 6. *Clemens 3678.* Transverse section of immature flower, showing open conduplicate carpels, × 37. FIG. 7. *Brass & Versteegh 11195.* Transverse section of older flower, showing adnation and coalescence of carpels, × 37.

PLATE IV

FIG. 8. *Ledermann 10884a.* Transverse section of basal part of the midrib, showing foliar vascular dictyostele, × 50. FIG. 9. *Y. U. 15717.* Transverse section of secondary xylem from a large stem, × 50. FIG. 10. *Y. U. 15717.* Tangential longitudinal section of the same piece of wood, × 50.

PLATE V

FIG. 11. *Brass 12103.* Flower with calyptrate calyx, calyptrate corolla, staminodes and stamens removed, approx. × 10. FIG. 12. Half of same flower as in *fig. 11,* viewed from cut surface, showing shape of torus and attached lower and distal carpels, approx. × 10. FIG. 13. *Clemens 3586.* Carpel with short and comparatively smooth style, approx. × 15. FIG. 14. Carpel from flower of *fig. 11,* showing plumose style, position of ovule (micropyle, *micr.*), ventral bundle, *ven. bn.,* and ovule trace, *ov. tr.,* approx. × 15.

PLATE VI

FIGS. 15–23. Diagrams of successive segments through flowering shoot and base of torus, showing average or basic vascular condition in *Himantandra.* Lower bract traces, *lo. br. trs.;* upper bract traces, *up. br. trs.;* bud trace, *bu. tr.;* cortical bundles, *cor. bn.;* outer calyptra, *o. cal.;* inner calyptra, *in. cal.* FIG. 24. *Brass 12572.* Outer staminode, approx. × 6. FIG. 25. *Brass 12572.* Stamen, approx. × 6. FIG. 26. *Brass 12572.* Inner staminode, approx. × 6.

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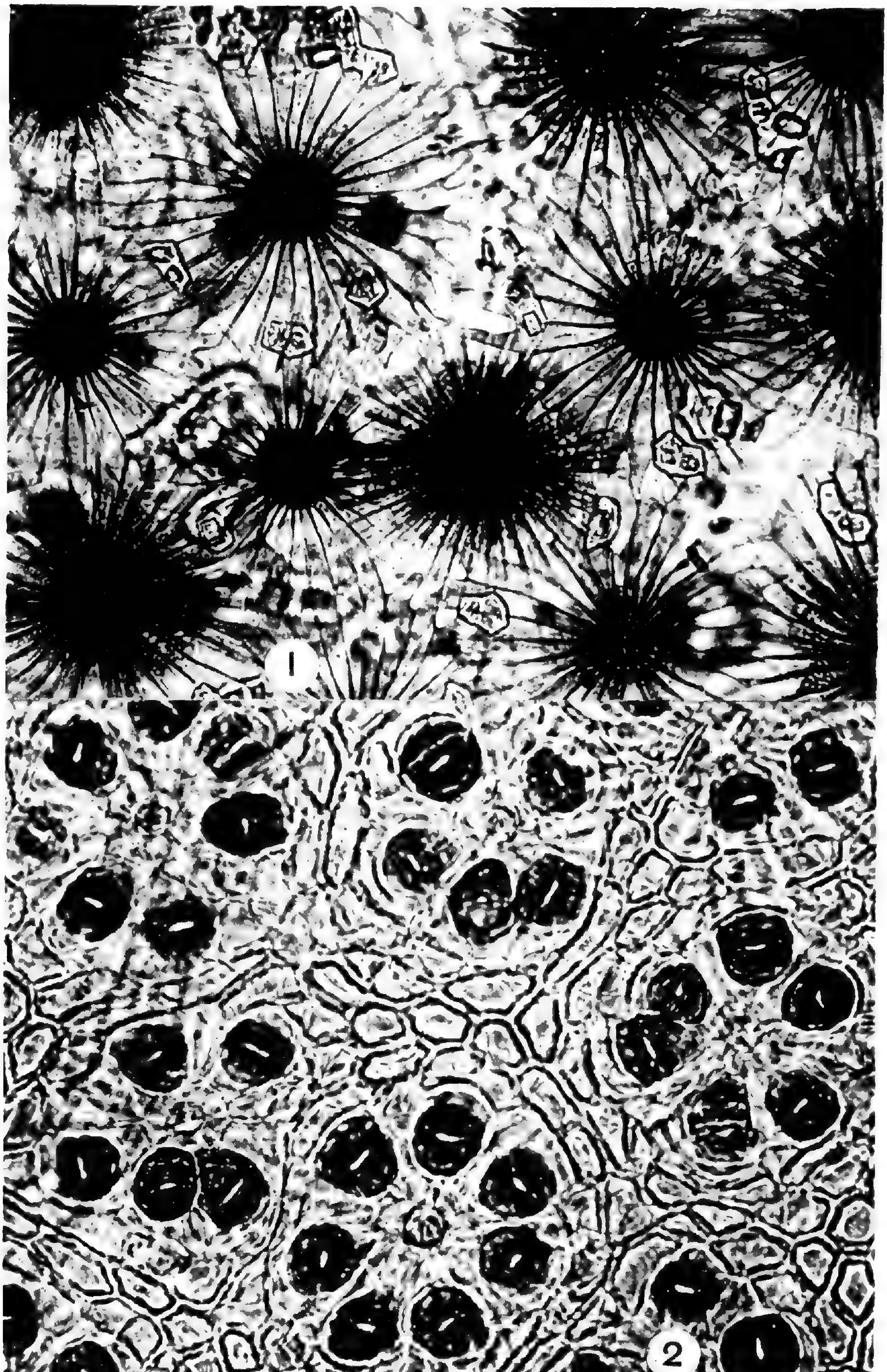
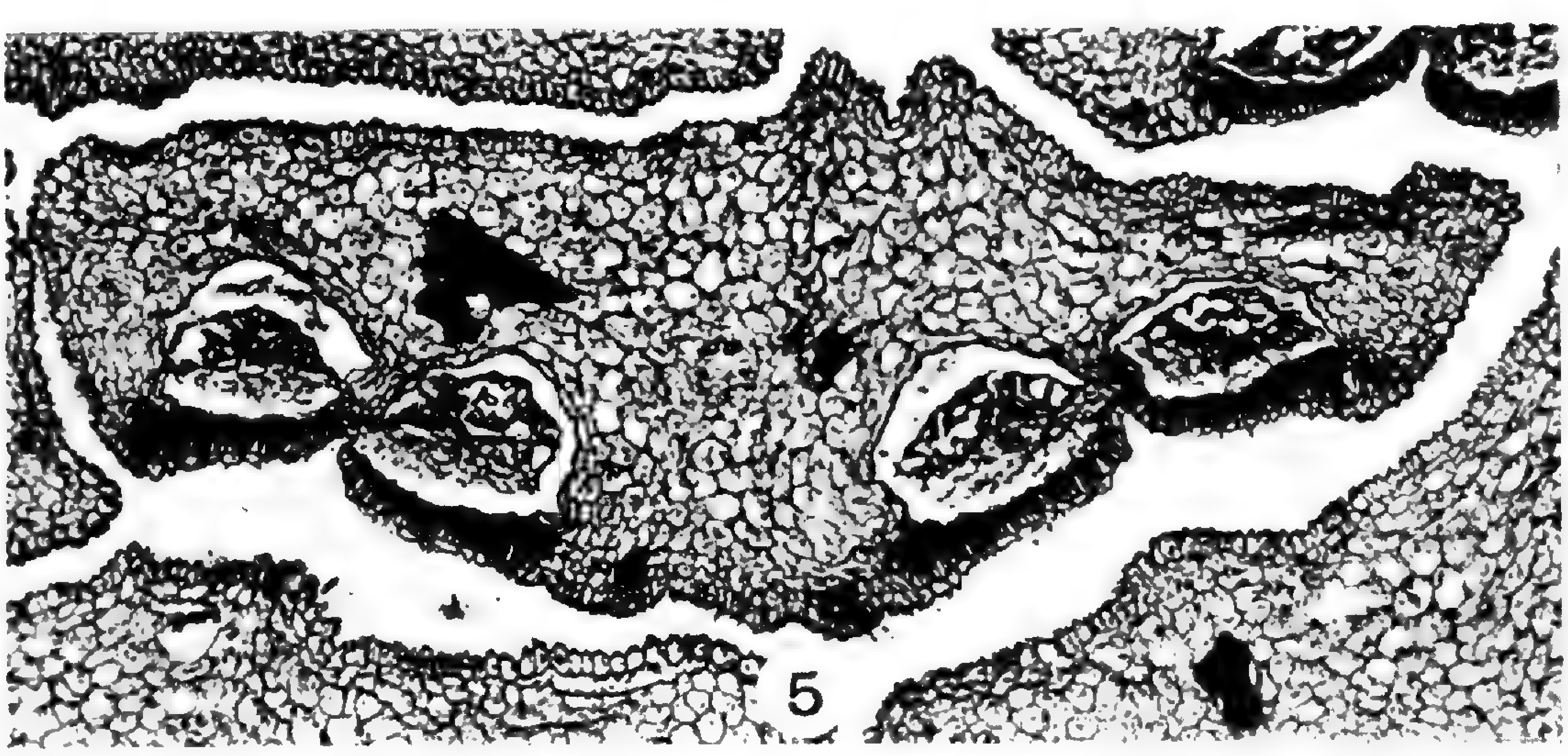


Himantandra Belgraveana



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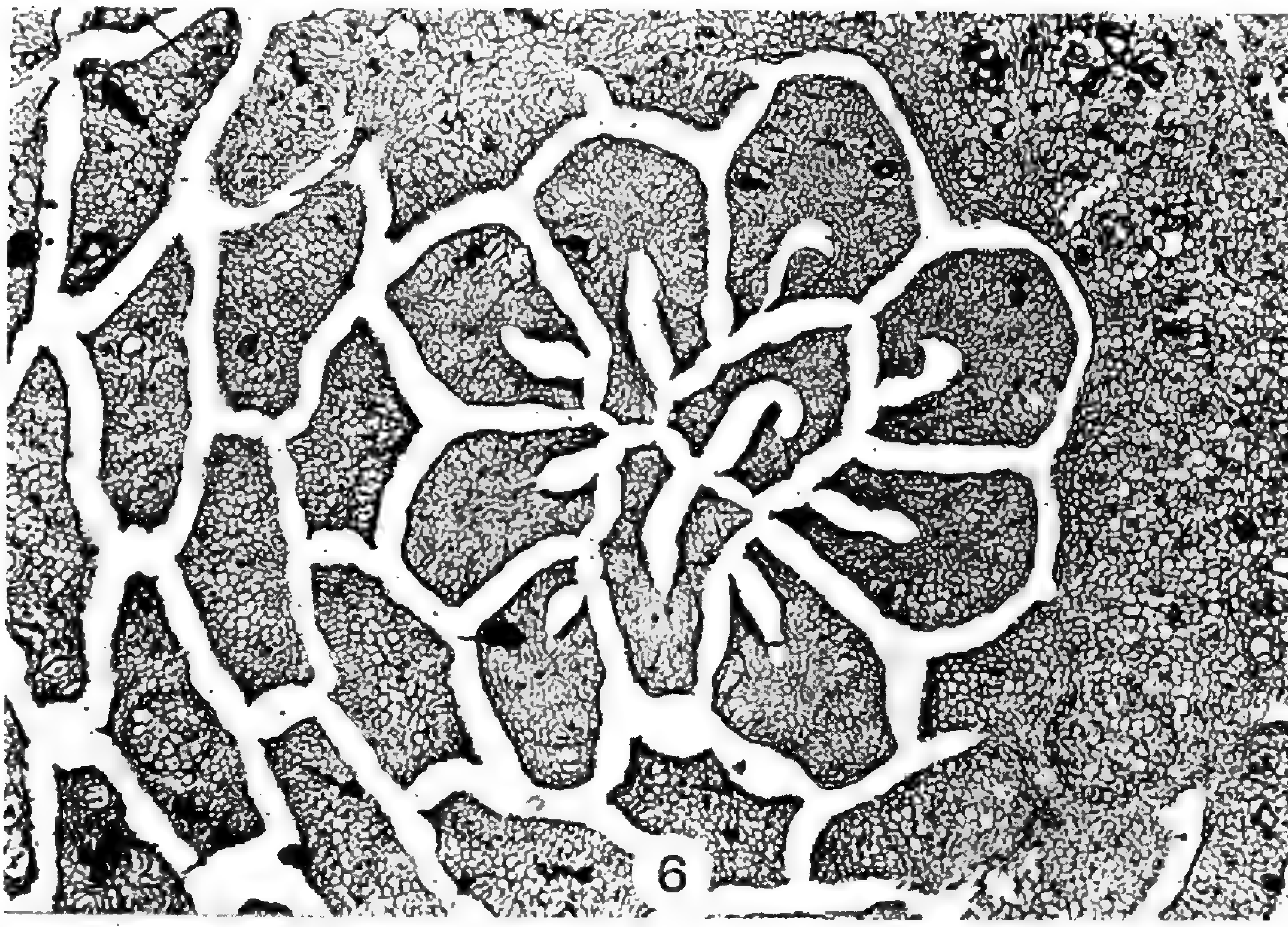

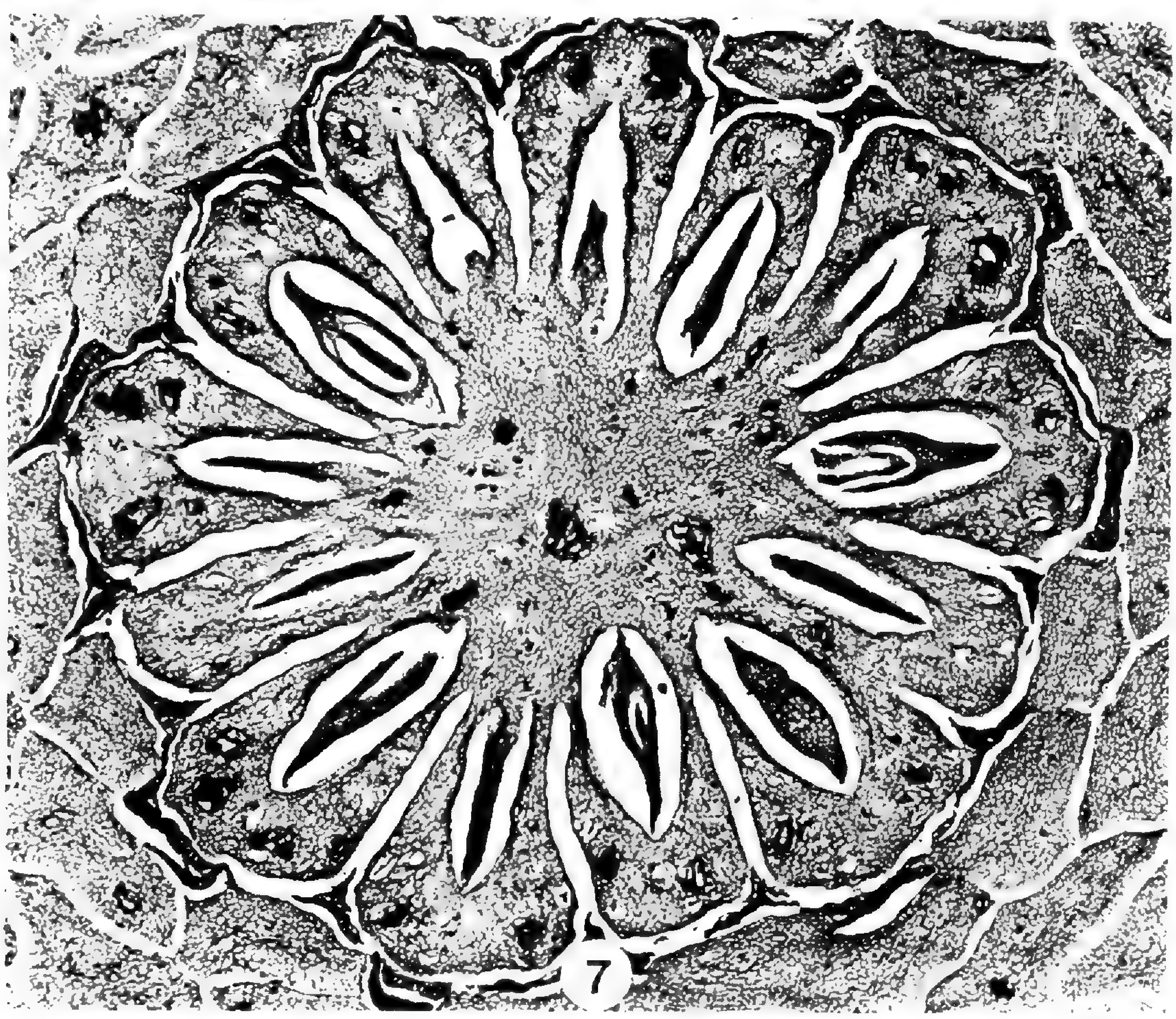

Himantandra Belgraveana

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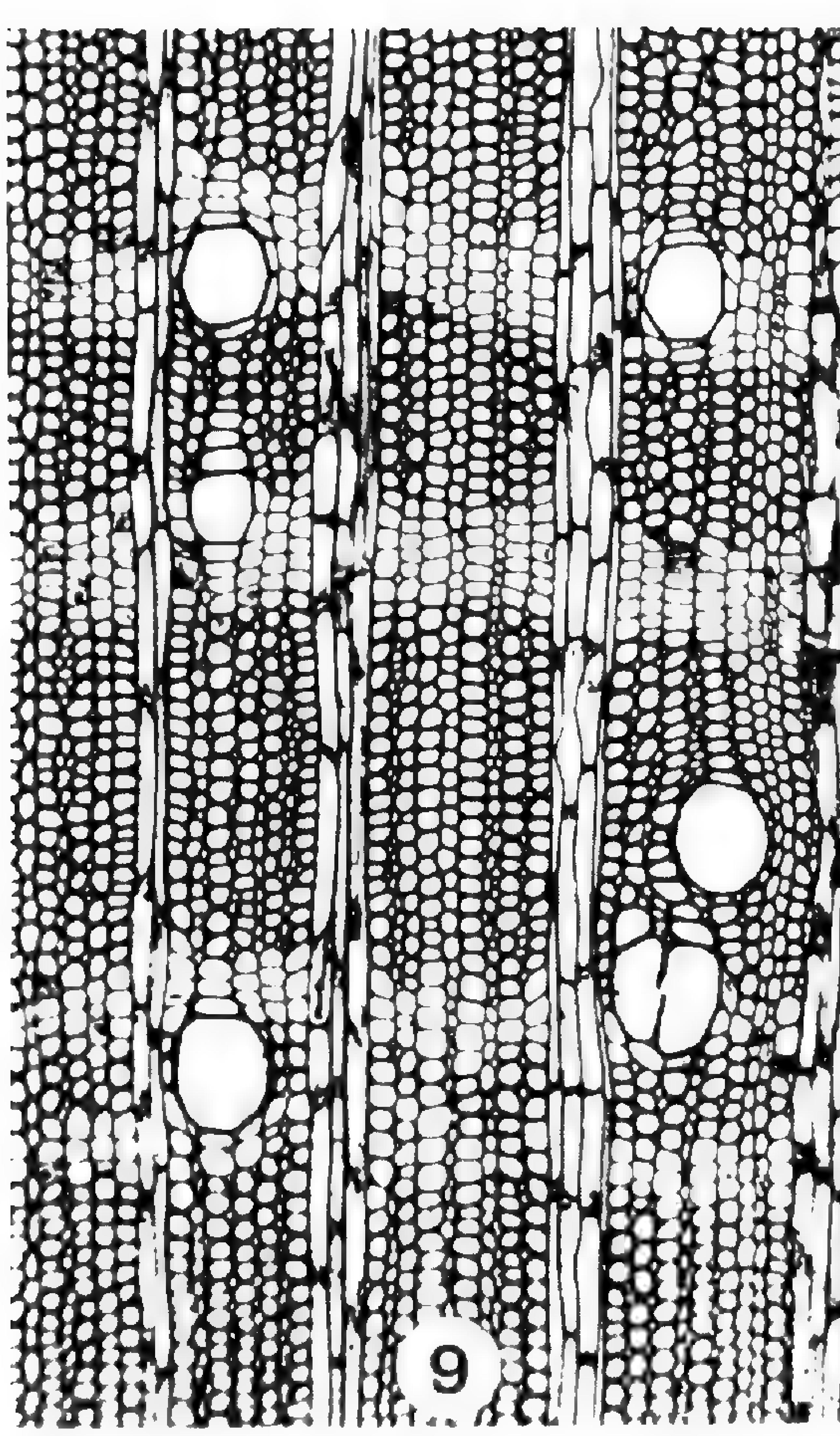

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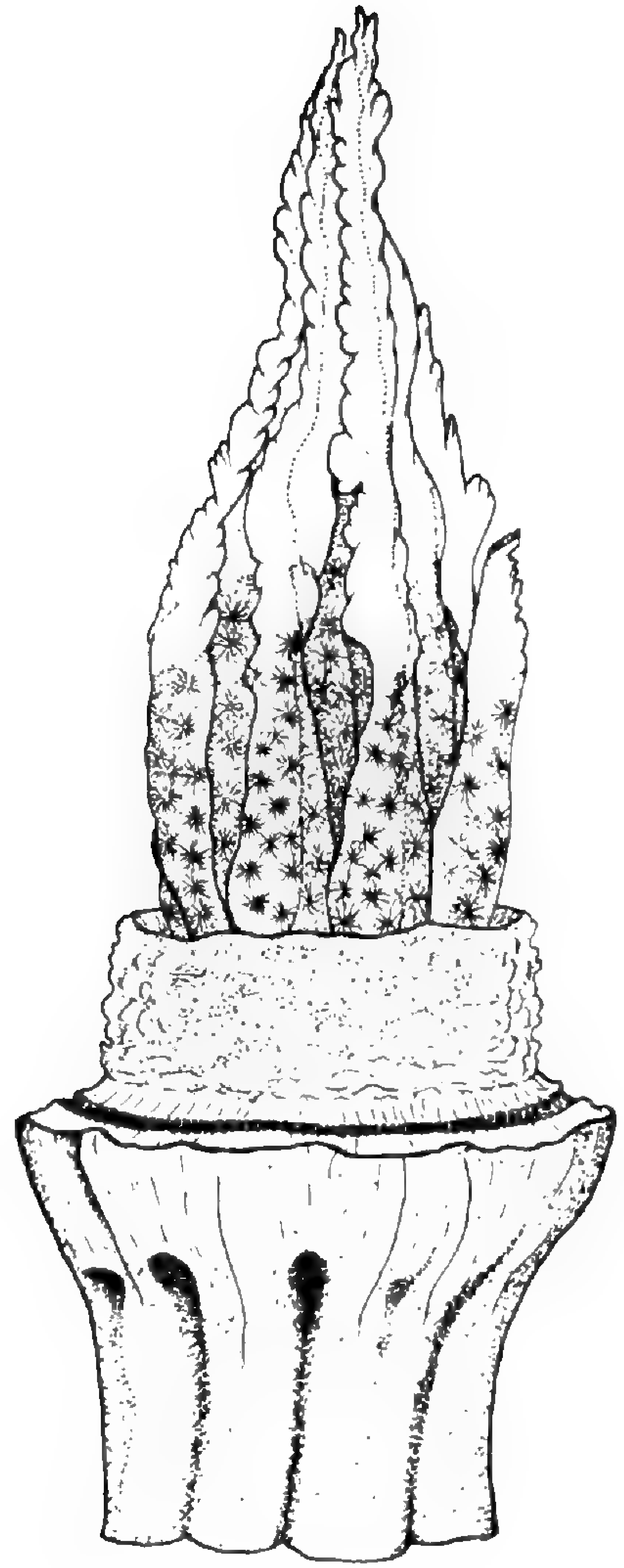
Himantandra Belgraveana



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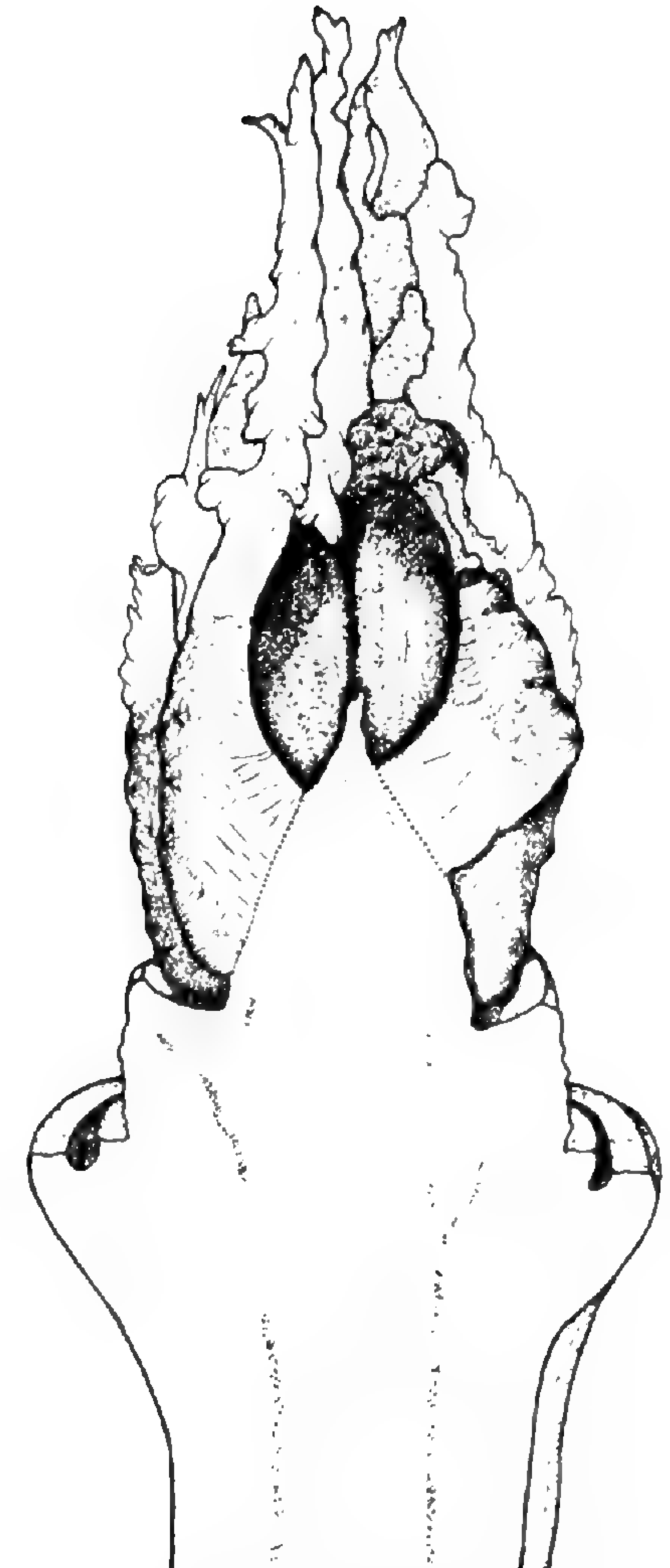

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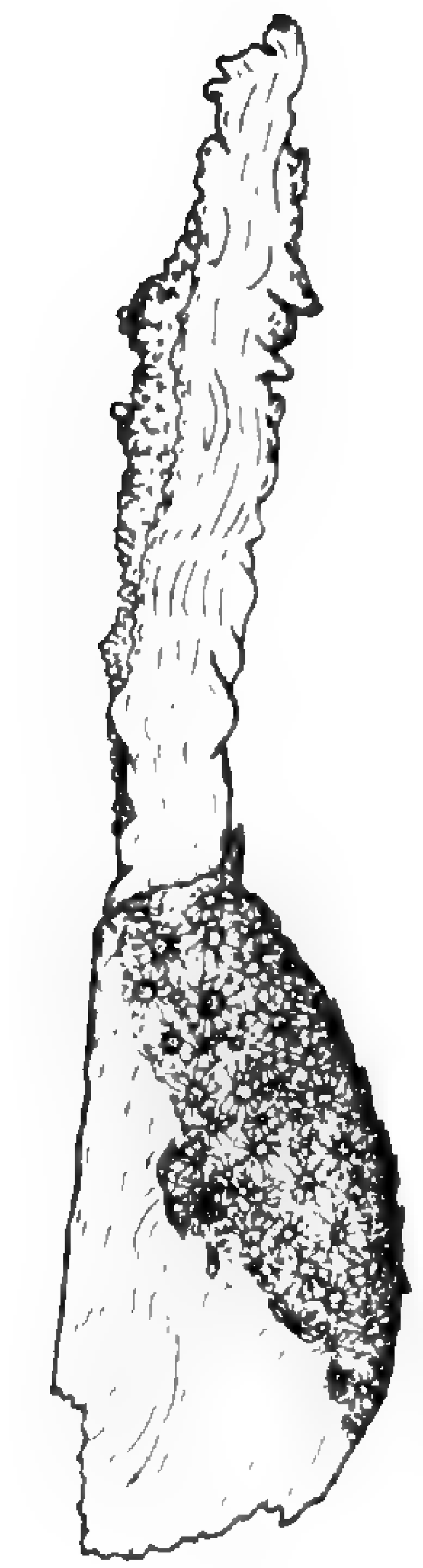

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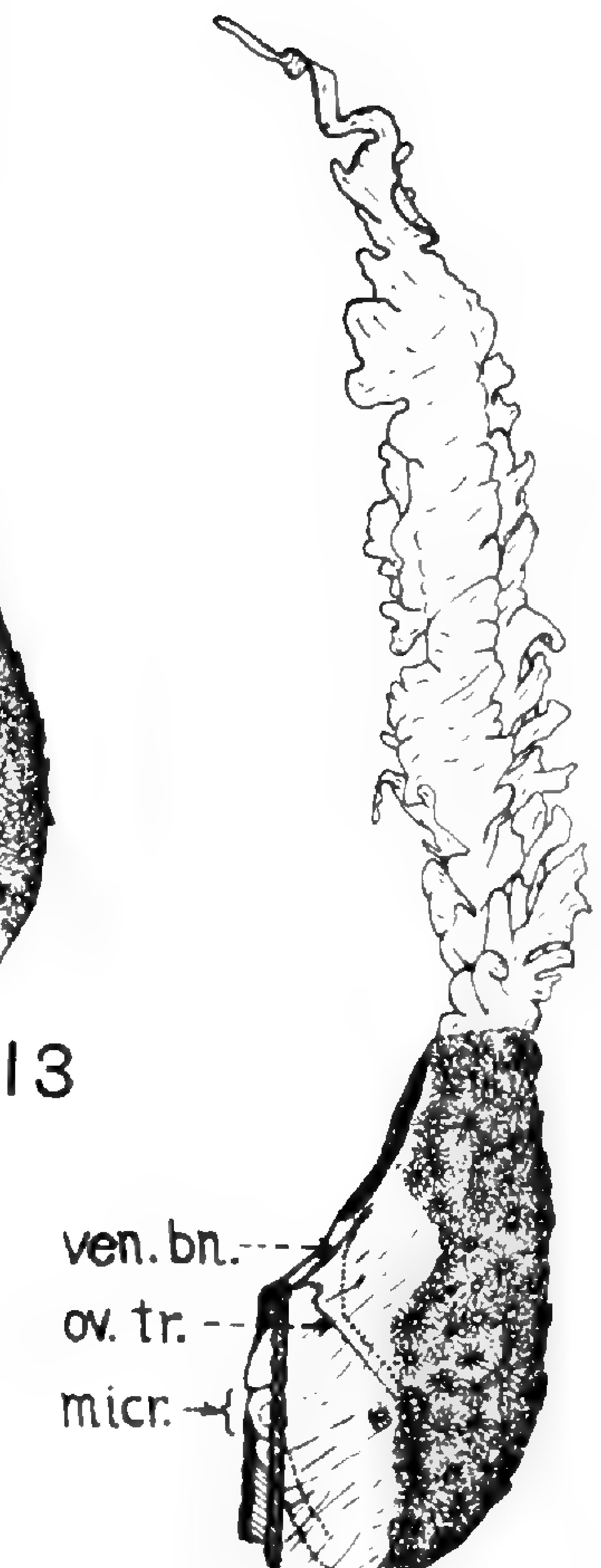

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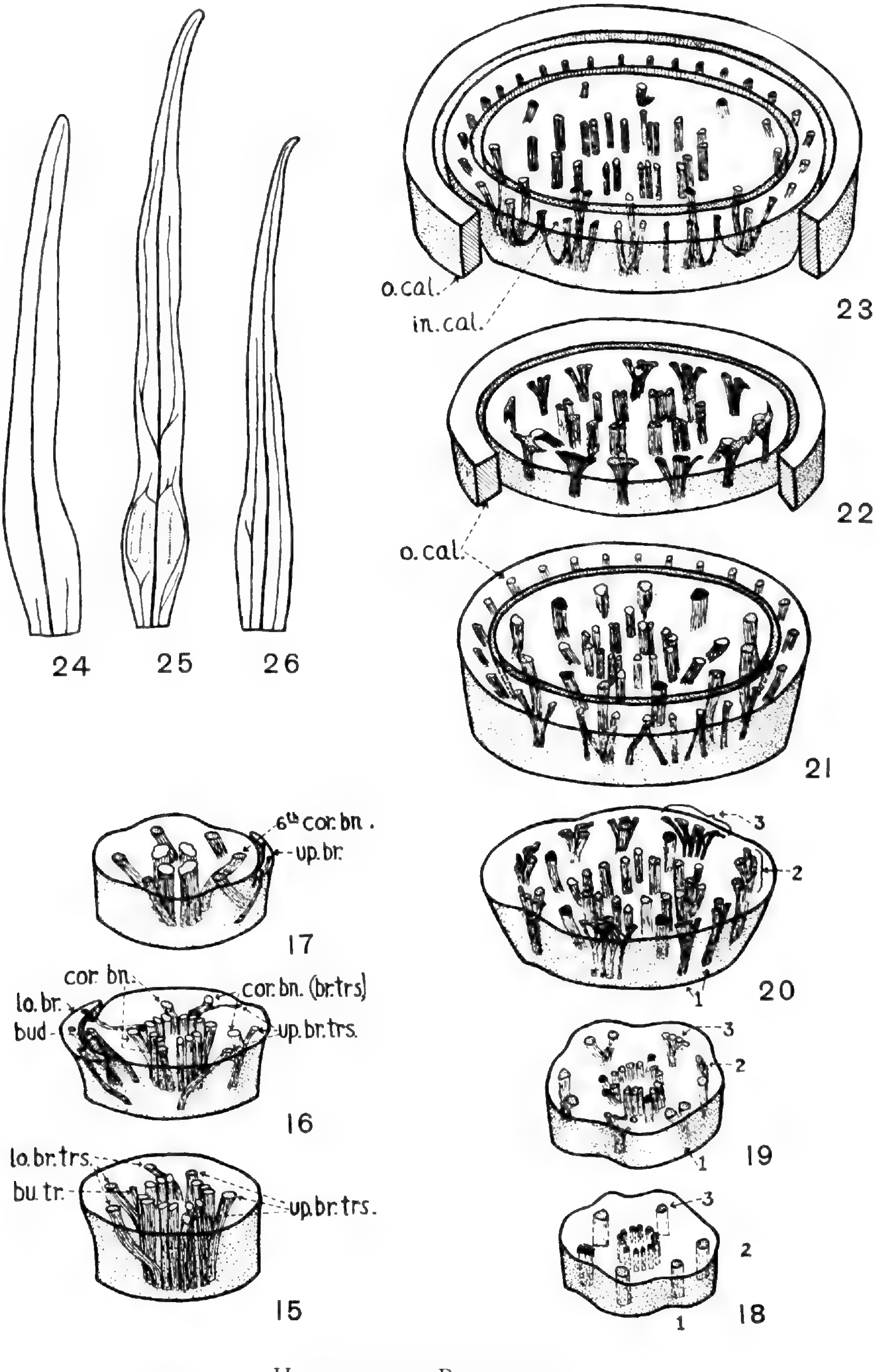
Himantandra Belgraveana



Himantandra Belgraveana

PLANTAE PAPUANAE ARCHBOLDIANAE, XII*

E. D. MERRILL AND L. M. PERRY

IN continuation of our work on the plants collected by the Archbold Expeditions in New Guinea, this article consists of a miscellany of notes and a few new species in the Cruciferae, Violaceae, Passifloraceae and Apocynaceae.

CRUCIFERAE

Cardamine Linnaeus

Cardamine papuana (Lauterb.) O. E. Schulz, Bot. Jahrb. **55**: 271. 1918.

Cardamine africana subsp. *borbonica* var. *papuana* Lauterb. in K. Schum. & Lauterb. Fl. Deutsch. Schutzgeb. Südsee Nachtr. 271. 1905.

NETHERLANDS NEW GUINEA: 15 km. southwest of Bernhard Camp, Idenburg River, *Brass 12164,* January 1939, alt. 1600 m., rain-forest, common on rocks in small streams (tufts 15–25 cm. high; flowers white); 6 km. southwest of Bernhard Camp, Idenburg River, *Brass 12922,* February 1939, alt. 1500 m., banks of a forest stream. BRITISH NEW GUINEA: Mafulu, *Brass 5540,* September-November 1933, alt. 1250 m., wet rocks of a forest stream, rare (flowers white).

We have accepted Schulz's designation of the Papuan material. Whether it is really more than a localized form of the wide-ranging *Cardamine africana* L. is impossible to determine with our limited collections.

Cardamine altigena Schlechter ex Schulz, Bot. Jahrb. **62**: 479. 1929.

NETHERLANDS NEW GUINEA: Lake Habbema, *Brass 9285,* August 1938, alt. 3225 m., with *Marchantia* in a long-grass marsh (flowers white); same locality, *Brass 9472,* on a mossy bank; 9 km. northeast of Lake Habbema, *Brass 10553,* October 1938, alt. 2800 m., stony bed of a stream, rare; 7 km. northeast of Wilhelmina-top, *Brass & Myer-Drees 10026,* September 1938, alt. 3560 m., wet grassy cliffs, rare.

Siliques 1.5–2 cm. long, 0.2 cm. wide, attenuate into a style 1–2 mm. long; stigma 0.5 mm. broad; seeds oblong, 1.6 mm. long, 1 mm. wide.

Papuzilla Ridley

Papuzilla minutiflora Ridley, Trans. Linn. Soc. II. Bot. **9**: 17. *t. 1, figs. 7–14.* 1916; Schulz, Nat. Pflanzenfam. ed. 2, **17b**: 275, 410. 1936.

NETHERLANDS NEW GUINEA: 2 km. east of Wilhelmina-top, *Brass & Myer-Drees 9986, 10334,* September 1938, alt. 3800 m., alpine grassland, massed on limestone rocks, also wet open places along small waterfall (flowers greenish to violet and white); northern slopes of Mt. Wilhelmina, *Brass & Myer-Drees 10053,* alt. 3900 m., prostrate in dense mats or forming loose cushions on screes (flowers and fruits purple).

Since the genus appears to be known only from the type-material of the species, we have placed these collections on record. They agree pretty well with the plate of the original material, but the pubescence of the stem varies from minutely pubescent to glabrous, and the leaves are often 7–9-incised-dentate.

*Botanical Results of the Richard Archbold Expeditions. See Jour. Arnold Arb. **24**: 34–59. 1943.

VIOLACEAE

Rinorea Aublet

Rinorea fasciculata (Turcz.) Merr. Philip. Jour. Sci. Bot. **12:** 286. 1917, Enum. Philip. Fl. Pl. **3:** 104. 1923.

Pentaloba fasciculata Turcz. Bull. Soc. Nat. Mosc. **27**(2): 341. 1854.

SOLOMON ISLANDS: Florida (N'Gela): northern end of island, *Brass 3509*, January 1933, alt. 75 m., hill rain-forests (slender small tree with thin brown bark and hard yellow wood; leaves dull dark green, all the tips destroyed by insects; flowers yellow-green).

This specimen compares reasonably well with the isotype in our herbarium. In the latter the anthers are a little larger and, in part of the inflorescences, the pedicels are scarred at the base, but this may be owing to the age of the growth. The inflorescences on the year old twigs have pedicels apparently scarred at the base; the scarred part we take to be the very short persistent axis of the old inflorescence. In the collection from the Solomon Islands the inflorescences are all on new growth and do not show this character.

Rinorea salomonensis (Rechinger) Melchior, Nat. Pflanzenfam. ed. 2, **21:** 352. 1925.

Alsodeia salomonensis Rechinger, Rep. Sp. Nov. **11:** 184. 1912, Denkschr. Math.-Nat. Kl. Akad. Wiss. Wien **89:** 579. *t. 6, f. 11 B.* 1913.

SOLOMON ISLANDS: Bougainville: Karngu, Buin, *Kajewski 2295*, October 1930, alt. 50 m., rain-forest, common (medium-sized tree up to 15 m. high; petals white with cream-colored edges; fruit somewhat triangular, 6 mm. long, 7 mm. diameter, with small appendage 2 mm. long).

In the specimen above cited there are, on the lower surface, minute tufts of brownish hairs in the axils between the primary veins and the midrib. The petals, about 5 mm. long, in full grown flowers are about twice as long as the sepals. The fruit has reticulate valves with 3 mottled brown seeds about 4 mm. in diameter. In general habit the species closely resembles *Rinorea carolinensis* Kaneh., as pictured in Bot. Mag. Tokyo **48:** 922. *f. 8.* 1934, but the anther-appendages are different; in the former they are simply acute at the apex, not lobed or erose as in Kanehira's species.

Hybanthus Jacquin

Hybanthus enneaspermus (Linn.) F. v. Muell. Fragm. Phytogr. Austr. **10:** 81. 1877, Pap. Pl. **2:** 4. 1885.

Viola enneasperma Linn. Sp. Pl. **1:** 937. 1753.

Ionidium enneaspermum Vent. Jard. Malm. sub 27. 1803–04; Merr. Enum. Philip. Fl. Pl. **3:** 106. 1923.

BRITISH NEW GUINEA: Western Division, Penzara, between Morehead and Wassi Kussa Rivers, *Brass 8434*, December 1936, occasional on savanna-forest ridges.

The species has once before been reported from New Guinea, but modern workers on the family in this region seem to have overlooked the record. The species is also reported from the Philippines under *Ionidium*.

Agatea A. Gray

Agatea macrobotrys Lauterb. & K. Schum. Fl. Deutsch. Schutzgeb. Südsee 453. *t. 14.* 1900; Melchior, Nat. Pflanzenfam. ed. 2, **21:** 360. *f. 157 D.* 1925, Bot. Jahrb. **62:** 373. 1929.

NETHERLANDS NEW GUINEA: Bernhard Camp, Idenburg River, *Brass 14057,* April 1939, alt. 50 m., flooded rain-forests of river plain (large climber in dense marginal growths of forest; flowers purple).

This specimen agrees with the original description in all details except that the ovary is sparsely hairy. In the previous records of this species only the type from Northeastern New Guinea has been cited.

Agatea salomonensis sp. nov.

Frutex scandens; ramulis maturis glabris novellis ± pubescentibus; foliis chartaceis utrinque glabris manifeste reticulatis petiolatis, petiolo glabrato 2.5–3 cm. longo, stipulis minutis subulatis, lamina late ovata 7–11 cm. longa 5.5–7.5 cm. lata, basi rotundata apice acute breviterque acuminata margine subintegra vel minute denticulata, venis primariis utrinsecus 6 vel 7 utrinque manifestis; inflorescentiis axillaribus paniculatis ± 20 cm. longis, rhachi ramulis pedicellisque ± patenti-pubescentibus, bracteis bracteolisque minutis; sepalis circiter 2 mm. longis oblongis obtusis ciliatis; petalis ciliolatis: posterioribus oblongis 4 mm. longis, lateralibus 5 mm. longis 3 mm. latis, labello 8–9 mm. longo medio valde ligulato constricto 2 mm. lato, parte distali subdolabriformi ± 6 mm. longa lataque emarginata extus glabra, intus apice et margine lato involuto excepto villosa, parte basali gibboso-saccata intus basi excepta villosa margine valde undulato; filamentis brevissimis 1 mm. longis connatis utrinque pubescentibus 2 anterioribus extus glandulosis vel tuberculatis, antheris 1 mm. longis, extus connectivo inter loculos pilosis, apice anguste appendiculatis, connectivo in appendicem petaloideam 1.5 mm. latam 2 mm. longam producto; ovario globoso ad basim piloso; fructibus immaturis.

SOLOMON ISLANDS: Bougainville: Karngu, Buin, *Kajewski 2309* (TYPE), October 1930, alt. 50 m., rain-forest, common (vine climbing rain-forest trees; petals white, the labellum with a touch of purple).

Agatea salomonensis is closely allied to *A. macrobotrys* Lauterb. & K. Schum. The flowers are larger, the pubescence of the inflorescence is more shaggy, the leaves are much more shortly acuminate or scarcely more than acute.

Viola Linnaeus

Viola betonicifolia Sm. subsp. **nepalensis** (Ging.) W. Becker, Bot. Jahrb. **54,** Beibl. 120: 166. 1917; Melchior, Bot. Jahrb. **62:** 374. 1929.

NETHERLANDS NEW GUINEA: Balim River, *Brass 11653,* December 1938, alt. 1600 m., occasional on grassy deforested slopes (flowers pale, almost white).

This species is widespread from the Himalayas southward, but it has not previously been reported from Netherlands New Guinea.

Viola lunata Ridl. Trans. Linn. Soc. II. Bot. **9:** 17. 1916; Melchior, Bot. Jahrb. **62:** 374. 1929.

NETHERLANDS NEW GUINEA: Southern slopes of Grand Valley, *Brass 9521* (coll. *Toxopeus*), August 1938, alt. 2350 m.; 9 km. northeast of Lake Habbema, *Brass 10732,* October 1938, alt. 2800 m., plentiful in herbaceous cover of a native clearing in the forest (ascending and spreading; flowers pale, almost white); Bele River, 18 km. northeast of Lake Habbema, alt. 2200 m., abundant on wet grassy banks of river (flowers pale). BRITISH NEW GUINEA: Murray Pass, Wharton Range, *Brass 4656,* July 1933, alt. 2840 m., among *Sphagnum* in a grassland hollow (small creeping herb); same locality, *Brass 4756,* on banks of stream (flowers pale purple); Vanapa Valley, Urunu, *Brass 4800*, August 1933, rare in swampy hollows on open grassland (flowers pale purple, marked with darker lines).

Apparently fairly common in the mountains of New Guinea; recorded by Melchior from the Arfak Mountains, the Carstensz Range (type-locality) and Mount Sarawaket.

Viola diffusa Ging. subsp. **tenuis** (Benth.) W. Becker, Philip. Jour. Sci. **19:** 714. 1921; Merr. Enum. Philip. Fl. Pl. **3:** 105. 1923.

Viola tenuis Benth. in Hook. Lond. Jour. Bot. **1:** 482. 1842.

NETHERLANDS NEW GUINEA: Bele River, 18 km. northeast of Lake Habbema, *Brass 11469*, November 1938, alt. 2200 m., rare herb growing under *Imperata* on formerly cultivated slopes (flowers pale violet). Southern China, Formosa, Philippines.

The only collection of this subspecies we have seen is a probable topotype from Hongkong. The New Guinean material differs in being a plant with smaller leaves and somewhat more narrowly winged petioles longer than the leaf-blades; the flower, however, seems to agree reasonably well with the description of that of the species.

PASSIFLORACEAE

Hollrungia K. Schumann

Hollrungia aurantioides K. Schum. Bot. Jahrb. **9:** 212. 1888; K. Schum. & Hollr. Fl. Kaiser Wilhelms Land 82. 1889; K. Schum. & Lauterb. Fl. Deutsch. Schutzg. Südsee 456. 1900; Harms, Nat. Pflanzenfam. **3**(6a): 86. *fig. 25, E, F.* 1893; Harms, op. cit. ed. 2, **21:** 495. *fig. 218, E, F.* 1925.

NETHERLANDS NEW GUINEA: 6 km. southwest of Bernhard Camp, Idenburg River, *Brass 12880*, February 1939, alt. 1200 m., rain-forest canopy liane.

Apparently otherwise known only from the type-material collected in Northeastern New Guinea.

APOCYNACEAE

The study of the Apocynaceae has brought to light some range-extensions and a few new species. *Carruthersia,* a Polynesian and Philippine genus, is reported for the first time from the Solomon Islands, and *Bleekeria* Hasskarl has been re-established.

Clitandropsis S. Moore

Clitandropsis novo-guineensis (Wernh.) S. Moore ex Markgr. Nov. Guin. **14:** 279. 1926; Markgr. Bot. Jahrb. **61:** 174. 1927.

NETHERLANDS NEW GUINEA: Bele River, 18 km. northeast of Lake Habbema, *Brass 11441.* BRITISH NEW GUINEA: Mafulu, *Brass 5253;* Tarara, *Brass 8676.* NORTHEASTERN NEW GUINEA: Morobe District, *Clemens 3914, 4523, 5266, 5419, 5443, 6462, 11096.* SOLOMON ISLANDS: Bougainville: Koniguru, Buin, *Kajewski 2075,* October 1930, alt. 900 m., common in rain-forest (flowers cream-colored, strongly scented; fruit greenish yellow, ovoid, 4 × 2.3 cm.); Guadalcanal: Uulolo, Tutuve Mountain, *Kajewski 2572, 2614,* April 1931, alt. 1200 m., rain-forest, common (vine climbing well into the tops of rain-forest trees; fruit orange, 4 cm. long, with a sharp apex, 2 cm. diam.).

For the present we are assigning all these collections to *Clitandropsis novo-guineensis* (Wernh.) S. Moore ex Markgr. In the Solomon Islands material the fruits are a little smaller, but we are not inclined to do more than give a provisional determination at present. We have not found the generic lines as drawn between *Melodinus, Clitandropsis* and *Pseudo-Willughbeia* very satisfactory in determining our rather scanty material.

Alstonia R. Brown

Alstonia macrophylla Wall. List no. 1648. 1829, nomen nudum; A. DC. Prodr. **8**: 409. 1844; vel aff.

SOLOMON ISLANDS: Bougainville: Kugumaru, Buin, *Kajewski 1834,* June 1930, alt. 150 m., rain-forest, common (medium-sized tree up to 20 m. high; follicles up to 50 cm. long).

This species is seemingly new for the Solomon Islands.

Alstonia longissima F. v. Muell. Pap. Pl. **5**: 91. 1877; Rehder in C. T. White, Jour. Arn. Arb. **10**: 260. 1929.

SOLOMON ISLANDS: Guadalcanal: Berande, *Kajewski 2449,* January 1931, sea-level, rain-forest, common (large tree up to 25 cm. high with very small buttresses; follicles 28 cm. long, 5 mm. diameter; timber used in making houses); San Cristobal: Kira Kira, *Brass 3014,* October 1932, coastal rain-forests, common (large tree with grey scaly bark; leaves thin, the midrib almost white).

The species was described from New Guinea and has since been reported from Queensland.

Alstonia Reineckeana Lauterb. Bot. Jahrb. **41**: 233. 1908; Stapf in Setchell, Amer. Samoa 58, *pl. 12, fig. A.* 1924; Christophersen, B. P. Bish. Mus. Bull. **128**: 177. 1935.

SOLOMON ISLANDS: Ysabel: Tiratona, *Brass 3404,* December 1932, alt. 600 m., rain-forest (small tree with shining leaves and cream-colored flowers); Guadalcanal: Uulolo, Tutuve Mountain, *Kajewski 2575,* April 1931, common in rain-forest (small tree up to 10 m. high, with showy white faintly scented flowers).

These flowering collections are a reasonably good match for *Christophersen 1903* from Samoa (of which we have only a fruiting specimen) and also for Setchell's plate of this Samoan species. The leaves are larger than those of the original description but not larger than those of Christophersen's collection. They differ from the New Caledonian material of *Alstonia plumosa* Labill. in the chartaceous texture of the leaves, the slightly more remote lateral veins, and the tendency to larger flowers. Some Kajewski collections from the New Hebrides previously recorded as *Alstonia villosa* f. *calvescens* Markgr. are certainly of this alliance and probably conspecific.

Alyxia R. Brown

Alyxia floribunda Markgr. Bot. Jahrb. **61**: 184. 1927.

NETHERLANDS NEW GUINEA: Bele River, 18 km. northeast of Lake Habbema, *Brass 11439,* November 1938, alt. 2200 m., occasional in forest undergrowth on steep limestone slopes (large scrambling shrub; panicles white).

This is an entirely glabrous fruiting specimen which seems most like the above-named species. It differs from the isotype in that the branchlets are less definitely angled and the leaves are 3–8 mm. petiolate.

Alyxia pugio Markgr. Bot. Jahrb. **61**: 182. 1927.

NETHERLANDS NEW GUINEA: 15 km. southwest of Bernhard Camp, Idenburg River, *Brass 12060,* January 1939, alt. 1800 m., mossy forest seral growths (slender scrambling shrub; flowers white).

Except for the broader and shorter leaves (4–6 × 1–3 cm.), this collection suits the description of *Alyxia pugio* Markgr. from the mossy forest of the Sepik Territory.

Alyxia subalpina Markgr. Bot. Jahrb. **61**: 183. 1927.

NETHERLANDS NEW GUINEA: 18 km. southwest of Bernhard Camp, Idenburg River, *Brass 12180, 12627,* January and February 1939, alt. 2100 and 2150 m., in shrubberies of a steep summit; low stunted mossy forest (scrambling shrub 1.5 m. high; corolla orange-colored with yellow lobes; fruit unripe); 15 km. southwest of Bernhard Camp, Idenburg River, *Brass 12361,* January 1939, alt. 1700 m., epiphytic on a tall tree in mossy forest (shortly climbing slender shrub).

The first two cited collections vary from the original description in having slightly narrower leaves, longer peduncles (5–7 mm.) and pedicels (4–5 mm.), shorter corolla-tube (2.5 mm.), and shorter stigmatic appendages. These differences, however, are so small that they cannot be considered specific without actual comparison with the type-specimen. *Brass 12361* differs in being more freely growing, with larger leaves and longer internodes, whereas the other two are compact with short branches. Possibly two species are represented, but, lacking flowers in the last number, we suspect that the contrast represents different phases of growth or age.

Alyxia fragrans sp. nov.

Frutex scandens; ramulis novellis puberulis; foliis quaternatim verticillatis glabris coriaceis anguste obovato-ellipticis, basi cuneatis breviter acutiusculis vel brevissime et obtuse acuminatis, 5–9 cm. longis 2.5–4.5 cm. latis, nervis lateralibus utrinque manifestis 2–3 mm. inter se distantibus rectis late patentibus; petiolo 5–9 mm. longo; inflorescentiis axillaribus paniculatis 13–(in fructu)16 cm. longis 4 cm. latis, pedunculo ± 7 cm. longo puberulo, ramulis 0.5–2.5 (in fructu 3) cm. longis pubescentibus angulatis; bracteis lanceolato-ovatis acutis 3 mm. longis interdum carinatis; lobis calycis ovatis 3.5 mm. longis subcarinatis extus pubescentibus intus glabris; corolla albida, tubo 4 mm. longo infra stamina 1 mm. et inter antheras piloso, lobis oblongis 1.5 mm. longis; staminibus in medio tubo insertis, filamentis circiter 0.4 mm. longis glabris, antheris lineari-oblongis 1.2 mm. longis apiculatis; stylo 1 mm. longo; stigmate ellipsoideo apice setoso, ovario dense piloso; fructu aurantiaco; mericarpiorum articulis 1 vel 2, ellipsoideis, ± 16 mm. longis et 12 mm. crassis, stipite circiter 7 mm. longo.

NETHERLANDS NEW GUINEA: Bele River, 18 km. northeast of Lake Habbema, *Brass 11577* (TYPE), *11300,* November 1938, alt. 2350 m., scrambling in a forest opening and frequent in open undergrowth under oaks (large shrub; leaves stiff, convex; inflorescence white; flowers fragrant; fruit orange-colored).

This species is closely allied to *Alyxia scabrida* Markgr. but is readily distinguished by the considerably larger and fewer flowers of the inflorescence.

Alyxia Lamii Markgr. Nov. Guin. Bot. **14**: 280. 1926, Bot. Jahrb. **61**: 183. 1927, vel aff.

BRITISH NEW GUINEA: Mt. Tafa, *Brass 5011,* May-September 1933, alt. 2400 m., common throughout forests (slender high climbing liane; corolla-tube pale brown, the lobes cream-colored; fruits green).

The collection differs from *Brass 12679* (from Netherlands New Guinea), which we have accepted as typical, chiefly in its lack of pubescence; also the leaves are less revolute on drying. Lacking further material and the privilege of examining types, the determination can only be accepted provisionally.

Ochrosia Jussieu

Ochrosia glomerata (Bl.) F. v. Muell. Fragm. Phytogr. **7:** 130. 1871; Markgr. Bot. Jahrb. **61:** 191. 1927.

Solomon Islands: Ysabel: Tatamba, *Brass 3442*, January 1933, alt. 50 m., hill-forests, common (tall tree with brown fissured bark, yellow when cut; wood hard, yellow; leaves smooth and shining; flowers white).

This collection is a reasonably good match for one so determined by Valeton in 1912, cultivated at the Botanic Garden of Buitenzorg. According to Markgraf the species is known from the Philippines and New Guinea.

Bleekeria Hasskarl

Although, for the most part, we have accepted generic names in current usage, on account of the difficulty which we encountered in determining a fruiting specimen from the Solomon Islands we have looked into the nomenclatural problems of *Ochrosia* Juss. sensu lato. Markgraf, Bot. Jahrb. **61:** 192–194. 1927, in a reasonably adequate discussion of the generic limits of the genus, decided that the two sections of *Ochrosia* Juss. as accepted by Valeton (as subgenera) and by F. v. Mueller (as sections) possessed generic value. Retaining the epithet *Ochrosia* Juss. for one group, he proposed the new name *Excavatia* Markgr. for the other, the sectional name *Lactaria* not being acceptable as a genus on account of having been coined for the true *Ochrosia* Juss.; further, Markgraf indicated that all the names given as synonyms of *Ochrosia* Juss. were to be considered in the same way. In so doing, he must have overlooked the little mentioned but greatly detailed description of Hasskarl's genus *Bleekeria,* based according to Hasskarl himself on the species *Bleekeria calocarpa* "(e Bleekeria kalokarpa sumptus)." Valeton, commenting on *Ochrosia calocarpa* Miq. (a transfer from Hasskarl's species), made this rather significant remark on the generic limits of *Bleekeria*: "introduisant toutefois dans la description du genre quelques-unes des propriétés qui n'appartiennent qu'à cette espèce." That is to say the type of the genus *Bleekeria* Hassk. has to be *Bleekeria calocarpa* Hasskarl, and the secondary application of this generic name to Rumphius' species is incidental and has nothing whatever to do with the typification of the genus. In addition, the fact that, four years later, Hasskarl considered the same two species under the genus name *Lactaria* is irrevelant, according to the present International Rules of Nomenclature. In 1923 Koidzumi, Bot. Mag. Tokyo **37:** 48–52, apparently divided *Ochrosia* Juss. into two parts, using the generic name *Lactaria* Rumph. for the true *Ochrosia* Juss. and *Bleekeria* Hassk. for the Section *Lactaria* F. v. Muell. (subg. Valeton). The name *Lactaria* Rumph. cannot supersede *Ochrosia* Juss., for it is a later designation first described by Rafinesque (1838) under the binomial system; but *Bleekeria* Hasskarl, Retz. **1:**

38–40. 1855, must replace *Excavatia* Markgraf, Bot. Jahrb. **61**: 194. 1927.

Bleekeria solomonensis sp. nov.

Arbor usque 15 m. alta glabra; ramulis teretibus novellis compressis; foliis oppositis vel ternatis chartaceis oblongis utrinque angustatis, 9–16 cm. longis 3.5–5.5 cm. latis, basi cuneatis apice subabrupte acuminatis, acumine 5–10 mm. longo acutiusculo, nervis lateralibus crebris subtransversis utrinque manifestis nervo marginali conjunctis; petiolo 1–1.5 cm. longo; inflorescentiis ternis in axillis verticilli summi foliorum; pedunculo communi ± 1.5 cm. longo compresso vel subalato; alabastro tantum viso bracteato; lobis calycis 5 lanceolato-ovatis, apice obtusiusculis, intus non glandulosis, 2 mm. longis 1 mm. latis; tubo corollae 6 mm. longo, lobis 7 mm. longis invicem sese dextrorsum tegentibus; antheris vix 1.5 mm. longis lanceolatis, filamentis 0.5 mm. longis infra faucem insertis; stylo 2 mm. longo; stigmate turbinato-conico; fructu apocarpo, mericarpiis 2 ovoideis obtusis compressis in sicco versus apicem alatis, ± 3.5 cm. longis et 2.5 cm. latis et 1 cm. crassis, obscure laxe reticulatis sub lente striate granulosis; excavationibus mesocarpii 2.2 cm. longis 0.5 cm. latis; semine unico elliptico plano 1.7 cm. longo 0.8 cm. lato.

SOLOMON ISLANDS: Bougainville: Kugumaru, Buin, *Kajewski 1859* (TYPE), June 1930, alt. 150 m., rain-forest, common (small tree up to 15 m. high; fruits boat-shaped, borne in pairs).

This species appears to be most like *Bleekeria mariannensis* (DC.) Koidz., but the latter has a narrower oblong fruit with more pointed apex and lateral wings. In *B. solomonensis* the dried fruit is winged at the apex and the wing extends down on both sides about ⅔ of the length of the fruit.

Bleekeria minima (Markgr.) comb. nov.

Excavatia minima Markgr. in Merr. & Perry, Jour. Arnold Arb. **21**: 199. 1940.

Type-collection: *Brass 8512*.

Micrechites Miquel

Micrechites Archboldiana sp. nov.

Frutex scandens, ramulis ultimis et bracteis inflorescentiae puberulis exceptis glaber; foliis coriaceis 9–17 cm. longis 3–8 cm. latis ellipticis, basi late cuneatis vel obtusis apice acuminatis, acumine 1–1.5 cm. longo, nervis lateralibus utrinsecus 7–10 oblique adscendentibus, reticulo inconspicuo; petiolo 1–2 cm. longo; inflorescentiis axillaribus et terminalibus paniculatis, 8–15 cm. longis 6–10 cm. latis, 4- vel 5-dichotomis; ramulis ultimis brevissimis, bracteatis, bracteis rotundatis circiter 1 mm. magnis; lobis calycis rotundatis 1 mm. longis ciliolatis interdum puberulis; corolla hypocrateriformi, tubo inflato sub faucem paullo angustato, 3.5 mm. longo 1.5 mm. lato, lobis sinistrorsum obliquis, parte inferiore oblongis dextrorsum tegentibus, parte superiore linearibus undulatis 3.5 mm. longis, fauce dense barbatis; antheris 1.5 mm. longis, inclusis, filamentis 1.5 mm. supra basim tubi affixis usque ad basim corollae decurrentibus, glabris; stigmate conico basi annulo angusto cincto; ovario dense setuloso 1–1.5 mm. longo, disco quam ovario paullo breviore 5-partito; mericarpiis glabris cylindricis horizontaliter patentibus immaturis 9 cm. longis et 6 mm. crassis; seminibus lineari-oblongis 2 cm. longis 2.5 mm. latis erostratis apice coma brunnea 2–2.5 cm. longa coronatis.

NETHERLANDS NEW GUINEA: 4 km. southwest of Bernhard Camp, Idenburg River, *Brass 13071, 13401* (TYPE), March 1939, alt. 850 m., rain-forest, common (canopy liane; corolla yellow with red lobes; fruit immature).

The general habit of this species is like that of Markgraf's *Papuechites*, but the seeds are unbeaked, with a terminal coma, whereas those of *Papuechites* are narrowed into an elongated somewhat filiform beak covered with long spreading hairs.

Carruthersia Seemann

Carruthersia Brassii sp. nov.

Frutex scandens glaber vel consperse pilosus, ramulis teretibus; foliis oppositis ovato-ellipticis basi retusis vel leviter cordatis apice longiuscule acuminatis, 5–14 cm. longis 3–8 cm. latis, utrinque glabris (vel consperse pilosis) brunneis subdiscoloribus, nervis lateralibus utrinsecus 9–11 utrinque perspicuis patenti-adscendentibus marginem versus arcuatim conjunctis, reticulo conferto subtus in sicco atro-brunneo; petiolo 1–2.5 cm. longo; inflorescentiis axillaribus terminalibusque 6–10 cm. longis, paniculatis, lobis calycis et bracteis ciliatis exceptis glabris; lobis calycis 1.5 mm. longis ovatis obtusiusculis intus pluriglandulosis; corolla hypocrateriformi fauce pubescente, tubo 9 mm. longo ad antheras paullum inflato extus glabro intus pubescente, lobis dextrorsum tegentibus 7–8 mm. longis 4 mm. latis, obliquis; staminibus circiter 2 mm. supra basim tubi insertis, filamentis vix 1 mm. longis pubescentibus, antheris circiter 2 mm. longis apiculatis liberis; disci squamulis tantum 2 oppositis inter carpidia; ovario apocarpo; stylo 1 mm. longo, stigmate anguste conoideo.

SOLOMON ISLANDS: Guadalcanal: Sorvorhio basin, *Kajewski 2702*, January 1932, alt. 180 m., rain-forest, common (vine with white flowers); San Cristobal: Huro River, *Brass 2609* (TYPE), August 1932, lowland rain-forests (scandent; sap milky; leaves coriaceous, pale below; flowers white).

The genus is already known to occur in the Philippines and Polynesia. This species from the Solomon Islands is closely allied to *C. Macgregori* Merr., but the inflorescence of the latter is constantly minutely pubescent and the flower is a little smaller than in the new species.

Wrightia R. Brown

Wrightia laevis Hook. f. Fl. Brit. Ind. **3:** 654. 1882; Markgr. Bot. Jahrb. **61:** 212. 1927.

NETHERLANDS NEW GUINEA: Bernhard Camp, Idenburg River, *Brass 13893*, April 1939, alt. 570 m., rain-forest of mountain slopes (subsidiary tree 12 m. high; flowers white). BRITISH NEW GUINEA: Mt. Tafa, *Brass 5570*, May-September 1933, alt. 100 m., rain-forest on low ridges, common (large tree; trunk corrugated; bark pale brown, slightly flaky; foliage pale green; flowers profuse, pale yellow, perfumed).

Markgraf reported this species from the Bismarck Archipelago, but we have not found any other record of it from Papuasia, although Markgraf determined the above-cited collection from Mt. Tafa.

Parsonsia R. Brown

Parsonsia curvisepala K. Schum. Bot. Jahrb. **9:** 215. 1888; Markgr. Bot. Jahrb. **61:** 219. 1927.

SOLOMON ISLANDS: San Cristobal: Waimamura, *Brass 2653*, August 1932, lowland rain-forest (one plant seen; large climber; leaves thin, very much paler below, the margins wrinkled; flowers yellow; follicles striate, green; coma on seeds pale brown; sap colorless, slightly viscid).

This specimen differs from those collected in New Guinea chiefly in the larger leaves (6–8 × 2.5–4.5 cm.).

Parsonsia Helicandra Hook. & Arn. Bot. Beechey's Voy. 197. 1836; Merr. Brittonia **1:** 236. 1933; Kaneh. & Hatus. Bot. Mag. Tokyo **53:** 11. 1939.

Parsonsia spiralis Wall. List no. 1631. 1829, nomen nudum; G. Don, Gen. Syst. **4:** 80. 1837; Markgr. Bot. Jahrb. **61:** 217. 1927.

SOLOMON ISLANDS: Bougainville: Karngu, Buin, *Kajewski 2230,* October 1930, sea-level, rain-forest, common (vine with green flowers; fruits 19.5 cm. long, 1 cm. diam.); Ysabel: Meringe, *Brass 3161,* November 1932, twining on foreshore trees, common; San Cristobal: Kira Kira, *Brass 2771,* August 1932, large climber on beach trees, common.

We have not found this widespread species previously recorded from the Solomon Islands.

Parsonsia lata Markgr. Bot. Jahrb. **61:** 221. 1927.

NETHERLANDS NEW GUINEA: 4 km. southwest of Bernhard Camp, Idenburg River, *Brass 13267,* March 1939, alt. 850 m., abundant in rain-forest of river plains (large canopy liane; flowers yellow). SOLOMON ISLANDS: Guadalcanal: Berande, *Kajewski 2434,* January 1931, sea-level, common in rain-forest (vine with cream-colored flowers; follicles 12 cm. long, at widest part 3.6 cm. wide, tapering slightly, green, covered with fine brown hairs).

In the Solomon Islands collection the leaves are a little broader in proportion to their length and tend to be less pubescent above than in the material from New Guinea. The species has been collected from Northeastern New Guinea.

Parsonsia mollissima (Wernh.) Markgr. Bot. Jahrb. **61:** 220. 1927.

BRITISH NEW GUINEA: Palmer River, 2 miles below junction Black River, *Brass 7089* (det. Markgraf), June 1936, alt. 100 m., climbing in forest substage (upper leaf surface glossy).

The type was collected in Netherlands New Guinea; the species probably occurs also in Northeastern New Guinea, cf. Markgr. l. c.

Parsonsia flavescens sp. nov.

Frutex scandens; foliis oppositis subcoriaceis lanceolatis vel ovato-ellipticis magnitudine ludentibus, 6–7 cm. longis 1.5–2.3 cm. latis vel 7–9 cm. longis 4.5–5 cm. latis, basi obtusis vel rotundatis, apice acutis vel obtuse acuminatis mucronatis, margine ± recurvatis, utrinque glabris subtus minute granulatis, nervis lateralibus ± 9 oblique patentibus utrinque prominulis vel interdum inconspicuis; petiolo 6–9 mm. longo minute pubescente; inflorescentiis axillaribus plurifloris 3–4.5 cm. longis puberulis; pedicello ± 4 mm. longo; calycis lobis ovatis acutiusculis 2 mm. longis intus pauciglandulosis; corolla flava; tubo 4.5 mm. longo extus glabro intus sub antheris minute piloso, lobis 3 mm. longis 1.5 mm. latis oblongo-lanceolatis; filamentis circiter 2 mm. longis, in medio tubo insertis geniculatis pubescentibus, antheris 4 mm. longis; stigmate 1.4 mm. longo obtuse conico in basi annulato; ovario glabro 0.5 mm. longo disco glabro aequilongo cincto.

NETHERLANDS NEW GUINEA: Bele River, 18 km. northeast of Lake Habbema, *Brass*

11573, November 1938, alt. 2350 m., on open face of cliff (small twiner; sap not milky; flowers yellow); Balim River, *Brass 11647* (TYPE), December 1938, alt. 1600 m., climbing in sparse second growths on deforested slopes (sap not milky; flowers yellow).

Among the New Guinean species this seems to approach *Parsonsia diversifolia* (Warb.) Markgr. most closely; the plant, however, is not hispidulous, the leaves are coriaceous, the flower is twice as large as the dimensions given for Warburg's species, and the disk is entire.

Parsonsia rubra Kaneh. & Hatus. ms.

Scandens; foliis coriaceis glabris lanceolato-oblongis, 6–12 cm. longis 1.5–4.5 cm. latis, basi rotundatis apice acuminatis, nervis lateralibus utrinsecus ± 6 supra impressis subtus prominulis; petiolo 1.5–2 cm. longo; inflorescentiis terminalibus usque 11 cm. longis; ramulis puberulis; corolla rubra extus glabra.

NETHERLANDS NEW GUINEA: Hollandia, *Brass 8991*, July 1938, alt. 100 m., rain-forest (large canopy liane; flowers red).

We have been able to match this collection only with *Kanehira & Hatusima 12220* from Netherlands New Guinea. We know that the description of this species was already in manuscript before Pearl Harbor and we anticipate that it is now published, although unavailable to us at present. However, not being able to cite the place of publication, and to protect our use of the name, we have appended a brief Latin description.

ARNOLD ARBORETUM,
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NEW AND NOTEWORTHY POLYPETALAE FROM BRITISH GUIANA

N. Y. Sandwith

The following descriptions, new combinations, and notes are based on material of Polypetalae collection recently in British Guiana, the specimens, unless otherwise stated, being deposited in the herbarium of the Royal Botanic Gardens, Kew.

DILLENIACEAE

Doliocarpus (Subgen. *Calinea,* Sect. *Eudoliocarpus*) **savannarum** sp. nov.

Ob habitum humilem, folia, flores subsessiles, ovarium dense pilosum valde distincta; a *D. virgato* Sagot e descriptione forsan affini foliorum paginae inferioris indumento debiliter piloso nec tomentoso-puberulo, nervis lateralibus semper paucioribus statim distinguitur.

Frutex humilis, erectus vel procumbens, haud scandens; ramuli subteretes, 3–6 mm. diametro, apicem versus foliiferi ac ibi adpresse pilosi, novelli fere subsericei. *Stipulae* lanceolatae vel lanceolato-oblongae, obtusae, 1 cm. longae, basi ad 5 mm. latae, adpresse pilosae. *Folia* elliptica vel elliptico-oblonga vel oblonga, apice breviter late cuspidato-acuminata, basi cuneata vel maxima obtusa subrotundata, 6–19 cm. longa, 2.5–9.2 cm. lata, valde coriacea, siccitate brunnea vel olivaceo-brunnea, subintegra sed dimidio superiore ob nervos laterales excurrentes distincte denticulata, subtus plus minusve nitidula, supra glabra, subtus secus costam nervosque laterales pilis debilibus satis sparse sed distincte induta ceterum glabra, costa nervisque primariis utroque latere 9–11 sursum arcuatis supra canaliculato-impressis subtus prominentibus, venis subhorizontaliter abeuntibus cum venulis intricate reticulatis omnibus supra vix prominulis sed obviis subtus prominentibus; petiolus adpresse pilosus vel glabrescens, supra canaliculatus subalatus, 1–3 cm. longus, ad 3 mm. crassus. *Flores* in fasciculos plerumque sub foliis dispositi, fere sessiles, pedicellis pubescentibus vix ad 1.5 mm. longis. *Sepala* orbiculari-ovata, apice rotundata, concava, 4.5–5 mm. longa, 3.5–4.2 mm. lata, extra pubescentia, intus glabra. *Petala* obovata, ad 6 mm. longa, ad 3.2 mm. lata. *Stamina* filamentis ad 5 mm. longis apice in connectivum dilatatis; antherarum loculi 0.5 mm. longi. *Ovarium* late ovoideo-subglobosum, dense pilosum; stylus ad 2.5 mm. longus, sparsius pilosus, stigmate peltato. *Fructus* kermesinus, globosus, 8–10 mm. diametro, satis sparse pubescens vel glabrescens, stylo persistente pubescente coronatus.

British Guiana: Kaieteur Savannah, c. 400 m., fl. Sept.-Oct. 1881, *Jenman 1038* (typus); *ibid.*, fr. Sept. 5, 1937, *Sandwith 1377*. Noted by Jenman as 3–5 ft. high, with erect growth, and by Sandwith as a trailing shrub with crimson berries, growing on sandy bushy ground.

Doliocarpus virgatus Sagot, which was based on imperfect material collected in French Guiana by Perrottet and Mélinon, was described by its author as having *inter alia*: "rami lignosi, validi, recti, virgati. Folia . . . superne glabrescentia, inferne breviter tomentoso-puberula. Nervi laterales, recti, numerosi." The specimens were said to be easily recognizable on account of the peculiar facies. M. Raymond Benoist, in a review of the Dilleniaceae of French Guiana in Bull. Soc. Bot. Fr. IV. **13:** 400–401. 1913, slightly amplified the description of *D. virgatus,* to which he referred an additional flowering collection from Pará, remarking that the latter bore fully expanded flowers, whereas the collections from French Guiana were in young fruit, so that it was impossible to be certain whether the stamens were folded back or erect in the bud-stage. On this account he still treated *D. virgatus* as an *espèce à caractères insuffisamment connus,* and did not place it in either Section *Othlis* or Section *Calinea.* The important points to be noted in Benoist's amplified description are the pubescent lower surface of the leaves and the 12–17 pairs of main lateral nerves, characters which sufficiently distinguish *D. virgatus* from the plant of the Kaieteur Savannah.

More recently, mention has been made of *D. virgatus* as an ally, in Section *Eudoliocarpus* of Subgen. *Calinea,* of *D. paraënsis* Sleumer in Rep. Sp. Nov. **39:** 45–46. 1935. The latter species evidently differs from *D. savannarum* in the short (6–10 mm.) petiole, the quite glabrous leaves with 7 pairs of main lateral nerves and the reticulation obscure on the lower surface, the glabrous oblong sepals, and the much larger (about 1 cm. × 6–8 mm.) petals.

FLACOURTIACEAE

Ryania pyrifera (L. C. Rich.) Uitt. & Sleumer var. **subuliflora** var. nov.

A planta typica sepalis angustioribus lineari-lanceolatis plerumque longioribus sursum saepius sensim longe attenuatis 2–4 cm. longis 3–8 mm. latis differt. *Folia* subtus secus costam nervosque primarios stellato-pubescentia, ceterum glabrescentia vel glabra.

British Guiana: Essequibo River, in wallaba forest, Labbakbra Creek, Tiger Creek, August 26, 1937, *Sandwith 1211* (typus); Demerara River, May 1889, *Jenman 4853;* Mazaruni-Kuribrong Divide, in wallaba forest, *Forest Dept. 893;* Bartica-Potaro road, 83rd milepost, in clump wallaba bush, June 1933, *Tutin 216* (Herb. Mus. Brit. and Kew).

A small tree of the lowest storey of the forests of the white sand areas, especially in wallaba forest, up to 20 ft. high, less than 1 inch in diameter; sepals pale greenish white; filaments white, pinkish or red at the base.

This has been written up and distributed as a new species under the name adopted here for the lower rank; the writer is convinced that it does not deserve a higher status on account of the variability in the shape and dimensions of the sepals which can be seen on a really extensive gathering from a single tree. In Trinidad, where typical *R. pyrifera* is plentiful, specimens have been collected (*Fendler 203, Broadway 9358*) on which some of the sepals match some of those on the type collection of var. *subuliflora.*

Ryania pyrifera var. **tomentosa** (Miq.) Sleumer ex Sleumer & Uitt. in Pulle, Fl. Suriname **3:** 286. 1935.

This variety, with leaves densely stellate-pubescent or tomentose all over the lower surface, is known in British Guiana from the following collections: Berbice River, *Forest Dept. 774;* Demerara River, *Jenman 3888, Persaud*

174, Forest Dept. 774, 2452; Pomeroon District, Tapakooma Creek, *Jenman 6616*. This, from the evidence of field notes, is an undergrowth tree of brown sand areas, while the color of the flower is similar to that of var. *subuliflora*.

Ryania Sagotiana Eichl. in Mart. Fl. Bras. **13**(1): 491. 1871; Sleumer & Uitt. in Pulle, Fl. Suriname **3**: 287. 1935.

This species, which has strongly prominulous ultimate veinlets on the lower surface of the leaves and, above all, a conspicuously raised disk and a long stipe to the ovary, has been twice collected in British Guiana: Buruma Creek, Kibilibiri Creek, Berbice River, 1919, *Forest Dept. 774A;* Upper Demerara River, Sept. 1887, *Jenman 4098*. This, again, is a shrub or small tree.

GUTTIFERAE

Caraipa simplicior sp. nov.

Inter species foliis inflorescentiisque pubescentibus praeditas ob inflorescentias axillares atque terminales valde abbreviatas reductas, scilicet cymas plerumque 1–3-floras gerentes, praeterea ob sepala magna singularis, *C. grandifoliae* Mart. forsan affinis sed forma inflorescentiae praeterea foliis petalisque minoribus distinguitur.

Arbor satis grandis, 27 m. alta; ramuli angulati superne furfuraceo-tomentelli. *Folia* lanceolata vel anguste elliptico-oblonga, apice acuta, obtusa vel brevissime cuspidata, basi cuneata sed saepe obtusa vel fere rotundata tum abrupte in petiolum decurrentia, 3.5–11 cm. longa, 1.3–4.3 cm. lata, illa inflorescentias subtendentia sensim reducta, coriacea, marginibus revolutis ac apice saepe recurvato fissoque, supra subopaca minute haud dense sed regulariter stellato-puberula, subtus plus minusve incana indumento lepidiformi arcte minute stellato-tomentella, costa nervisque supra canaliculato-impressis subtus (costa valde) prominentibus, nervis primariis utroque costae latere 16–20 patulo-adscendentibus subrectis sed marginem versus sursum arcuatis, nervis secundariis crebris supra impressis haud obviis subtus manifestis sed inconspicuis; petiolus 4–10 mm. longus. *Inflorescentiae* e cymis axillaribus atque terminalibus plerumque simplicibus 1–3-floris rarius compositis 4-floris brevipedunculatis ad 2.5 cm. longis ubique praesertim sepalis ferrugineo-stellato-tomentellis constantes; bracteae conspicuae, ovatae vel ovato-oblongae, 5–10 mm. longae, ad 3.5 mm. latae, nonnunquam majores foliaceae; bracteolae similes sed paulo minores; pedicelli 3–5 mm. longi rigidi. *Sepala* basi tantum connata, late ovata, apice obtusa, basi rotundata, 5.5–6 mm. longa, 5 mm. lata, nonnunquam extra plus minusve carinata, utrinque stellato-tomentella. *Petala* obovata, unilateraliter in appendicem latam membranaceam producta, hac inclusa 1.4–1.5 cm. longa, 0.6–0.8 cm. lata, partibus crassioribus utrinque dense stellato-puberulis partibus membranaceis glabris ciliatis. *Stamina* longiora ad 7 mm. longa; antherae forma generis propria obovato-rhomboidea, circiter 0.75 mm. longae atque latae. *Ovarium* pluricostatum, 2.75 mm. diametro, stellato-tomentellum; stylus glaber, 3.5 mm. longus, clavatus, apicem versus sensim incrassatus. *Fructus* non visus.

British Guiana-Venezuela boundary region: Roraima, slopes near Arabupu, in swampy soil in mixed forest, 1380 m., Dec. 15, 1938, *Forest Dept. 2823* (field no. *P. 51*) (TYPUS); tree 90 ft. high, 12 in. diam., with scaly bark like that of Sawarri (*Caryocar nuciferum*); fls. white, cup-shaped; calyx green; petals buff; stamens white.

This species somewhat resembles *C. minor* Huber and *C. parvifolia* Aubl. in its leaves. *Caraipa minor,* however, has the leaves densely pilosulous beneath with simple hairs, while its sepals are connate for at least half their length. *Caraipa parvifolia* Aubl., the type of which consists of leaves and branchlets alone, has relatively shorter petioles and, if other French Guiana sheets are correctly identified with it, a terminal compound inflorescence with small sepals (see Jour. Bot. **80:** 53. 1942).

MALPIGHIACEAE

Byrsonima incarnata sp. nov.; Subgen. *Macrozeugma,* Sect. *Colobotheca,* Subsect. *Atrichotheca,* seriei *Stenolepis,* ex clavi cl. Niedenzu in Engler, Pflanzenreich 94 (IV. **141**). 1928.

Ut videtur juxta *B. perseifoliam* Griseb. atque *B. frondosam* Mart. ex Juss. ponenda, ab utraque ovario tomentoso, praeterea ab illa antherae connectivi appendicula loculos longe superante, ab hac foliis majoribus senectute tantum fere glabris statim distinguitur; revera, ut videtur, *B. Schomburgkianae* Benth. magis affinis, a qua petiolis longioribus, bracteolis ovatis, antherae loculis glabris, ovario tomentoso distinguitur.

Arbor parva vix mediocris, circiter 13 m. alta, ramulis summis teretibus hornotinis dense adpresse ferrugineo-pilosis. *Stipulae* ovatae, obtusae, 4.5–6.5 mm. longae, extra indumento ramulorum indutae. *Folia* obovata, obovato-elliptica vel elliptica, apice rotundata brevissime cuspidata vel in exemplis maximis ellipticis magis attenuata ac acuminata, basi in petiolum attenuata cuneata, 11–26 cm. longa, 5.4–10.5 cm. lata, satis tenuiter coriacea, supra siccitate brunneo-nigrescentia nitidula subtus pallidiora, supra sparse cinereo-pubescentia vel plus minusve glabra subtus juventute satis copiose pubescentia demum fere glabra, costa nervisque primariis supra prominulis subtus prominentibus, nervis primariis utroque costae latere 12–18 patulis vel patulo-ascendentibus et satis longe a margine anastomosantibus, nervis secundariis supra inconspicuis vel impressis subtus venuliscum planis vel tenuiter prominulis satis conspicuis; petiolus indumento ramulorum praeditus, demum glabrescens, 1–2.5 cm. longus. *Racemi* 10–18 cm. longi; rhachis angulata, satis dense subadpresse pallide ferrugineo-pilosa, nisi basim versus densiflora; bracteae anguste lanceolato-oblongae, obtusae, 5–7 mm. longae, basi ad 2 mm. latae, patulae vel patentes et sursum incurvatae, demum deciduae, extra praesertim secus medium fere subsericeo-pubescentes; bracteolae dimidio breviores, ovatae, obtusae, extra pubescentes; pedicelli villosulo-ferrugineo-tomentosi, 5–9 mm. longi. *Alabastra* carnea. *Sepala* glandulas roseo-carneas 2.5–3 mm. longas siccitate albo-flavescentes gerentia; lamina deltoideo-ovata, obtusa, 2.5–3.5 mm. longa, 2.5 mm. lata, utrinque pubescenti-tomentosa. *Petala* alba roseo-suffusa, vel pallide rosea, ungue 3–3.5 mm. longo, lamina orbiculari-cordata vel (in petalis minoribus) reniformi-orbiculari, 5.5–8 mm. longa, 6.5–8 mm. lata. *Torus* pilosus. *Stamina* glabra, filamentis brevissimis antherae subaequilatis circiter 0.5 mm. longis; antherae connectivo incluso 2–2.6 mm. longae, loculis brevibus obscuris circiter 1 mm. longis lineari-oblongis glabris apice obtusis rotundatis neque mucronatis nec aristatis, connectivi appendicula valde evoluta crassa oblonga vel conoidea obtusa glabra usque ad 1 mm. lata loculos longe plus quam duplo superante. *Ovarium* ovoideum, dense tomentosum, 2 mm. longum, 1.75 mm. diametro; styli glabri, fere 2 mm. longi. *Fructus* non visus.

BRITISH GUIANA: Moraballi Creek, Essequibo River, in greenheart forest on brown loam, Oct. 13, 1938, *Fanshawe* in *Forest Dept. 2737* (TYPUS); Bartica-Potaro road, near 14th milepost, in wallaba forest on white sand, Aug. 19, 1937, *Sandwith 1145*. Each of the trees from which these collections were made was about 50 ft. high and 4 inches in diameter. The calyx is pale olive or brown, with waxy vermilion glands, while the petals are pale pink or white with a tinge of pink.

The fact that this tree is almost certainly an ally of *B. Schomburgkiana*, a savannah species with hairy anther-loculi in Niedenzu's Subsect. *Dasytheca* of the Subgenus *Macrozeugma*, shows that this author's choice of characters in the anthers for constituting major divisions of his key results in an artificial arrangement which separates species naturally allied.

The addition of this species and of *B. Poeppigiana* Juss. (see Kew Bull. **1937**: 102. 1937, and Lloydia **2**: 188. 1939) brings the number of species of *Byrsonima* known to occur in the Colony up to fourteen. The key offered by the writer in Kew Bull. **1935**: 314–315. 1935 must now be emended for the inclusion of these two species, as follows:

Anther loculi not horned:
- Mature leaves glabrous or nearly so; petals white to deep rose:
  - Leaves subsessile, rounded and more or less cordate at the base, obtuse, rounded or emarginate at the apex. .... *B. coccolobifolia.*
  - Leaves distinctly petiolate, attenuate and cuneate at the base:
    - Leaves commonly or always exceeding 9 cm. in length; bracts linear to narrowly oblong-lanceolate:
      - Petioles less than 1 cm. long; bracteoles linear-oblong; anther loculi pilosulous. .... *B. Schomburgkiana.*
      - Petioles 1 cm. or more long; bracteoles ovate; anther loculi glabrous. .... *B. incarnata.*
    - Leaves usually less than 9 cm. long; bracts ovate or ovate-lanceolate. .... *B. eugeniifolia, concinna* and *bracteolaris.*
- Mature leaves not glabrous or, if nearly so, then petals yellow; petals bright yellow except in *B. chalchophylla*:
  - Bracts conspicuously curled backwards:
    - Leaves reddish rusty-tomentose beneath; petioles commonly more than 1.5 cm. long. .... *B. Aerugo.*
    - Leaves sparsely pubescent or glabrescent beneath; petioles rarely up to 1.5 cm. long. .... *B. Poeppigiana.*
  - Bracts not conspicuously curled backwards. .... *Species as in the previous key.*

Byrsonima Poeppigiana is a species of Amazonian Brazil and Peru which has recently been found as a small river-bank tree in the far interior of British Guiana, towards the Brazilian frontier.

Kostermans, in Pulle, Fl. Suriname **2**: 243. 1936, and in his notes on the new and critical species of Surinam Malpighiaceae (in Meded. Bot. Mus. en Herb. Utrecht **25**: 10–12. 1936), reduces Bentham's *B. rugosa* to *B. stipulacea* Juss., of which he regards it as merely a form with gland-bearing sepals.

Banisteriopsis elegans (Tr. & Pl.) comb. nov.

Banisteria elegans Tr. & Pl. in Ann. Sci. Nat. IV. **18**: 322. 1862; Nied. in Engler, Pflanzenreich 93 (IV. **141**): 412. 1928.

Banisteriopsis elegans subsp. **cordata** (Nied.) comb. nov.

Banisteria elegans subsp. *cordata* Nied. in Verz. Vorles. Ak. Braunsberg W.-S. **1912–1913**: 10. 1912, in Engler, Pflanzenreich 93 (IV. **141**): 413. 1928.

Banisteriopsis elegans subsp. **cordata** var. **ciliata** (Nied.) comb. nov.

Banisteria elegans subsp. *cordata* var. *ciliata* Nied. in Verz. Vorles. Ak. Braunsberg W.-S. **1912–1913**: 10. 1912, in Engler, Pflanzenreich 93 (IV. **141**): 413. 1928.

Banisteriopsis elegans subsp. **cordata** var. **pulcherrima** var. nov.

Var. *ciliatae* (Nied.) Sandwith affinis foliis magis coriaceis basi profundius eximie auriculato-cordatis, bracteis inflorescentiae irregulariter longius fimbriatis apice nonnunquam pectinatis fimbriis nonnullis ad 4 mm. longis, floribus speciosioribus differt.

British Guiana: Kaieteur Savannah, c. 400 m., fl. and fr. Sept. 8, 1937, *Sandwith 1430* (typus); *ibid.*, Sept.-Oct. 1881, *Jenman 1256; ibid.*, Aug. 1933, *Tutin 694* (Herb. Mus. Brit. and Kew); *ibid.*, Feb. 20, 1939, *Sir Geoffrey Evans 12;* Membaro Creek, Mazaruni River, Feb. 14, 1939, *Forest Dept. 2845* (field no. *P. 73*); Roraima, "Our House," Dec. 10, 1884, *im Thurn 136,* Sets A and C.

This is one of the most beautiful of all the remarkable plants found on the hard sandstone conglomerate of the Kaieteur Savannah. It is a shrub trailing over bushes and small trees to a length of some 12 feet. The flowers are borne in showy lax sprays and simulate those of a species of *Oncidium.* They are at least 2.5 cm. across, conspicuously zygomorphic, with bright yellow fringed petals, the anterior one striped with crimson veins in the lower half, and white stigmas. The peculiar long cilia of the bracts of the inflorescence are crimson. The fruiting thyrse is scarcely less attractive than the flowering sprays, since the large wings of the samaras are pink.

It is by no means certain that this beautiful plant, with its very definite range which is shared by so many others, does not deserve a higher rank than is proposed for it; but this could not satisfactorily be accorded without a thorough review of Niedenzu's treatment of the aggregate species *B. elegans,* and insufficient material has so far been accumulated for this purpose from other parts of the range. Moreover, there is the further question of the relationship of *B. elegans* with *B. leptocarpa* (Benth.) R. O. Williams, to which Kostermans has recently reduced its subsp. *cordata* var. *ciliata* (see his notes on new and critical species of Surinam Malpighiaceae, in Meded. Bot. Mus. en Herb. Utrecht **25**: 8. 1936). If this reduction be correct, then the case for raising this new var. *pulcherrima* to specific rank becomes stronger, since *B. leptocarpa,* which is a very common species in British Guiana and occurs with var. *pulcherrima* on the Kaieteur Savannah, is remarkably distinct from it in the field, having a much denser more complex inflorescence, with smaller flowers and rather pale yellow petals. But the writer is by no means convinced that the type collection of *B. elegans* subsp. *cordata* var. *ciliata,* viz. *H. H. Smith 1509* from Santa Marta, Colombia, should be so summarily reduced to *B. leptocarpa,* since it does not show this characteristic inflorescence.

RUTACEAE

Rhabdodendron amazonicum (Benth.) Huber in Bol. Mus. Goeldi **5**: 427. 1909; Ducke in Arch. Jard. Bot. Rio **3**: 181. 1922.

In the opinion of the writer, *Lecostemon sylvestre* Gleason (in Bull. Torrey Club **54**: 608. 1927) cannot be separated from *Rhabdodendron* *amazonicum,* a frequent small tree of campos and campinas in Amazonian Brazil. The variability of that species was discussed by Ducke in 1922 and is apparent in several British Guiana collections, especially in the size, the texture, and the prominence of the venation of the leaves, the angle taken by their lateral nerves, the degree of pubescence on the inflorescence, and the length of the pedicels. In British Guiana this species occurs as a small to medium-sized tree, on white or dark brown sand. The following collections are in the Kew Herbarium.

BRITISH GUIANA: Hill slope on brown sand, Warunana Creek, Ituni River, Berbice River, *Forest Dept. 450;* slope on white sand, Kuruabaru River, Demerara River, *Forest Dept. 450A;* in wallaba forest, Moraballi Creek, Essequibo River, *Forest Dept. 2747;* common in "clump wallaba" (*Dicymbe corymbosa*) bush, 83 miles along Bartica-Potaro road, *Tutin 243* (Herb. Mus. Brit. and Kew); in forest on white sand between Kangaruma and Garraway Stream, Potaro River, *Sandwith 1237;* in dense forest between Kangaruma and Potaro Landing, *Gleason 211* (type coll. of *Lecostemon sylvestre*). *Forest Dept. 2747* (Moraballi Creek) was taken from a tree 60 ft. high and 12 inches in diameter; the other collections were all from small trees of the undergrowth.

The genus *Rhabdodendron* Gilg & Pilger and the question of its identity with *Lecostemon* DC. were fully discussed by Huber in Bol. Mus. Goeldi **5:** 424–431. 1909, where a new tribe in Rutaceae was proposed for *Rhabdodendron.*

Rhabdodendron Gardnerianum (Benth.) comb. nov.

Lecostemon Gardnerianum Benth. in Hook. Jour. Bot. & Kew Misc. **5:** 295. 1853; Hook. f. in Mart. Fl. Bras. **14**(2): 54. 1867; Huber in Bol. Mus. Goeldi **5:** 427. 1909.

BRAZIL: Bahia: Banks of the Rio Preto, Sept. 1839, *Gardner 2814,* "a small tree 12–16 feet high." This locality lies in the northwestern corner of the modern State of Bahia; it was incorrectly placed by Bentham in the State of Piauhy, while in Gardner's day it apparently lay within the southwestern limits of that of Pernambuco (see Gardner's "Travels," ed. 1. 298, 309, and map).

Evidently a member of this genus, and strikingly distinct on account of the small leaves, but not included in the conspectus of *Rhabdodendron* given by Huber, and not mentioned by Engler in the latest treatment of Rutaceae in Engler & Prantl, Nat. Pflanzenfam. ed. 2. **19A:** 358. 1931, where Huber's tribe Rhabdodendreae is accepted.

OCHNACEAE

Ouratea cataractarum sp. nov.

Inter congeneros forma foliorum inflorescentiaeque, pedicellis longis rectis valde distincta.

Frutex vel arbor parva, glabra, ramulis summis tenuibus 1.5–3 mm. diametro, internodiis brevibus. *Stipulae* lanceolatae, 3–5.5 mm. longae, longitudinaliter striatae. *Folia* anguste salicifolia, lineari-elliptica vel lineari-lanceolata vel anguste oblanceolata, in apicem acutum longe attenuata, nonnunquam acuminata, basi in petiolum longe acute attenuata atque decurrentia, 4.5–12.5 cm. longa, 0.7–2.2 cm. lata, basin versus integra superne tenuiter satis obscure (apicem versus conspicuius) obtuse serrulata, marginibus cartilagineis subrevolutis, coriacea, supra nitida, siccitate olivacea vel subtus brunnea, costa supra prominula subtus prominente, nervis venisque utrinque subaequaliter prominulis, nervis primariis utroque costae latere 6–8 primo sursum arcuatis tum praerupte ascendentibus et in marginem demum provectis, venulis subhorizontalibus crebris obviis; petiolus 4–8 mm. longus. *Inflorescentia* terminalis, erecta, paniculata, pyramidalis, 4–8 cm. longa, ad 10 cm. lata, ramis satis paucifloris patulis vel patulo-ascendentibus rectis angulatis inferioribus ad 4.5 cm. longis; bracteae bracteolaeque deciduae, haud visae; pedicelli ascendentes, recti, graciles, 1.2–1.9 cm. longi, superiores apice ramorum corymbos praebentes. *Alabastra* ovoideo-oblonga, obtusa, 6–7.5 mm. longa, ad 3.75 mm. diametro. *Sepala* flava, oblongo-lanceolata, obtusa, apice cucullata, 7–8 mm. longa, 2.5–3 mm. lata, concava, subcoriacea, longitudinaliter tenuiter striata, interiora marginibus late membranaceo-scariosis. *Petala* laete flava, obovato-spathulata, unguiculata, 8–9 mm. longa, 5.3–6.5 mm. lata. *Antherae* 6.3–7 mm. longae. *Torus* sub anthesi 0.8 mm. longus, sub carpidiis maturis turbinato-subglobosus 4 mm. longus 4.5 mm. latus. *Carpidia* 5, sub anthesi 0.8 mm. longa, matura (drupae) ellipsoidea vel obovoideo-ellipsoidea 8–8.5 mm. longa ad 5.5 mm. diametro.

British Guiana: Potaro River, Amatuk portage, on rocks by the fall, fl. Aug. 31, 1937, *Sandwith 1244* (typus); Kaieteur Savannah, fl. et fr. Sept.-Oct. 1881, *Jenman 890, 1213* (fr.), *1264*. A shrub or small tree, with bright yellow sepals and petals.

This is a very pretty small tree, presumably to be classed as one of Dr. Van Steenis' "rheophytes" on account of the willow-like leaves and the habitat — see Bull. Jard. Bot. Buitenzorg III. **12:** 174–175. 1932. The same morphological adaptation is seen in the beautiful *Hirtella angustissima* Sandwith, which grows in the same locality at Amatuk and in many other spots along the banks of the Potaro.

Ouratea cernuiflora sp. nov.

Ob racemos axillares, flores nutantes cernuos, calycem omnino integrum coriaceum sub anthesi tantum ad basin in lobos 2–3 concavos fissum, scilicet sepalis omnino secum concretis nec etiamnunc alabastro singillatim distinguendis imbricatis postea sejunctis, peregregia, *O. vaccinioidi* (St. Hil. & Tul.) Engl. forsan affinis.

Frutex vel arbor parva, glabra, ramulis rigidis 2.5–5 mm. diametro densifoliatis internodiis brevibus. *Stipulae* lanceolatae, 10–11 mm. longae, longitudinaliter striatae. *Folia* elliptica vel obovato-elliptica, apice obtusa nonnunquam rotundata, summo apice ipso semper plus minusve levissime emarginato necnon decurvo pagina superiore concavo, basi attenuata cuneata ac in petiolum decurrentia, 2.5–10.5 cm. longa, 1–5 cm. lata, integra vel sub lente dimidio superiore obsolete remote undulato-serrulata, marginibus cartilagineis, utrinque plus minusve nitida, siccitate brunneo-olivacea, costa supra secus sulcum paginae tenuiter saepe acute prominula subtus prominente inferne lata obtusa superne angustata acutata, nervis venulisque supra immersis oculo vix vel haud distinguendis subtus nunc prominulis nunc primariis exceptis obscuris atque plus minusve immersis, primariis utroque costae latere circiter 8–10 primo arcuatis tum sursum (inferioribus longe, superioribus gradatim brevius) marginem versus praerupte ascendentibus, intermediis e costa exorientibus numerosis, venulis creberrimis subhorizontalibus parallelisque; petiolus supra canaliculatus, 2–10 mm. longus. *Inflorescentia* e racemis simplicibus ex axillis foliorum plane evolutorum exorientibus praeterea e panicula terminali racemiformi basi tantum breviter ramosa constans, axibus angulatis compressis ascendentibus; racemi 3–7.5 cm. longi, superne satis densiflori; bracteae bracteolaeque ovatae vel ovato-oblongae, obtusae, nonnunquam emarginatae, 1.5–3.75 mm. longae, ad 2 mm. latae, longitudinaliter striatae; pedicelli recurvi, 3–9 mm. longi. *Flores* cernui, nutantes, siccitate (etiam in vivo ?) saepe secundi. *Alabastra* ovoidea, apice breviter acuminata vel obtusata, ad 6.5 mm. longa, ad 5 mm. diametro. *Calyx* egregius, omnino coriaceus, integer, sepalis secum omnino concretis haud singillatim distinguendis nec ut in ceteris speciebus visis distinctis atque marginibus scariosis imbricatis, sub anthesi ad basin in lobos 2 vel 3 valde concavos ovatos vel semicirculares obtusos rotundatos vel subacutos atque plus minusve apiculatos 6–7.5 mm. longos 5.5–8 mm. latos longitudinaliter striatos marginibus incrassatis fissus. *Petala* obovato-spathulata, elliptico-oblonga vel oblonga, apice acute erosa biloba, in basin latam attenuata, 7–10 mm. longa, 3.3–5.75 mm. lata. *Antherae* 4.3–6 mm. longae. *Torus* sub anthesi 0.8 mm. longus, sub carpidiis maturis turbinato-pulvinatus 2–4 mm. longus circiter 3.5 mm. latus. *Carpidia* 5, sub anthesi 0.8 mm. longa, matura obovoideo-subglobosa 5–7 mm. longa 4–5.5 mm. diametro.

BRITISH GUIANA: Kaieteur Savannah, Potaro River, fl. Sept.-Oct. 1881, *Jenman 863, 1042* (TYPUS), *1210*, "a spreading shrub or small tree, about 10 ft. high;" François Creek, Mahaicony River, Demerara Co., fr. March 1934, *Davis* in *Forest Dept. 2367*, "shrub 6–10 ft. high, abundant in scrub savannah, soil swampy with peaty humus overlying white sand. Peduncle, calyx and fruit deep red, seeds dark glossy greyish-green or pale yellow."

An outstanding species of *Ouratea* on account of the ascending axillary racemes with nodding flowers on recurved pedicels and the very peculiar calyx with completely fused and indistinguishable sepals, ruptured at the time of flowering into 2 or 3 concave coriaceous lobes. A tendency to a gradation towards this phenomenon can be observed in certain other species, for instance, on some specimens of *O. acuminata* (DC.) Engl., in which the inner sepals adhere so closely to the coriaceous outer members that their broadly scarious free margins cannot be separated and distinguished without dissection and examination of the inner side of the whole calyx.

A possible ally of this plant is *O. vaccinioides* (St. Hil. & Tul.) Engl., of the States of Bahia, Minas Geraes, and Rio de Janeiro, in Central Brazil; it has somewhat similar but uniformly small leaves, terminal panicles of nodding more or less secund flowers, and distinct sepals.

This is the second instance of a rare undescribed plant growing both on the British Guiana peneplain, on the low-lying scrub savannah of the Mahaicony River, and on the Kaieteur Savannah at the edge of the Pakaraima escarpment; the previous example was the malpighiaceous *Byrsonima eugeniifolia* Sandwith.

Several other undescribed *Ourateae* from British Guiana are represented in the Kew Herbarium, but they are more critical than the two very distinct species described above, and a review of the members of the genus occurring in the Colony cannot be prepared without the examination of specimens and literature which are at present unavailable. The number of species of *Ouratea* found in British Guiana is probably not less than twenty.

ROYAL BOTANIC GARDENS,
KEW.

NOTEWORTHY SPECIES FROM MEXICO AND ADJACENT UNITED STATES, I

IVAN M. JOHNSTON

SINCE, in continuation of studies of the flora of northern Mexico, many noteworthy species from the adjacent parts of the United States will be discussed, it seems advisable to begin a new series under the above more inclusive title to replace my "New Phanerogams from Mexico," of which no. V was published in this Journal, **24**: 90–98. 1943. Unless otherwise noted, the material cited in this series is deposited in the Gray Herbarium or in the herbarium of the Arnold Arboretum.

Atriplex prosopidum, sp. nov.

Frutex monoicus rotundus pallidus 5–12 dm. altus ramosissimus; ramulis gracilibus foliosis ascendentibus numerosis teretibus pallidis vesiculosis; foliis integerrimis numerosis alternis oblanceolatis ad late oblanceolatis vel oblongo-obovatis, 4-plo ad subduplo longioribus quam latis, 15–20(–24) mm. longis, 3–6(–7) mm. latis, supra medium vel medium versus latioribus, deinde basim versus in petiolum 1–2 mm. longum gradatim attenuatis, costatis sed enervatis, indumento pallido vesiculoso tectis, apice obtusis vel subretusis; floribus masculis flavis in panicula conspicua terminali subnuda moniliforma dispositis; floribus femineis abundantibus glomeratis in spica plus minusve interrupta infra medium foliato-bracteata dispositis; bracteis fructiferis 4-alatis dense furfuraceis summum ad apicem connatis, corpore (alis 1–3 mm. latis exclusis) 1–2 mm. longe stipitato 3–5 mm. longo infra medium crassiore apice in rostrum 1–1.5 mm. longum angustum vel triangularem protracto, corpore alato a latere viso triangulari vel triangulari-ovato, 2.5–6 mm. lato, supra medium saepe latiore, basi rotundo vel obtuso, margine alis prominenter paucidentatis; seminibus brunneis ad 2 mm. longis, radicula lateraliter erecta.

COAHUILA: About 10 miles north of Cuatro Cienegas, *Wynd 742* and *744*; south of El Oso, rounded bush 2–3 ft. tall, *Johnston 8877* (TYPE, Gray Herb.); near Flores, plant bushy, somewhat globose, 1–4 ft. tall, *Johnston 8875;* 12 miles north of Monclova, bush 3–4 ft. tall, *Johnston 7187*.

This species appears to be a relative of *A. canescens*, but differs in selection of habitat, indument, form of growth, color of herbage, shape of leaves, and size and shape of fruit. The fruit has four wings as in *A. canescens*, but it is smaller, distinctly more furfuraceous, and short-stipitate. About Flores and El Oso, on the road from Cuatro Cienegas north to Ocampo (in the area where Wynd also collected the plant), I was able to compare living specimens of *A. prosopidum* and *A. canescens*. The former is a pallid rounded somewhat globose bush growing with *Suaeda*. *Atriplex canescens* did not associate with the *Suaeda* and differed conspicuously from *A. prosopidum* in being taller, stricter in branching and erect, and a light ashy green rather than pallid. The indument of *A. prosopidum* is similar to that of *A. obovate* and *A. Nuttallii,* and hence very much denser and much paler than in *A. canescens.* North of Cuatro Cienegas and north of Monclova the plant grows abundantly in silty, somewhat gypseous and saline valley soils supporting a luxuriant growth of *Prosopis glandulosa.* About Flores and El Oso *A. canescens* was rare in the areas where *A. prosopidum* abounded, perhaps because of the gypseous content of the soil.

Suaeda jacoensis, sp. nov.

Planta succulenta annua vel perennis 1–3 dm. alta glabra pallide viridis, basi ramosa; caulibus gracilibus numerosis erectis strictis simplicibus vel sparse ramosis plus minusve minute verrucosis non raro rosaceis; foliis linearibus 1–2 cm. longis 1.2 mm. latis compressis succulentis, apice obtusis apiculatis, inferioribus conspicue oppositis, ceterum alternis; floribus axillaribus sessilibus glomeratis subspicatis; bracteis hyalinis triangularibus vel oblongis dentatis vel lacerato-dentatis haud conspicuis; calyce fructifero latiore quam lato (sine appendiculis 1–1.5 mm. diametro) depresso asymmetrico, lobis deltoideis margine scariosis dorso irregulariter tuberculato-cristatis vel carinatis, basi non raro transverse alatis vel gibbosis; seminibus horizontalibus 1.1–1.3 mm. longis nitidis atro-brunneis; stylis 2.

COAHUILA: Salt-flats at the southeastern end of Laguna de Jaco, common, *Johnston & Muller 1087, Stewart & Johnston 1975* (TYPE, Gray Herb.) and *1976.*

Related to *Suaeda mexicana,* from which it differs in its lower stature, more slender and smaller leaves (which are conspicuously opposite below), more slender somewhat purplish usually verrucose stems, and irregularly cristate and keeled mature calyx-lobes. The perianth-lobes become unequally cristate and carinate at maturity, some being almost unappendaged, others corky-tuberculate, while others may have a vertical as well as a transverse basal keel that may become corky-thickened. In *S. mexicana* all the perianth-lobes become corky-thickened and prolonged off obliquely at their base. The proposed species may appear as a perennial, with the stems arising from a small caudex crowning a coarse persisting root. Most of the plants seen, however, appear to be annual. The species is very common on the flats at the southeastern end of Lake Jaco. The soil here is strongly saline and also gypsiferous.

Suaeda nigrescens, sp. nov.

Frutex 3–6 dm. altus ascendenter ramosus erectus vel decumbens in sicco saepe nigrescens; ramulis gracilibus rigidulis fruticosis ramulosis angulatis, pilis minutis brunnescentibus saepe abundantibus donatis, in vivo saepe purpurascentibus; foliis succulentis plus minusve glaucis glabris 3–5(–8) mm. longis 1(–2) mm. latis, plus minusve compressis lineari-oblongis vel oblanceolatis numerosis confertis, medium versus latioribus, apice obtusis vel rotundis, basi angustatis; floribus glomeratis basim versus foliorum superiorum vix conspicuorum enatis homomorphis subspicatis; bracteis scariosis triangularibus vel ovato-triangularibus sparse dentatis inconspicuis haud persistentibus; calyce fructifero glabro turbinato 1.5–2 mm. diametro, lobis deltoideis convexis succulentis; stylis 2 vel 3; seminibus nigris nitidis oblique ovoideis crassis erectis vel horizontalibus ca. 1 mm. longis.

COAHUILA: 4 mi. southwest of Hermanas, saline flat, *Johnston 7074;* 8 mi. north of Avalos, saline flat, *Johnston 7340;* 12 mi. north of La Ventura, saline flat, *Johnston 7650* (TYPE, Gray Herb.). SAN LUIS POTOSI: 6 mi. northwest of Cedral, saline flat, *Johnston 7603;* San Miguel, saline flat, *Johnston 7619;* San Domingo Lake, *Lundell 5576;* Hacienda del Salado, Dec. 1827, *Berlandier 1345;* San Luis Potosi to Tampico, *Palmer 778½*.

Suaeda nigrescens, var. **glabra**, var. nov.

A varietate typica differt ramulis omnino glabris saepe glaucis, raro ramulis junioribus pilis sparsissimis pallidulis donatis.

CHIHUAHUA: Meoqui, 1935, *LeSueur 197*. COAHUILA: about 30 mi. south of Sierra Mojada, 1937, *Wynd 771*. TEXAS: along irrigation ditch, Rio Grande Valley, near old Fort Quitman, *Waterfall 3993a* (TYPE, Gray Herb.); saline plains of Rio Grande [near Eagle Pass], 1848, *Wright;* salt flats near Pilgrim, Gonzales Co., *Cory 18992* and *19213*. NEW MEXICO: White Sands, Otero Co., *Archer 7334;* Hagerman, Chaves Co., *Benke 5023*.

The present plant is that treated by Standley, in No. Am. Fl. **21**: 90 (1916) and in Bull. Torr. Cl. **44**: 428 (1917), as indistinguishable from the Old World *Suaeda fruticosa* (L.) Forsk. That species was based on plants from the Mediterranean coast of France and Spain. It differs from our present plant in aspect, as well as in the more slender and elongate styles and less persistent more scarious bracteoles. Our species behaves as a native plant and I am convinced that it is indigenous. It is related to *S. fruticosa,* but so are such generally recognized West American species as *S. Torreyana* Wats., *S. Palmeri* Standl., *S. ramosissima* (Standl.) Johnston, etc. In fact, our plant is as closely related to these American congeners as it is to the Old World plant. Unless most of the American members of *Suaeda* Section *Salsina* are to be submerged in *S. fruticosa,* the present species must also be accorded recognition.

I can find no available published names for the present plant. *Suaeda fruticosa* var. *multiflora* Torr. (1857) is based upon a collection by Bigelow, from "Llano Estacado," or, to be more precise, from the region about Tucumcari, New Mexico. This plant may represent *S. nigrescens* var. *glabra,* but because of *Suaeda multiflora* Phil., a Chilean species, the name is unavailable for our North American plant. *Suaeda Moquini* (Torr.) Greene, based upon the casually published *Chenopodina Moquini* Torr. (1858), is properly discarded as a hyponym by Standley, in Bull. Torr. Cl. **44**: 428 (1917). Standley, in No. Am. Fl. **21**: 90 (1916), cites *S. intermedia* Wats. (1879) as a synonym of *S. fruticosa*. That species, based upon cited material from Utah, collected by Ward, Parry, Hooker and Gray, is not *S. nigrescens*. Since *Parry 84,* from "Central Utah," is the only cited collection of *S. intermedia* with good flowers and is the only one on whose sheet Watson wrote his binomial, I am taking that plant as the type of *S. intermedia* Wats. This type and the other cotypes all appear to represent the common Utah plant which most recent authors, including Standley, have called *S. Torreyana* Wats. Though it seems probable that Watson proposed *S. Torreyana* to include American plants formerly placed in *S. fruticosa,* usage has centered his binomial on Great Basin plants, and Standley has typified it with the material collected on the west shore of the

Great Salt Lake by Stanbury. *Suaeda diffusa* Wats. was based upon eleven collections, of which the two collections of Charles Wright represent *S. nigrescens*, and of which *Gregg 458* represents *S. suffrutescens* var. *detonsa*. Seven of the original eleven collections came from Utah and Arizona and appear to represent the plant commonly called *S. Torreyana*. In describing *S. diffusa*, Watson drew heavily on his collection no. *996* and his account of it in the Botany of the King Expedition, p. 294. That specimen is logically the type of his *S. diffusa*. It was collected in Truckee Valley and is conspecific with *Heller 8650*, also from that area, and obviously belongs to the aggregate called "*S. Torreyana*." Standley cites *Dondia conferta* Small as a synonym of *S. fruticosa*. That species, based on plants collected on the coastal flats at Corpus Christi, Texas, differs from *S. nigrescens* in its spreading less fruticose habit, large flowers, and conspicuous leafy bracts. It is the sea-coast plant found on the coast of Texas and eastern Mexico and in the West Indies. It should be called:

Suaeda conferta (Small), comb. nov.

Dondia conferta Small, in Bull. N. Y. Bot. Gard. **1**: 280. 1899.

Suaeda suffrutescens Wats., var. **detonsa**, var. nov.

A varietate genuina differt foliis glabris, caulibus non raro glabrescentibus.

COAHUILA: 3 mi. west of Cuatro Cienegas, saline flats, loosely and widely branched, 1–5 ft. tall, frequently supported by other bushes, *Johnston 7128* (TYPE, Gray Herb.); 3 mi. south of Cuatro Cienegas, saline land, low shrub, *White 1913;* Cuatro Cienegas, *Marsh 2042;* Perros Bravos, shrubby, 3 ft. tall, abundant, Sept. 20, 1848, *Gregg 458;* Saltillo, July 1880, *Palmer 1167;* 5 mi. west of Viesca, plant erect, *Johnston 7739;* Bolson de Mapimi, April 15, 1847, *Gregg 449*.

Suaeda suffrutescens is the most common and mostly widely distributed member of its genus in trans-Pecos Texas and along the Rio Grande and Pecos valleys in adjacent New Mexico. It extends south in northern Coahuila and Chihuahua. If not restricted to saline gypseous soils, it at least appears strongly to favor that substratum. The species is readily recognized because of its pubescence, abundant staminate flowers, and very moderately fleshy usually hairy perianth-lobes.

As originally described, the species was a complex. The specimens originally cited are *Berlandier 1345*, representing *S. nigrescens* from San Luis Potosi, and *Wright 578* in part and *Emory*, representive of the species as here taken. In subsequent usage the name *S. suffrutescens* has been applied to the present plant of Texas and to another, more western species, also with hairy herbage. The latter, *S. ramosissima* (Standl.) Johnston, was segregated and named by Standley, who redefined *S. suffrutescens* and gave its type-locality as "Western Texas." I have selected *Wright 578 in part* as the type-collection. This is part of a mixed sheet containing specimens obtained by Charles Wright at three different localities in trans-Pecos Texas and representing three different species, *S. suffrutescens* Wats., *S. duripes* Johnston, and *S. nigrescens* var. *glabra* Johnston. These were obtained at (1) Escondido Springs, about 20 miles east of Ft. Stockton, Aug. 17, 1849, (2) near Ft. Stockton, Aug. 18, 1849, and (3) near San Elizario, Oct. 4,

1849. Just which species was obtained at which locality cannot now be determined. The largest specimen on the sheet represents *S. suffrutescens* as here accepted. It was distinguished from the other material on the sheet by Watson and labeled by him "*S. suffrutescens*, W." It is a form of the species with the leaves only sparsely hairy. Watson's reference to the material collected by "*Emory*" is unintelligible unless it refers to the material treated by Torrey in the Botany of the Mexican Boundary, p. 184, as *Suaeda fruticosa* var. *multiflora.* Torrey cites collections of Bigelow from Presidio del Norte (i.e. Ojinaga) which probably represent *S. suffrutescens,* the common species at that locality, and collections of Thurber from the Rio Pecos, which perhaps represent *S. duripes.*

The plant of southern Coahuila, which I have distinguished as *S. suffrutescens* var. *detonsa,* differs from the more northern typical form of the species in having green glabrous leaves that contrast noticeably with the hairy stems. Its stems are usually densely hairy, occasionally, however, they are only sparsely so. Among the specimens which I have cited as representing the var. *detonsa, Gregg 458* was referred to *S. diffusa* and Gregg's collection from the "Bolson de Mapimi" was referred to *S. Torreyana* when Watson originally published these latter species.

Suaeda duripes, sp. nov.

Planta succulenta herbacea vel fruticosa 5–30 cm. alta; ramis gracilibus ut videtur ascendentibus vel decumbentibus, laevibus vel obscure vesiculato-tuberculatis, glabris vel pilis sparsissimis minutissimis obsitis; foliis succulentis linearibus vel oblongo-obovatis 3–7 mm. longis 1–3 mm. latis compressis, basim versus gradatim contractis, haud petiolatis, late affixis a basi usque ad 1–1.5 mm. supra basim induratis et in caule persistentibus, apice obtusis vel rotundis; glomerulis plurifloris, basi foliis haud vel breviter longioribus basim versus induratis enatis; bracteolis inconspicuis mox deciduis membranaceis triangularibus vel lanceolato-triangularibus saepe integris; perianthio infra medium lobato sub anthesi succulento maturitate vesiculoso et suberoso-incrassato depresso ca. 2–2.5 mm. diametro, lobis prominenter convexis; seminibus nigris erectis nitidis laevibus.

TEXAS: Pecos River, in salt soil, Nov. 1850, *Thurber 114* (TYPE, Gray Herb.); trans-Pecos Texas, 1849, *Wright 878 in part.*

A well marked species, apparently confined to Reeves and Pecos Counties, Texas, and characterized by thickened and persistent leaf-bases and the corky-thickened lobes of the fruiting calyx. The collection of Charles Wright is part of the mixed sheet which I have described above in my discussion of *S. suffrutescens.* It consists of small apparently annual plants less than a decimeter tall. Since Wright's field notes give his collection from San Elizario as a small bush, it is obvious that his material of *S. duripes* was collected either near the present Ft. Stockton or about 20 miles to the eastward, along the old San Antonio-El Paso wagon road, at the watering place which Wright called Escondido Springs. Thurber's material was collected along the northern wagon road to El Paso which crossed the Pecos about 50 miles south of the New Mexico boundary and then went up the west side of the river to Delaware Creek before continuing westward.

Tidestromia carnosa (Steyerm.), comb. nov.

Cladothrix lanuginosa var. *carnosa* Steyerm., in Ann. Mo. Bot. Gard. **19:** 389 (1932).

Tidestromia lanuginosa var. *carnosa* Cory, in Rhodora **38:** 405 (1936).

This plant appears to be restricted to gypseous saline Upper Cretaceous clays and is known only from Brewster County, Texas, and south of Ojinaga, Chihuahua. South of Ojinaga I found it growing in close proximity to *T. lanuginosa*. The two species were so completely different in appearance and so constant in their differences that it seems surprising that they have continued to be treated only as variety and species. From the widely ranging *T. lanuginosa* the present species differs in the very fleshy yellowish green nearly glabrous herbage, more brittle stems, and more indurate involucres bearing subsessile leaves. These characters are constant in all the herbarium material I have examined. The closest relative of *T. carnosa* is *T. tenella* Johnston, of the gypseous soils in western Coahuila south of Laguna del Rey, from which it differs in having much coarser stems and leaves, flowers that dry brownish rather than white, and coarsely branched rather than minutely barbellate hairs along the stem and on the flowers. The three species *T. lanuginosa, T. carnosa,* and *T. tenella* are all annual herbs. The remaining species of the genus are all strong-rooted perennials.

Tidestromia suffruticosa, var. **coahuilana,** var. nov.

A varietate typica differt indumento laeviore minus pruinoso, foliis involucratis petiolatis, floribus mox glabratis; caulibus rigidis distincte fruticosis.

COAHUILA: Sierra Cruces, 5 km. west of Picacho San José, limestone hillside, *Stewart 820;* Sierra Cruces, 5 mi. north of Santa Elena, stony bank, *Johnston & Muller 1014* (TYPE, Gray Herb.); Sierra del Pino, Cañon Ybarra, dry hillside, *Stewart 1855;* Lomas del Aparejo, east side of Llano de Guaje, *Johnston & Muller 773;* south end of Sierra del Pino, northeast of Armendais, rocky flat, *Johnston & Muller 363;* western base of grade over Cuesta Zozaya, limestone slopes, *Muller 3287* and *Johnston 9300;* Aguaje Pajarito, west end of Sierra Fragua, rocky ridges and slopes, *Johnston 8677;* 3 mi. west of Socorro, dry arroyo banks, *Johnston 8844;* Sierra Paila, Oct. 1910, *Purpus 4927.*

Typical *T. suffruticosa* was based upon material collected by Wright on mountain sides near Frontera, July 19, 1851, and on hills about 30 miles west of the Pecos, Aug. 18, 1849. Subsequent collections have been made in Brewster County, Texas, and in Dona Ana County, New Mexico. This typical form, of Texas and New Mexico, differs from the plant of central and western Coahuila in its looser pruinose indument, much less woody stems, permanently hairy flowers, and shorter petioles on the involucrate leaves. These differences are not always strongly developed, but together they add up to appreciable differences in the gross aspects of the two plants. In Coahuila the plant is most commonly found on planed down upper Cretaceous beds at the base of anticlinal mountains and is usually associated with *Dyssodia acerosa* and *Coldenia hispidissima* and other indicators of somewhat gypseous soil. The localities at which the typical form of *T. suffruticosa* has been collected suggest that it too may select rocky soils containing at least some gypsum.

Tidestromia rhizomatosa sp. nov.

Planta perennis prostrata ramosa grisea pilis ramosis vestita; rhizomatibus laevibus brunneis gracilibus; caulibus 1–2 mm. crassis griseis 1–2 dm. longis basi gemmis albis parvis donatis, internodiis 5–20 mm. longis; foliis carnosis saepe plus minusve reflexis et plano-convexis subtus conspicue crassinerviis, inferioribus obovatis 5–12 mm. longis 5–10 mm. latis, maturitate plus minusve glabrescentibus, supra medium latioribus deinde basim versus gradatim attenuatis, apice rotundis vel obtusis, superioribus ovatis sessilibus; glomerulis 1- vel 2-floris; floribus lacteis 3 mm. longis; lobis perianthii obtusiusculis ovato-oblongis ad 3 mm. longis 1–1.2 mm. latis quam bracteis lateralibus circa duplo longioribus, extus basim versus glaberrimis brunnescentibus alibi tomentosis; tubo staminali 0.4–0.5 mm. alto staminodia 5 et filamentas 5 gerentibus; filamentis subulatis 0.7–0.9(–1.2) mm. longis, antheras ad 1 mm. longas 4–5-plo longiores quam latas gerentibus; staminodeis subulatis quam filamentis 1/5–1/2 brevioribus; ovario globoso; stigmate profunde bilobato; semine ad 1.3 mm. longo erecto brunnescente ovoideo.

COAHUILA: Near El Anteojo, about 3 miles west of Cuatro Cienegas, with *Allenrolfea* on a silty saline, probably also gypseous, flat just east of the pond, locally abundant, decidedly prostrate, grayish, rhizomatous, leaves fleshy and more or less reflexed, Sept. 5, 1941, *Johnston 8873* (TYPE, Gray Herb.).

A perennial species with the stems flat on the soil and spreading underground by slender smooth rhizomes. The leaves are fleshy, thinly clothed with trichomes, and more or less plano-convex and reflexed. They are very strongly veined beneath. The species is most closely related to *T. gemmata,* from which it differs in its rhizomes, lank more elongate stems, more or less glabrescent more fleshy reflexed leaves, slightly larger flowers, and the development of staminodes. The well developed staminodes distinguish the species from all its congeners save only *T. oblongifolia* (Wats.) Standley, of California and Arizona. The plant is probably a halophytic gypsophile.

Tidestromia gemmata, sp. nov.

Planta perennis pilis ramosis dense vestita, e radice valida palari profunda apice gemmis conspicuis albo-tomentosis donata et non raro caudicem compactam proferente oriens; caulibus laxe ramosis prostratis vel decumbentibus rubiginosis pilis griseis vestitis 1.5–2.3 mm. crassis 1–1.5 dm. longis, internodiis 1–2.5 cm. longis; foliis juvenilibus albis vel cinereis, maturis dilute flavescentibus; foliis inferioribus conspicue petiolatis, lamina 12–15(–23) mm. longa 1–1.6 mm. lata, subtus prominenter nervata, apice obtusa vel rotundata, basi truncata vel obtusa in petiolum 4–8(–10) mm. longum abrupte contracta; foliis superioribus numerosis ovatis subsessilibus sursum gradatim reductis; glomerulis 2–4-floris; floribus lacteis 2.5 mm. longis; lobis perianthii ad 2 mm. longis lanceolato-oblongis vel ovato-oblongis obtusiusculis quam bracteis lateralibus circa duplo longioribus, extus basim versus glabris alibi praesertim medium versus tomentosis; tubo staminali 0.6–0.7 mm. alto; staminodeis nullis; filamentis 0.8–1.2 mm. longis; antheris oblongis 0.8–1 mm. longis.

COAHUILA: Just south of Matrimonio Viejo, restricted to gypsiferous shales, prostrate, common, Sept. 22, 1941, *Johnston 9363* (TYPE, Gray Herb.); just east of Americanos, on cemented gravels capping gypsum, prostrate, locally common, Sept. 23, 1941, *Johnston 9379;* 20 km. southeast of Rancho Alegre on road to Acatita, on flats, prostrate, common, Sept. 20, 1942, *Stewart 2668.*

This species superficially resembles coarse plants of *T. lanuginosa,* but differs in its coarse very strong tap-root, conspicuous large cottony buds borne near the surface of the soil, slightly more fruticulose reddish stems, and thicker more strongly veined leaves. I first recognized the distinctness of the species near Matrimonio, where I found it growing near specimens of the common and widely distributed annual, *T. lanuginosa.* I suspect that the Tidestromias I noted as growing in gypsum seams in the shales south of Laguna de Leche may also belong to *T. gemmata.*

Spiraea Northcraftii, sp. nov.

Frutex; ramulis gracilibus rigidis laxe ascendentibus vel subdivaricatis glaberrimis, vetustioribus griseis subspinescentibus, juventute castaneis; foliis minutis numerosis crassis laevibus enervatis obscure costatis pallidulis glaberrimis solitariis vel plus minusve fasciculatis integerrimis oblanceolatis, 3–8 mm. longis 1–2.5 mm. latis, apicem versus latioribus deinde basim versus in petiolum 0.5–1 mm. longum subcastaneum gradatim contractis, apice rotundis vel obtusis abrupte conspicueque mucronatis; inflorescentia terminali subcorymbosa 8–15-flora plus minusve hemisphaerica ca. 8 mm. diametro glabra; bracteis linearibus 1–1.5 mm. longis, pedicellis 1–1.5 mm. longis, hypanthio 1.5 mm. alto et diametro, lobis triangularibus ad 1 mm. longis valvatis intus sparse tomentulosis; petalis albis 1.5–2 mm. longis 1–1.3 mm. latis, margine erosis; staminibus 15, filamentis linearibus 1.5 mm. longis; carpellis 2 vel 3 glaberrimis; folliculis non visis.

COAHUILA: Summit of Picacho de Jimulco, 13 km. east of Jimulco, in thick underbrush in woodland association with oak, pine and juniper, June 29, 1941, *Stanford, Retherford & Northcraft 115* (TYPE, Gray Herb.).

A microphyllous shrub related to *S. Hartwegiana* Rydb., of Hidalgo, Puebla and Oaxaca, from which it differs in being smaller in all parts, and in having a shorter less elongate hypanthium and a dense few-flowered subcorymbose rather than an elongate many-flowered racemose inflorescence.

Vauquelinia Retherfordii, sp. nov.

Frutex 3 m. altus; ramulis cortice grisea glabra obtectis; foliis apice ramulorum confertis lineari-oblongis 2–5 cm. longis 4–7 mm. latis, basim versus in petiolum 2–4 mm. longum pallidum abrupte contractis, supra viridibus inconspicue sparseque puberulentis canaliculatis sed inconspicue minuteque reticulatis, subtus pallidis tomentulosis pilis mollibus contortis brevibus albis dense vestitis maturitate aliquantulum deciduis, margine utrinque dentibus 15–20 parvis ascendentibus donatis, apice obtusis; corymbo terminali 2–3 cm. diametro 10–30-floro, ramulis tomentulosis; hypanthio hemisphaerico 3–4 mm. diametro dense puberulente; sepalis ovatis intus tomentulosis; petalis ellipticis albis ad 4 mm. longis ca. 2 mm. latis integerrimis; staminibus 12–15, filamentis linearibus ca. 3 mm. longis; capsulis submaturis globoso-ovoideis ca. 3 mm. diametro.

COAHUILA: Sierra Jimulco, about 11 km. northeast of Jimulco, in rolling hills covered with *Agave, Yucca* and low mesquites, *Stanford, Retherford & Northcraft 87* (TYPE, Gray Herb.).

A species related to *V. californica,* from which it differs in its smaller narrow elongate short-petiolate leaves clustered on short-shoots, its permanently tomentulose lower leaf-faces, and its small few-flowered corymbs.

Thamnosma Stanfordii, sp. nov.

Frutex 6 dm. altus ramosissimus glaberrimus; ramulis teretibus tuberculatis 1–2 mm. crassis foliosis evanescenter glaucis; foliis numerosis confertis lineari-oblanceolatis vel linearibus compressis 7–12 mm. longis 0.8–1.5 mm. latis, medium versus usque ad apicem versus latioribus, costatis sed enervatis, juventute subglaucis, margine minute sed distincte sinuatis; floribus 1 vel 2 extra-axillaribus apicem ramuli versus gestis; pedicellis 1.5–2 mm. longis, fructiferis ad 5 mm. longis; calyce ca. 4 mm. longo infra medium lobato, lobis triangulari-oblongis ca. 3 mm. longis obtusis purpurascentibus basi ad 2 mm. latis; corolla alba purpurascente; petalis 4, ad 10 mm. longis, oblongo-ovatis (infra medium ad 4 mm. latis) acutis; filamentis 4 exterioribus ad 5 mm. longis; filamentis 4 oppositipetalis 3 mm. longis linearibus; antheris ellipsoideis ca. 1.5 mm. longis; stylo stamina superante; capsula stipite ad 1 mm. longo incluso 1 cm. longa, ca. 6 mm. lata, apice ca. 2 mm. profunde bilobata.

COAHUILA: Sierra de Jimulco, 11 km. northeast of Jimulco, rolling hills with *Agave, Yucca* and low mesquites, plant 2 ft. tall, fl. purple, fennel-like odor, June 27, 1941, *Stanford, Retherford & Northcraft 16* (TYPE, Gray Herb.).

A very distinct addition to this small genus of North America and Africa. In its strongly biseriate stamens and in its bushy growth-habit it departs widely from the three American species previously described. It is a much-branched slender-stemmed bush with numerous leaves. The leaves somewhat suggest those of *T. texana*. The large flowers superficially resemble those of *T. montana*. The capsule most suggests that of *T. texana* but is larger and more elongate. The stamens in *T. texana* and *T. montana* (flowers not known in *T. trifoliata*) are subequal. In *T. Stanfordii* the filaments of the inner whorl of stamens are very conspicuously shorter than those of the outer whorl.

Pseudosmodingium ? anomalum, sp. nov.

Frutex erectus ca. 2.5 m. altus; ramulis vetustioribus cortice grisea glabra obtectis, hornotinis dense puberulentis; foliis submaturis (vetustioribus non visis) simplicibus angustissimis integerrimis minute puberulentis apice ramulorum confertis, 2–5 cm. longis 2–3 mm. latis, utrinque attenuatis costatis sed haud vel vix nervatis, 1–2 mm. longe petiolatis; paniculis sub anthesi (fructiferis non visis) 4–5 cm. longis elongatis sparsifloris sparse ramosis minute sparseque puberulentis quam foliis subduplo longioribus, axi paniculae gracillimo parte 1/3 raro ad 1/2 inferiore nudo deinde sursum ramulos 3 vel 4 gracillimos 3–12 mm. distantes ascendentes sparsifloros 3–10 mm. longos simplices vel raro pauciramosos gerente; bracteis linearibus 1–2 mm. longis; floribus minutis 5-meris; pedicellis gracillimis 1–3 mm. longis; sepalis ca. 0.6 mm. longis et latis triangularibus apice rotundis basi abrupte constrictis; petalis imbricatis ellipticis vel elliptico-ovatis, 1.5 mm. longis 1.2 mm. latis, medium versus vel infra medium latioribus, apice rotundis, basi subtruncatis; disco patelliformi; antheris ca. 0.5 mm. longis et latis, basi cordatis, apice rotundis; filamentis subulatis ca. 0.6 mm. longis latere exteriore disci affixis; ovario sessili glabro stigmatibus 3 tuberculatis terminato; fructu ignoto.

COAHUILA: Sierra de Jimulco, about 11 km. northeast of Jimulco, along arroyo in rolling hills covered with *Agave, Yucca* and low mesquites, plant uncommon, erect, 8 ft. tall, June 28, 1941, *Stanford, Retherford & Northcraft 73* (TYPE, Gray Herb.).

A deciduous shrub with slender woody stems bearing scattered clusters of elongate simple entire leaves on short-shoots. The type material shows nearly fully grown new leaves and well developed inflorescences with the flowers at anthesis. Without fruit the generic position of the plant is necessarily uncertain. I have placed it in *Pseudosmodingium* because in that genus I find leaves clustered on similar short-shoots, panicles of similar position and form, and flowers of similar appearance and structure. Prof. Irving W. Bailey reports that the wood of the plant is also suggestive of the genus. The described species of *Pseudosmodingium,* however, have well developed imparipinnate leaves. The leaves are distinctly simple in the present plant. Their obscure veining shows that they are not phyllodal and the absence of a secondary basal articulation gives no indication that they might be the terminal leaflet of an otherwise suppressed pinnate leaf.

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PUBLICATION DATES FOR THE BOTANICAL PARTS OF THE PACIFIC RAILROAD REPORTS

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IN the present paper I present such data as I have been able to assemble concerning the exact dates of publication of the various botanical papers contained in the Pacific Railroad Reports. These reports, based upon explorations in the western United States between 1853 and 1855, and published by the War Department under the lengthy title, "Reports of Explorations and Surveys for a Railroad Route from the Mississippi River to the Pacific Ocean," include important botanical papers by Torrey, Gray, Engelmann, and others, in which were first described a large number of the characteristic West American plants. A study of the various volumes of the Pacific Railroad Reports reveals puzzling discrepancies between dates found on the title pages of the volumes, those on the initial leaf of the separate reports within each volume, and those found scattered through the text. In a search for precise information regarding the dates of publication of the botanical portions of the Pacific Railroad Reports, I have consulted the Historic Letter File at the Gray Herbarium and searched for contemporary mention of these papers. The letters of John Torrey and George Engelmann have supplied much detailed information.[1] The published proceedings of the Academy of Natural Sciences of Philadelphia, the American Philosophical Society, and the Academy of Science of St. Louis have also provided exact dates at which copies of the completed volumes of the Reports had been distributed from Washington. From these sources it has been possible to assign reasonably exact dates to the various botanical reports, accurate in most cases to within a month or two. In less disturbed times, when at least Torrey's letters at Kew and St. Louis and Gray's letters at Kew, New York, and St. Louis can be examined, it seems probable that additional information may be found which will establish an even more precise dating for these papers.

[1]Contemporary letters also help to date Torrey's and Engelmann's important botanical reports in vol. 2 of Emory's Report on the United States and Mexican Boundary Survey. Torrey wrote Gray, on Jan. 10, 1859, that he was preparing a list of errata from page-proof of his Mexican Boundary Report. Engelmann wrote Gray on Apr 1 5, 1859, that he had ordered separates of his account of the boundary Cacti but did not know if his report had been printed. On June 7, 1859, Torrey was expecting his printed report. Schott (in a letter at the N. Y. Botanical Garden, *fide* notation in the Gray Herbarium copy) stated that the botanical reports were issued before April 21, 1859. On June 2, 1859, Engelmann wrote Gray that he had seen the printed report, and on June 6, the volume was displayed at the session of the St. Louis Academy. Engelmann, in Sept., 1859, wrote that his separates were still in Washington and yet undistributed. The second volume of the Boundary Survey was obviously issued in May or late April, 1859. No advance separates of the botanical reports were issued.

The Pacific Railroad Reports appeared in two editions, first in octavo and later, much enlarged in scope, in quarto. In explanation of this procedure Torrey wrote Gray, on Sept. 14, 1854, "This [Lieut. Whipple's report] will be printed in the ordinary *pub. doc.* & then a revised edition will be ordered in which our illustrations can come & any additional descriptions & observations that may be ready. He says this is the only way, or the Natural History may be thrown out altogether."

The octavo first edition of the Pacific Railroad Reports appeared as House Executive Document no. 129, 33rd Congress, 1st Session. Announced as a three-volume work, only two volumes of text were published. There are only two botanical reports in the octavo edition, Torrey's catalogue of the plants collected on the Pope Expedition and Bigelow's account of the forest trees and vegetation observed during the Whipple Expedition. These botanical reports were not illustrated. Bigelow's report was reprinted apparently without change, in the second, quarto, edition of the Reports. The account of the plants collected on the Pope Expedition, a taxonomic paper, was subsequently much changed in the second edition and merits special comment.

The botanical report of the Pope Expedition appeared on pp. 307–324 of part 2, of volume 2, of the octavo edition. Althought Torrey wrote Gray, on Nov. 4, 1854, just after he had sent the manuscript of this report to Washington, that, "You have had a larger share in the Catalogue than I . . ," the catalogue as published gives Torrey as sole author. This first edition of the botanical report on the Pope plants has become a forgotten item in the literature of West American botany. There is no copy of the report at the Gray Herbarium, and Dr. H. W. Rickett (in lit. Aug., 1942) writes that there is none in the library of the New York Botanical Garden. In their later writings Torrey and Gray, apparently considering the octavo report as a preliminary one and superseded by the enlarged and changed quarto edition published about two years later, invariably cited only the second edition of the Pope Report. Later botanists, unaware of the early edition, have done the same. The first edition of the Pope Report can be dated reasonably well. The publication of the octavo edition of the Pacific Railroad Reports is noted in the American Journal of Science (**20:** 299) for September 1855. Engelmann, however, saw the publication several months earlier, for, writing Gray on June 12, 1855, he states, "I see in some of the Pacific Railroad Reports Torrey has mentioned without describing several new Euphorbia coll. before by Wright or Fendler — going ahead of me — but it serves me right." The first edition of the Pope Report, accordingly, must have appeared before the middle of 1855, probably in the spring of that year.

The following three specific names, none listed in Index Kewensis, were published in the first edition of Pope's Report and abandoned in the second edition: *Ehretia ? hispida,* nomen (p. 320), *Stegnocarpus ? Ciocarya* (p. 320), and *Camassia Gawleri* (p. 323). In the second edition they are replaced by the following newly published names: *Eddya hispidissima,* *Stegnocarpus canescens*, and *Camassia Fraseri*. The names *Eritrichium crassisepalum* (p. 321), *Euphorbia Wrightii* (p. 321), *Euphorbia dilatata* (p. 321), *Euphorbia albomarginata* (p. 321), and *Euphorbia Fendleri* (p. 321), nomina nuda in the first edition, were supplied with descriptions in the second edition. The well-known species *Selenia dissecta* (p. 308), *Stenandrium barbatum* (p. 317), and *Pentstemon Fendleri* (p. 318) were well-described in the first edition of the report. The species *Astrophyllum dumosum, Ammoselinum Popei, Phacelia Popei, Eritrichium pusillum,* and *Ptilocalyx Greggii,* published in the second edition, are not mentioned, at least by name, in the first edition.

The second edition of the Pacific Railroad Survey Reports was published in sumptuous quarto volumes. The text of the first edition was reprinted with few changes, and many new special reports with many plates were added. This second edition is the one represented in most libraries. It appeared in two forms, differing only in title-page, as Senate Executive Document no. 78, and as House Executive Document no. 91, both of the 33rd Congress, 2nd Session. As originally planned the work contained eleven volumes. Subsequently two more volumes (numbered vol. 12, pt. 1, and 12, pt. 2) were added and published as House Executive Document 56, 36th Congress, 1st Session. In the completed work, botanical reports are found in volumes no. 2, 4, 5, 6, 7, and 12^2.

Volume 2 of the quarto reports contains the botanical reports for the Beckwith and the Gunnison Expeditions, and the second edition of the botanical report for the Pope Expedition. These reports are by Torrey and Gray. The complete volume was issued at Washington in 1857. Within this volume Captain Pope's "Explanatory Note to the Geological Report" bears the printed date Feb. 18, 1857. Torrey, in a letter to Engelmann dated July 30, 1857 (quoted by Rodgers in his book "John Torrey," p. 248), speaks of the Beckwith and Pope reports as "contained in a volume [of the Pacific Railroad Reports] just published . . " On October 6, 1857, the volume had been received from Washington and accessioned at the Philadelphia Academy.

Torrey and Gray had reprints of the botanical reports published in vol. 2 before the end of June 1857. On Oct. 20, 1855, Torrey had written Gray that the botany of the Beckwith (and Gunnison) report was printed and that separates were ordered. In his letter of Jan. 9, 1856, he stated that the botany of the Pope report was not yet printed, and on March 12, 1856, he asked if Sprague was still at work on the plates for that report. The authors seem to have received the printed plates for the Pope Report shortly before Torrey's letter of June 23, 1857. At that time Torrey wrote, "You probably rec'd from me, lately, a parcel containing 50 sets of plates for Bot. Pope. You can return the 10 extra copies of the Beckwith letter-press, or I will send you the plates for them — just as you like. My parcel for England will go soon. A friend will take care of it. I will send Pope's and Beckwith's Rep. to Hooker, etc." The botanical parts of the Pope and Beckwith-Gunnison reports are apparently those acknowledged and commented upon by Sir William Hooker in his letter to Gray, dated Nov. 27,

1857. These same reports (with complete text and plates) were reviewed by Hooker in the final issue of the Kew Journal of Botany, **9:** 376 (Dec. 1857). He states that the botany of the Beckwith-Gunnison reports was "Published January 7, 1857." No such date is given for the botany of the Pope Report. Torrey's letter of June 23, 1857 (already quoted above) does seem to infer that the complete botany of the Beckwith-Gunnison report and at least the text of the botany of the Pope Report had been in the hands of the authors for some time. While Hooker may have been correct in stating that the botanical part of the Beckwith-Gunnison Report had been "published January 7, 1857," there is no evidence that it was distributed by the authors until after June 1857, and little if at all before the time when the whole of vol. 2 was available to the general public at Washington. I believe that the effective dates of publication of the botanical reports for the Beckwith-Gunnison and Pope expeditions is either June or early July, 1857. This date is two years later than the date of publication for the botanical appendix in the first (octavo) edition of Pope's Report.

Volume 4 of the quarto reports contains the important botanical catalogues by Torrey, Engelmann, Bigelow, and Sullivant, based upon material assembled during Whipple's Expedition.

On May 22, 1857, Torrey wrote Gray that the text of his part of the Whipple Report was printed and that he was preparing the index, and on July 22, 1857, that his extra copies were ready but the plates were still unprinted. On Aug. 12, 1857, he wrote, "A day or two ago I was surprised to get from Dr. Bigelow a printed copy of the Bot. of Whipple's Exped. containing our portion, together with the Cactaceae, an introductory article on the Bot. Geography explored & a memoir on the principal forest trees found on the route . . . I have 150 copies of the plates of Cactaceae, which were intended for extra copies of text that Dr. B. promised, long ago, to have struck off. I did not learn till yesterday that the lithographer had printed these. My own extra copies of Bot. have not yet arrived, & I rather think that they may include Bigelow's articles." On Aug. 22, 1857, having just returned from Montreal, Torrey wrote, "My extra copies of Plant. Whipple have not arrived, but I found a single one (sent by Express) on my table this morning. It contains Bigelow's two reports & Sullivant's Mosses, the latter not in a previous copy sent two weeks ago. I am mortified to find so many typographical errors . . . Perhaps the Superintendent of Public Printing will authorize the insertion of the *errata list* in all copies." On Sept. 2, 1857, Torrey received word from Washington that 150 copies of the botanical report had been shipped to him. These arrived by Sept. 10th, when he wrote, "They do not contain Bigelow's article, Cactaceae, nor Sullivant's mosses. So if the Cactaceae have not been received for Engelmann we must fall back on Bigelow for these, who has 200 copies of the entire Botany. I have 200 copies of the Cact. plates . . . We can distribute our part of the Botany without Bigelow's, & your 50 copies shall be sent as soon as I can get them ready — but you had better not distribute till we get errata printed." Engelmann, travelling in Europe, did not get his reprints until May, 1858. C. W. Short (Louisville, Kentucky) wrote Gray on Sept. 10, 1857, "Mr. Sullivant has been so good as to send me a copy of his very beautiful Mosses of Whipple's survey." Although the volume of the Pacific Railroad Reports containing the Whipple Reports was only received at the Boston Society of Natural History on Jan. 1, 1858, at the Philadelphia Academy on Jan. 5, 1858, and at the St. Louis Academy on March 8, 1858, and was first reviewed in the American Journal of Science (**25:** 149) for Jan., 1858, the evidence is clear that Torrey, Gray, Bigelow, and Sullivant had sufficient copies of the botanical portions of the Whipple Report to establish Sept. 1857 as the effective date of issuance for this important botanical volume.

Volume 5 of the quarto reports contains the two botanical reports based on the collections of the Williamson Expeditions, one by Torrey, the other by Durand & Hilgard. The substance of the Durand & Hilgard report first appeared as "Plantae Heermannianae" in the Journal of the Philadelphia Academy **3:** 37–46 (Nov. 1854). A reprint of this article was sent Gray by Durand with a covering letter dated Dec. 4, 1854. The revised report on the Heermann collections was in print at Washington before Sept. 2, 1857, for on that date Torrey wrote that, by some mistake, he had received 150 copies of Durand & Hilgard's report intended for the authors.

Torrey's report, on the plants collected by Blake during the Williamson Expeditions, was probably printed much later. Concerning this report there is only one reference in his letters which may be significant. On June 12, 1858, he wrote Gray, "As to those plates of Blake and Antisell's Repts. I don't mean to let you pay for any unless I learn that some extra copies of the letter press can be obtained from the Public Printer." The whole volume, containing Torrey's report, was displayed at the St. Louis Academy on March 22, 1858. There is no reason for believing that Torrey received advance reprints. The effective date of Torrey's report is probably the date of issuance of the complete volume in Washington, about Feb., 1858.

Volume 6 of the quarto reports contains the botanical reports resulting from the Williamson & Abbot Expeditions in 1855. The botanical reports were organized and partially written by J. S. Newberry. On July 23, 1857, Newberry, in ill health, wrote Gray, asking him to read all the proofs of the botanical report which would soon become available. On Sept. 2, 1857, after learning that Newberry was to join a new expedition in the West, Torrey wrote Gray, "What is to be done with Newberry's Report? If he goes with Ives you will probably attend to proof reading . . . " On April 5, 1858, the completed volume was displayed at the session of the St. Louis Academy. The volume probably first appeared in Washington in March, 1858.

Volume 7 of the quarto reports contains Torrey's report on the collections of Parke's Expedition. On Sept. 10, 1857, Torrey wrote, "Two days ago I rec'd proofsheets of a small report that I prepared for Antisell (Parke's Exped.). An officer saw them & begged . . . that I might see them before being worked off. They permitted him to do so but said, if the sheets were not returned by next mail, the printer should proceed without corrections.

Part of the work had already been printed & I did not know that it was in press!" Torrey's letter of June 12, 1858, already quoted in connection with his account of Blake's plants (vol. 5), is the only other reference to this report in his letters to Gray. F. W. Vaughn, writing for A. A. Humphreys of the Office of the Pacific Railroad Surveys, wrote Gray on May 8, 1858, that volumes 5, 6, and 7 of the reports were being sent him. Volume 7 was available at the Philadelphia Academy May 11, 1858, and was displayed at the St. Louis Academy on May 17, 1858. The volume probably came from the press in Washington in April 1858.

Volume 12, part 2, of the quarto reports contained the final expanded report of Stevens' explorations across the northern United States. The botanical papers it contains are written by Gray and Cooper. I have no detailed information concerning this report. The publication of the report was authorized by the U. S. House of Representatives on March 25, 1860. The volume was received at the Boston Society of Natural History on Feb. 12, 1861. It was displayed at the St. Louis Academy on June 17, 1861. The Library of Harvard University did not receive its copy until Aug. 19, 1861. The volume, accordingly, was published probably late in 1860 or in Jan. 1861.

The dates of publication for the botanical papers published in the two editions of the Pacific Railroad Reports may be summarized as follows:

FIRST EDITION (in octavo)		
Volume 2:	Botany of the Pope Report, by Torrey	before June 1855
SECOND EDITION (in quarto)		
Volume 2:	Botany of Beckwith and Gunnison Reports, by Torrey & Gray	about the middle of 1857
	Botany of Pope Report (2nd edition), by Torrey & Gray	about the middle of 1857
Volume 4:	Botany of the Whipple Report	advance reprints Sept. 1857
Volume 5:	Botany of Williamson Report: Heermann collections, by Durand & Hilgard	advance reprints Sept. 1857
	Blake collections, by Torrey	about Feb. 1858
Volume 6:	Botany of Williamson & Abbot Report	about March 1858
Volume 7:	Botany of Parke Report, by Torrey	about April 1858
Volume 12[2]:	Botany of Stevens Report	Jan. 1861 or late 1860

ARNOLD ARBORETUM,
HARVARD UNIVERSITY.

JOURNAL

OF THE

ARNOLD ARBORETUM

VOL. XXIV JULY, 1943 NUMBER 3

A SECOND SUMMARY OF THE SCROPHULARIACEAE OF NEW GUINEA*

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With five plates

THE third series of Archbold Scrophulariaceae from New Guinea differs from its predecessors in coming from the western or Netherlands half of the island.[1] The specimens have again been gathered by Mr. L. J. Brass, but this time some were collected jointly with Dr. E. Myer-Drees, a forester who accompanied the expedition on behalf of the Netherlands government. The expedition entered from the northern coast and climbed Mt. Wilhelmina in the Snow Mountains. The Scrophulariaceae found at high altitudes, mostly species of *Hebe* and *Euphrasia*, seem to be wholly endemic, and show what a break must occur in the highest zones of vegetation between this mountain and the previously visited Carstensz Peak in the Nassau Range, several degrees to the westward.[2]

Since political conditions will probably prohibit for some years further botanical exploration of the mountains of New Guinea, it seems appropriate to present now a summary of our present knowledge of the Scrophulariaceae of the island. It is nineteen years since the last such record, "Die Scrophulariaceen Papuasiens,"[3] by Dr. R. Schlechter, a study enumerating 26 species in all, 19 of which were lowland and 7 alpine. With continued exploration, figures for both the lowland and the highland species have increased, but the lowland mainly by the addition of widespread Indo-Malayan plants, while the highland count builds up by endemic restricted species. The figures now are 34 for the lowland and 25 for the highland, making a present total of 59 species. The sharp separation of lowland

*Botanical Results of the Richard Archbold Expedition.

[1]For account of the Third Archbold Expedition, which visited New Guinea in 1938, see Richard Archbold's "Unknown New Guinea" in Nat. Geogr. Mag. **79**: 315–344. 1941.

[2]See "Report on the Botany of the Wollaston Expedition to Dutch New Guinea, 1912–13," by Henry N. Ridley, in Trans. Linn. Soc. II. Bot. **9**: 1–284. 1916.

[3]In Bot. Jahrb. **59**: 99–117. 1924.

and highland floras for this family in New Guinea, first pointed out by Schlechter and discussed in my reports on the Scrophulariaceae of the First and Second Archbold Expeditions,[4] is made more emphatic as collections accumulate. In this family it is a tribal rather than a generic matter, the Gratioleae and Buchnereae being lowland, and the Veroniceae and Euphrasieae alpine.

To make the present summary as complete as possible, it will be necessary to consider again some problems based upon the earlier expeditions and therefore concerning plants of eastern New Guinea. Also, there have reached me, either directly or through the Arnold Arboretum, various collections made by Mrs. Mary Strong Clemens in the mountains of the Morobe District or the Saruwaket Range, both being in Northeastern New Guinea. These will also be reported in the present paper.

But this material, altogether, does not contain many collections, and it would have been indeed desirable to have seen what specimens are in the herbarium at Buitenzorg, Java, and in the herbaria of Germany and England. But, even with those, any enumeration now is but a milestone directing to the task yet before us in adequately collecting for study the New Guinean flora. There are still undescribed lowland Scrophulariaceae, though these will be vastly outnumbered by the alpine species of *Hebe* and *Euphrasia* certain to be revealed as expeditions reach more isolated mountain areas.

As in previous papers, the present summary will present keys when thought needed. Additions to the island's flora will be starred. It hardly seems necessary to explain the obvious abbreviations to herbaria: AA — Arnold Arboretum; ANSP — Academy of Natural Sciences of Philadelphia; GH — Gray Herbarium; Mich — University of Michigan.

Key to the genera in New Guinea

A. Corolla with the upper lobes external, overlapping in the bud; stigmas distinct; leaves opposite or ternate, often glandular-punctate; lowland. (Antirrhinoideae-Gratioleae).
  B. Anther-cells separated on short arms of the connective; leaf-blades glandular-punctate.
    C. Anthers all developed, polleniferous; capsule globose to ovoid; sepals alike; bracts leaf-like, the inflorescence foliose.
      D. Bracteoles none; sepals distinct; capsule depressed-globose, equally septicidal and loculicidal; seeds longitudinally lined; corolla 4–5 mm. long; leaf-blades ovate, petioled............................1. *Poarium*.
      DD. Bracteoles developed, a pair beneath the calyx; sepals united proximally; capsule globose to ovoid, primarily loculicidal; seeds vestigially reticulate to smooth; corolla 7–15 mm. long; leaf-blades various..2. *Limnophila*.
    CC. Anthers unequally developed, one cell of those on longer pair of filaments abortive; capsule conic, twice as long as wide, septicidally and then loculicidally dehiscent; sepals unequal, the posterior largest; bracteoles present beneath calyx; bracts much smaller than the leaves, the inflorescence of spikes or spike-like racemes............................3. *Adenosma*.
  BB. Anther-cells contiguous.

[4]First Expedition reported in Brittonia **2**: 177–188. 1936, and **3**: 95. 1938; Second Expedition in Jour. Arnold Arb. **20**: 75–84. 1939.

C. Bracteoles developed, a pair at base of the unequal sepals; corolla white, with violet lines; anther-cells parallel; capsule about equally septicidal and loculicidal; leaf-blades glandular-punctate. . . . . 4. *Mella*.

CC. Bracteoles none; corolla more or less violet-blue or purplish; anther-cells divaricate; leaf-blades not (or in some species of *Lindernia* slightly) punctate.

D. Anterior filaments straight, from their lowest contact free from the corolla-tube; capsule loculicidal; sepals united proximally; bracts subulate. . . . . 5. *Mazus*.

DD. Anterior filaments adnate to corolla as antero-lateral ridges, distally free and each sharply bent back upon itself (this appearing as a knob-like process), thence abruptly ascending; capsule septicidal.

E. Placenta covering entire width of the septum; capsule 7 mm. long, globose-ovoid; corolla 20 mm. long, pale purple; leaves sessile, lanceolate-attenuate, the longer 10–15 mm. long. . . . . . 6. *Artanema*.

EE. Placenta covering median half or less of septum, which, including its bare lateral portions, persists as a thin plate; capsule globose-ovoid to linear-cylindric; corolla smaller; leaves petioled or sessile, the blades much smaller.

F. Sepals distinct or united partially, plane, the calyx, if as long as the capsule, not investing it; bracts all opposite, usually leaf-like (subulate only in *L. antipoda*) . . . . 7. *Lindernia*.

FF. Sepals united nearly throughout, the calyx exceeding the capsule and closely investing it; bracts foliose or more usually subulate, the pedicels (by suppression of internodes) sometimes in fours. . . . . 8. *Torenia*.

AA. Corolla with the lower or lateral lobes external, overlapping in the bud; stigmas wholly united, capitate or punctiform; leaf-blades not punctate. (Rhinanthoideae).

B. Upper lobes of corolla simply spreading, distinct or united; anthers all distinct, glabrous, unawned; seeds many, wingless.

C. Sepals distinct; stamens two, the postero-lateral pair alone developed; anther-cells equal; corolla tubular-campanulate to rotate; seeds flattened, smooth; pedicels not bracteolate; alpine. (Veroniceae).

D. Corolla 25–28 mm. long, the lobes five, much shorter than the tube; flowers solitary, sessile; stems woody. . . . . 9. *Detzneria*.

DD. Corolla smaller, the lobes (by fusion of the posterior) appearing four, as long as or longer than the tube; flowers racemose, pedicelled.

E. Capsule turgid, septicidal; stems woody, erect or diffuse. . . 10. *Hebe*.

EE. Capsule flattened, loculicidal; stems herbaceous, prostrate. . . . . 11. *Veronica*.

CC. Sepals united at least half their length; stamens four, both pairs developed; anther-cells not equal; corolla campanulate or salverform, the tube longer than the five distinct lobes; capsule loculicidal; seeds reticulate; pedicels bibracteolate; lowland. (Buchnereae).

D. Corolla campanulate, yellow; anther-cells two, unequal; calyx not tubular.

E. Calyx symmetrical, externally glabrate, internally densely and softly hairy, the hairs appearing as a fine ciliation of the triangular calyx-lobes; corolla 5–6 mm. long, spreading-campanulate; capsule 5 mm. long, wholly loculicidal; leaves linear, entire or with a pair of slender lobes. . . . . 12. *Sopubia*.

EE. Calyx asymmetrical, deeply cleft anteriorly and distally so upcurved that the short free lobes appear as tips to upper side of corolla and capsule, externally densely hispid, internally glabrous; corolla 17–20 mm. long, more narrowly campanulate; capsule 7–8 mm. long, secondarily also somewhat septicidal; leaves linear-lanceolate, entire. . . . . 13. *Centranthera*.

DD. Corolla salverform, the narrow throat hairy within; anther-cell one, the other lost by abortion; calyx tubular, more or less ribbed.
E. Corolla-tube straight, the corolla pink, bluish or white; ribs of calyx relatively faint; leaf-blades narrowly elliptic to linear-lanceolate.............14. *Buchnera*.
EE. Corolla-tube decurved near apex, the corolla reddish-purple, orange-yellow, or white; ribs of calyx pronounced; leaf-blades linear to filiform.............15. *Striga*.
BB. Upper lobes of corolla united to form a concave galea, the white or violet corolla strongly zygomorphic; anthers cohering or distinct, the cells hairy and unequal, awned; capsule loculicidal; seeds few, with slightly raised longitudinal wings (or wing-like ridges); alpine. (Euphrasieae)....16. *Euphrasia*.

*1. **Poarium** Desvaux

(Genotype, *P. veronicoides* Desv., the only original species)

This generic name, appearing in Hamilton's Prodromus Plantarum Indiae Occidentalis, p. 46, 1825, is the oldest applicable to the group to which I have applied the recent name *Lendneria* Minod of 1918. It is a genus of some 20 species, distinguishable from *Stemodia* L., also neotropical, by seeds lined or ridged instead of vestigially reticulate, capsules thinner-walled, bracteoles wanting instead of present beneath sepals, leaf-blades petioled instead of clasping, and usually (but not constantly) by corolla-throat hairy within on the upper instead of the lower side. The following much-described species, a widespread tropical weed, proves to be also in New Guinea.

*1. **Poarium verticillatum** (Miller) comb. nov.

Erinus verticillatus Miller, Gard. Dict. ed. 8. n. 5. 1768. Collected at Vera Cruz in 1731 by William Houstoun; type seen at British Museum in 1930.

This was later described as *Capraria humilis* Ait. (1789), as collected in the East Indies by J. G. Koenig; again as *Stemodia parviflora* Ait. (1812), its best known name and actually based on *Erinus verticillatus;* and finally as *Poarium veronicoides* Desv. from Hispaniola, the type of which, in the Museum d'Histoire Naturelle at Paris, I saw in 1930.

NORTHEASTERN NEW GUINEA: Morobe District, Lae, *Mary S. Clemens 10447* (AA); Malahang Station, mission grounds, *Mary S. Clemens* on May 29, 1940 (ANSP).

2. **Limnophila** R. Brown

Schlechter (in Bot. Jahrb. **59:** 100. 1924) credits four species to New Guinea and the Bismarck Archipelago, distinguishing them by key and giving their occurrence. These are all Indo-Malayan and are presumably immigrants to New Guinea from farther west. Two, *L. aromatica* (Lam.) Merr. and *L. fragrans* (Forst.) Seem., have been already reported from earlier Archbold Expeditions in Brittonia **2:** 181. 1936, and in Jour. Arnold Arb. **20:** 76. 1939. Of these *L. aromatica* appears to occur at low altitudes throughout the island, and it was collected in 1938 on the Balim River (*Brass 11827*). *L. rugosa* (Roth) Merr., probably equally widespread, has been gathered at Hombron Bluff, British New Guinea, by *L. J. Brass* (no. *1651*), and at the Kajabit Mission, Morobe District, Northeastern New Guinea, by *M. S. Clemens* (no. *10437K*), the latter getting it from "girls who prize the fragrant leaves," and the former stating that the natives carry it in their armbands, using it at dances and feasts. Brass reports it as smelling "strongly of aniseed" and describes the flower as with "lavender blue mouth, tube yellow." The remaining species is the widespread oriental aquatic, *L. sessiliflora* (Vahl) Blume.

3. **Adenosma** R. Brown

Schlechter (l. c. 102) credits two species to New Guinea, *A. javanicum* (Bl.) Koord. and *A. papuanum* Schlechter, to which in 1939 I added *A. ternatum* and now propose *A. punctatum*. The first species, an Indo-Malayan plant remarkable for the resemblance of its calyx to the *Bacopa* alliance of neotropical America, is only remotely related to the others. The four may be distinguished as follows:

A. Sepals hirsute, not reticulate, the outer lanceolate to oblong-lanceolate, 2 to 4 times the width of the inner two; flowers in definite spikes, the bracts much smaller than the leaves; capsule sulcate on septal line; leaf-blades dentate; stem erect.
  B. Root perennial; stem hirsute, not glandular.
    C. Leaves ternate, the blades minutely glandular-punctate beneath, 2–2.5 cm. long; corolla 10 mm. long, externally glabrous; capsule 7–8 mm. long.. 1. *A. ternatum.*
    CC. Leaves opposite, the blades with larger glandular dots, 1.2–1.5 cm. long; corolla 7–8 mm. long, externally finely pubescent; capsule 5 mm. long.. 2. *A. punctatum.*
  BB. Root annual; stem finely pilose with glandular hairs; leaf-blades 1.8–2.9 cm. long; corolla 12 mm. long, externally finely glandular-pubescent.. 3. *A. papuanum.*
AA. Sepals finely pubescent, strongly reticulate, the outer widely ovate-cordate, many times the width of the inner two; flowers isolated in axils of the functioning leaves; capsule not sulcate over septum; leaf-blades crenate; stem extensively repent.. 4. *A. javanicum.*

1. **Adenosma ternatum** Pennell in Jour. Arnold Arb. **20:** 77. 1939.

Collected by *L. J. Brass* (no. *7816*) on the Fly River in British New Guinea.

*2. **Adenosma punctatum** sp. nov.

Herba perennis, 3–4 dm. alta, ramosa; caulis et rami teretiusculi, hirsuti, eglandulosi; folia opposita, petiolata, ovata, obtusa, basi rotundato-cuneata, margine dentata, utrinque hirsuto-pubescentia, laminis 1.2–1.5 cm. longis, 9–12 mm. latis, petiolo 5–10 mm. longo; flores inferiores plus minusve remoti, alii in racemum spiciformem congesti; bracteolae duae, lineares, calyce breviores; sepala inaequalia, lanceolata vel lineari-lanceolata, 5–6 mm. longa; corolla 7–8 mm. longa, tubulosa, bilabiata, extus minute pubescens, labio supero apice retuso, labio infero hirsuto, trilobato, lobis retusis; stamina glabra, connectivis globosis, antherarum superarum cellulis aequalibus, sed inferarum uno rudimento inaequalibus; capsula 5 mm. longa, nigra, latere ad septum sulcata, loculicida et tardius etiam septicida; semina 0.3 mm. longa, ovoidea, minute lineata.

Root not seen, but thickened bases with several stems ascending therefrom denote a perennial duration. Stem 3–4 dm. tall or more, branched (many branches abbreviated, forming axillary leafy fascicles, but the upper branches ascending-spreading). Stem and branches slightly angled, laxly foliate. Leaves opposite, petiolate, the blades ovate, obtuse, dentate, above pilose-hirsute, beneath paler and glandular-punctate, hirsute on the larger veins, 1.2–1.5 cm. long, 9–12 mm. wide, at base widely cuneate or rounded to hirsute petioles 5–10 mm. long. Bracts smaller, the upper nearly spatulate and not exceeding the sepals. Lower flowers few and isolated, the upper numerous and forming short spike-like racemes. Lower pedicels becoming 2 mm. long, the upper shorter. Bracteoles linear, shorter than the calyx. Sepals unequal, lanceolate, the inner nearly linear, all obtuse, 5–6 mm. long, hirsute, the uppermost longest and widest, oblong-lanceolate. Corolla 7–8 mm. long, tubular-bilabiate (without record of color), externally finely pubescent; upper lip projecting-arched, its lobes rounded, scarcely distinct at the retuse apex; lower lip 2-ridged and pilose-hirsute thereon, distally with three retuse lobes. Filaments glabrous, the anterior pair longer; connective knob-like; postero-laterals with two nearly equal anther-cells, antero-laterals with one anther-cell developed, the other rudimentary. Stigmas wide, apparently plate-like, the apex of the fused styles thick-winged. Capsule 5 mm. long, conic, distally attenuate, black, firm, laterally furrowed on septum, loculicidal and secondarily somewhat septicidal. Seeds 0.3 mm. long, ovoid, brown, minutely lined.

NORTHEASTERN NEW GUINEA: Morobe District, Malolo Mountains, alt. 240–270 m., *Mary S. Clemens 4359* (AA, TYPE), November 1936, in late flower and fruit.

The name refers to the strong dotting of the leaves, but there are other species, especially *A. glutinosum* (L.) Druce, that show it as pronouncedly.

3. **Adenosma papuanum** Schlechter in Bot. Jahrb. **59**: 103. 1924.

Northeastern New Guinea.

4. **Adenosma javanicum** (Blume) Koorders. See Schlechter, l. c. 102. 1924.

Northeastern New Guinea.

4. **Mella** Vandelli

Differs from *Bacopa* Aubl. (1775) and *Herpestis* Gaertn. fil. (1807) in definitely bilabiate corollas, pinnately veined leaf-blades, and erect habit. I have previously used for this dominantly neotropical genus the name *Caconapea* Cham. (1833), the earliest typifiable generic name, since *Mella* (Vand. Fl. Lusit. et Bras. 43. 1788) appeared without citation of species. The latter would therefore be invalid under the American Code but valid under the new International Rules of Botanical Nomenclature. There are a few oriental species, the following extending to New Guinea and northern Australia.

1. **Mella floribunda** (R. Br.) comb. nov.

Herpestis floribunda R. Br. Prodr. Fl. Nov. Holl. **1**: 442. 1810.

Originally described from tropical northeastern Australia. Collected in British New Guinea by L. J. Brass, no. *3730*, and reported as *Bacopa floribunda* in Brittonia **2**: 181. 1936.

*5. **Mazus** Loureiro

Both Brass' and Mrs. Clemens' collections bring this genus into the flora of New Guinea, its representative being the common tropical weed that has been included in *M. japonicus* (Thunb.) Kuntze, but which seems to be separable by the following contrast:

A. Leaf-blades widely oblong to nearly oval, cuneately narrowed to petioles often as long as the blades; lower pedicels usually longer than the calyces; plants (stems, leaves, pedicels, and calyces) minutely, and scarcely or not glandularly, pubescent, or (especially the leaves) glabrous.................... *M. japonicus*.

AA. Leaf-blades oblanceolate to narrowly obovate, primarily runcinate-lobed, attenuate to ill-defined petioles; lower pedicels usually about equaling the calyces; plants hirsute-pubescent, the hairs largely glandiferous............... *M. goodenifolius*.

Mazus japonicus, described from Japan, is mainly a plant of warm temperate climates, and has become adventive to the New World. *M. goodenifolius* is more definitely tropical and oriental. I had suspected that it would prove to be Loureiro's *rugosus* from Cochinchina, but his description of the leaf-shape precludes that possibility.

*1. **Mazus goodenifolius** (Hornemann) comb. nov.

Gratiola goodenifolia Hornemann, Enum. Pl. Hafn. 19. 1807. Original description not seen, but its diagnosis[5] quoted in Willd. Enum. Pl. Hort. Berol. 654. 1809, where it is included as a synonym of *Hornemannia bicolor* Willd., there described from "India orientalis." I suspect from the alteration of Willdenow's primary diagnosis to "H. foliis obovatis basi integerrimis, calycibus patulibus pedunculisque glabris," that the latter was based primarily upon material of *M. japonicus*, since the omitted account of an incised-serrate narrow leaf-blade would denote the plant now considered, while the allusion to glabrous pedicels and calyces could only be to *M. japonicus*. In both the corolla would be bicolorous, the upper lip blue, the lower white.

An oriental weed, widespread over New Guinea. Collected in 1938 by L. J. Brass in Netherlands New Guinea, no. *11403* from Bele River, northeast of Lake Habbema, and no. *12925* from Bernhard Camp on the Idenburg River. Also gathered by Mary S. Clemens in the Morobe District of Northeastern New Guinea, no. *4975* in 1937 from Ogeramnang, and no. *11286F* in 1940 from Matap.

6. **Artanema** D. Don

(Genotype, *Torenia fimbriata* Hook., from Australia.)

1. **Artanema longifolium** (L.) Vatke.

Earlier than my record (in Jour. Arnold Arb. **20**: 78. 1939), this wide-ranging Indo-Malayan plant had been gathered by Branderhorst in 1907 at Merauke in southeastern Netherlands New Guinea and reported by Diels and Lanjouw in Nova Guinea Bot. **14**: 534. 1928.

7. **Lindernia** Allioni

With the including of *Ilysanthes* Raf. and the arising of several problems of interpretation, it seems desirable to consider this genus rather fully. The following key distinguishes all species that I have seen from New Guinea.

A. Capsule globose to ellipsoid-ovoid, not or only slightly exceeding the calyx; anterior filaments bearing anthers.

B. Sepals united about ⅔ their length, glabrous................ 1. *L. crustacea*.

[5]"Gratiola (*goodenifolia*) foliis obovato-lanceolatis inciso-serratis basi integerrimis, racemis terminalibus."

BB. Sepals distinct nearly to base.

C. Leaf-blades oval to ovate, crenate-serrate to nearly entire, rounded or subcordate at base; bracts oval, the flowers axillary; capsule semiglobose; corolla 9–10 mm. long; sepals and angles of stem hirsute with long nonglandular hairs, the divaricate pedicels nearly glabrous........2. *L. hirta*.

CC. Leaf-blades ovate to nearly oblong, serrate-dentate; bracts subulate, the flowers in evident racemes; capsule ellipsoid-ovoid to ovoid; corolla 3–5 mm. long; pedicels glandular-puberulent or -pubescent.

D. Sepals hirsute with mostly glandless hairs; entire surface of stem and leaves hirsute with spreading glandless hairs, the main blades usually 3–6 cm. long and narrowed at base, only the uppermost rounded-cordate and sessile..3. *L. viscosa*.

DD. Sepals sparsely glandular-puberulent to glabrous; angles of stem sharp and with ascending short and stiff glandular hairs; leaf-blades glabrate (except for such lines on main veins beneath), usually narrower and smaller (1–2 cm. long), only the lower narrowed at base, the others rounded to sessile bases.............................4. *L. papuana*.

AA. Capsule much longer than wide, much exceeding the sepals, which are distinct nearly to base.

B. Leaf-blades sessile or clasping; corolla 5–10 mm. long; stems ascending or erect, often rooting at lower nodes.

C. Blades ovate to lance-ovate, crenate, rounded or cordate at base; anterior filaments anther-bearing; corolla 10 mm. long............5. *L. cordifolia*.

CC. Blades oblong to oblanceolate, usually narrowed at base; anterior filaments without anthers; corolla smaller.

D. Margin of blades crenate to dentate, the teeth appressed and not prolonged; corolla 7–8 mm. long.........................6. *L. anagallis*.

DD. Margin of blades sharply and deeply serrate, the teeth spreading and prolonged into setaceous tips; corolla 5 mm. long.........7. *L. ciliata*.

BB. Leaf-blades petioled, elliptic, sharply serrate, but the teeth not setaceous-tipped; corolla 13–15 mm. long; anterior filaments without anthers; stems extensively repent, the flowering portions abruptly erect......8. *L. antipoda*.

1. **Lindernia crustacea** (L.) F. v. Muell.

This widespread tropical weed, cited by Schlechter (l. c. 106) and me (in Brittonia **2:** 181. 1936, in Jour. Arnold Arb. **20:** 79. 1939) from many localities throughout New Guinea, is among Mrs. Clemens' recent collections from Morobe; there are also several collections made by Netherlands botanists in western New Guinea at the Gray Herbarium.

2. **Lindernia hirta** (Cham. & Schlecht.) comb. nov.

Gratiola pusilla Willd. cur. L. Sp. Plant. ed. 4. **1:** 105. 1797. "Habitat in India ad scaturigines." Descriptive of a small plant of the species now considered. Basis of *Lindernia pusilla* (Willd.) Schlechter in Bot. Jahrb. **59:** 106. 1924, unfortunately preoccupied by *L. pusilla* (Thunb.) Merr. in Philip. Jour. Sci. Bot. **11:** 312. 1916 [1917]. Although intended for the present species and citing *Gratiola pusilla* Willd. as a synonym, the latter was based upon *Selago pusilla* Thunb. Prod. Plant. Cap. 99. "1794–1800," the part containing p. 99 actually published in 1800; Thunberg's brief diagnosis "S. foliis ovatis serratis pilosis, flore terminali subsolitario" is impossible for our plant, as this has leaf-blades crenate to entire and an inflorescence of several pairs of long-pediceled flowers, while its occurrence is far from South Africa.

Torenia hirta Cham. & Schlecht. in Linnaea **2:** 571. 1827. "E. Luconia retulimus"; collected by Chamisso & Eschscholtz on the Romanzoff Expedition. Clearly the species now considered.

Vandellia scabra Benth. Scroph. Indicae 36. 1835. The name long applied to this species.

Recorded by Schlechter (l. c. 107) from the Bismarck Archipelago, and recently collected at Boana, Morobe District, Northeastern New Guinea, by Mary S. Clemens, no. *41468a* (Mich); also at Balim River, Netherlands New Guinea, by L. J. Brass, no. *11821* (AA, ANSP).

*3. **Lindernia viscosa** (Hornemann) Boldingh, Zakfl. Landbouwstr. Java 165. 1916, nomen; Merrill, Enum. Philip. Fl. Pl. **3:** 439. 1923, cum syn.[6]

Gratiola viscosa Hornemann, Enum. Pl. Hort. Hafn. 19. 1807. Description seen as quoted in account of *Hornemannia viscosa* (Hornem.) Willd. Enum. Pl. Hort. Berol. 654, 1809, where its habitat was given as "in India orientali." Descriptive of the species now considered in its leaves serrate and hispid, the uppermost cordate and sessile, the flowers racemose and decussate, and the peduncles viscid. On this we can only assume that *Lindernia viscosa* Boldingh was based; Merrill independently made the transfer in 1923, adding the name-bringing synonym.

Vandellia hirsuta Buch. Ham. ex Benth. Scroph. Indicae 36. 1835. The specific epithet long applied to this species, and more appropriate in its allusion to the copious hairiness rather than to the obscure glandularity.

A common Indo-Malayan species occurring east to western New Guinea, as shown by specimens in the Gray Herbarium from Manokoeari (*R. F. Janowsky 502*) and Piorienbivak near the Mamberamo River (*H. J. Lam 509*), Netherlands New Guinea.

*4. **Lindernia papuana** sp. nov. Plate I, A.

Herba annua, 0.5–1 dm. longa, ramosissima; caulis quadrangulatus, angulis hispidulus; folia oblongo-ovata, acuta, serrato-dentata, glabrata (subtus proxime venis hispidula), laminis 1–2 cm. longis, 6–8 mm. latis,

[6] In Boldingh's "Zakflora voor de Landbouwstreken op Java," Batavia, i–viii. 1–204, October, 1916, a number of new binomials appear in his key to the families, genera, and species but in no case are these names indicated as new, nor in any case is a name-bringing synonym given; they are merely followed by the abbreviation "Bold.," and appear in the work only as follows:

"Bloeiwijze bijna geheel zonder bladen.................... *Lindernia viscosa* Bold.
Bloemen in de bladokzels van goed ontwikkelde bladen.... *Lindernia pusilla* Bold."

In so far as Boldingh's binomials were actually new, they were entered in Index Kewensis, Suppl. 9, 1935. Those in the Scrophulariaceae are *Ilysanthes procumbens* Bold. p. 164, and *Lindernia viscosa* Bold., *L. pusilla* Bold., *Microcarpaea minima* Bold., and *Stemodia verticillata* Bold. p. 165. It is manifest that Boldingh attempted to detect and to use the earliest published specific name in each case that was valid under the generic names accepted by him, but it is most unfortunate that he failed to indicate the original sources of these names. Strictly in accordance with the rules it is doubtful if these Boldingh names of 1916 should be accepted as validly published, due to their presentation in a most unorthodox manner. His method of publication transcends the provision of the International Code of Botanical Nomenclature that requires, in transferring specific names from one genus to another, that the name-bringing synonym must be cited. They may be considered as illegitimate names, but in view of the fact that they are now listed in Index Kewensis, Suppl. 9, 1938, sometimes with the name-bringing synonym added, it does seem desirable to accept them and to complete the record as has been done in this case. To complete the record in all cases will be difficult, for in the case of *Lindernia pusilla* Bold., who can say whether it was his intent to base this on *Gratiola pusilla* Willd. (1797), or on *Selago pusilla* Thunb. (1800), or on both? The Willdenow and Thunberg entities are actually two entirely different species; the first is a *Lindernia,* but the second apparently does not belong in this genus. As published by me in 1916 [1917], *Lindernia pusilla* Merr. must be typified by *Selago pusilla* Thunb., and the entry in Index Kewensis, Suppl. 9, 1938, for the combined Boldingh-Merrill transfers cites Thunberg's name as the one synonym.— E. D. Merrill.

basi rotundatis, sessilibus; racemus terminalis, florum 3–7 paribus compositus, sparse glandulari-puberulentus; bracteae subulatae; pedicelli 5–8 mm. longi, adscendentes; sepala 2.5 mm. longa, lineari-lanceolata, acuta, glabrata; corolla 3–4 mm. longa, alba, glabra, labio supero rotundato fere integro, labio infero trilobato, lobis triangulari-ovatis; stamina glabra, omnia antherifera; capsula 2.5 mm. longa, ellipsoideo-ovoidea, glabra; semina 0.25 mm. longa, flava, cylindrica, truncata, obsolete reticulata.

Low much-branched herb. Stems diffusely ascending, 0.5–1 dm. long, four-angled, the angles slightly winged and bearing ascending short stiff glandless hairs. Leaf-blades oblong-ovate, serrate-dentate, obscurely and callosely ciliate, glabrate, beneath slightly paler and proximally with veins somewhat stiff-pubescent, mostly 1–2 cm. long, 6–8 mm. wide, rounded to sessile bases, only the lower attenuate proximally. Inflorescence a raceme of 3 to 7 pairs of flowers, the rachis and pedicels sparsely glandular-puberulent, the latter ascending, 5–8 mm. long; bracts (above the short wide lowermost one) subulate, 0.5–1.5 mm. long. Sepals 2.5 mm. long, linear-lanceolate, acute, minutely and obscurely pilose to glabrous. Corolla 3–4 mm. long, white, glabrous, the tube slightly widened horizontally, anteriorly 2-ridged; upper lip scarcely retuse at the truncately rounded apex, the lower slightly longer, the lobes triangular-ovate, widely deflexed-spreading. All filaments antheriferous, the posterior short, ascending, the anterior forming by their attachment the antero-lateral ridges of the corolla that distally project as minute rounded knobs, the free distal portions of the filaments arched-ascending. Capsule 2.5 mm. long, ellipsoid-ovoid, glabrous. Seeds 0.25 mm. long, yellow, cylindric, truncate, obsoletely reticulate.

NORTHEASTERN NEW GUINEA: Morobe District, Kajabit Mission, alt. about 300 m., *Mary S. Clemens 10907* (ANSP, TYPE, AA), Dec. 25, 1939, in flower and fruit (forming loose spreading mats along margin of slow rivulet). NETHERLANDS NEW GUINEA: Near Pioniorbivak, alt. 60 m., region of Mamberamo River, *H. J. Lam 511* (GH).

In Schlechter's account this was called *Lindernia trichotoma* (Benth.) Schlechter, based upon *Tittmannia trichotoma* Benth. in Wall. Numer. List no. 3943. 1831, a ***nomen nudum***. That would be identical with the Indian species long known as *Vandellia multiflora* (Roxb.) G. Don, based upon *Torenia multiflora* Roxb. Fl. Ind. **3:** 96. 1832, a plant described as with smooth stem and merely subserrate leaves, agreeing with J. D. Hooker's statement that the leaves of the Bengal plant are entire or sinuate. Evidently the Papuan plant, with its stiffly hairy stem and rather sharply serrate-dentate leaves, cannot be this, nor do I identify it with any other known species.

5. **Lindernia cordifolia** (Colsmann) Merrill.
Gratiola cordifolia Colsmann, Prodr. Descr. Grat. 15. 1793; repr. in Archiv Bot. **2:** 244. 1799. "Habitat in graminosis humidiusculis Zeylon[a]e [a *D. König* collecta]." Leaf-blades described as "obsolete serratis."

The plant, represented by *Brass 5918*, from Dagwa, Oriomo River, British New Guinea, appears to be this well-known Indo-Malayan species rather than *Lindernia angustifolia* (Benth.) Wettst., as identified by me in Brittonia **2:** 182. 1936.

6. **Lindernia anagallis** (Burman f.) comb. nov.
Ruellia anagallis Burman f. Fl. Ind. 135. 1768. "Habitat in Java and Amboina."

Based upon plants collected in Java by Kleinhof and on Rumphius' description and illustration of the Amboina form, the latter because of the illustration being taken as the type. Unfortunately, the Academy lacks vol. 5 of Rumphius' Herbarium Amboinense, but Merrill's Interpretation of that work (p. 467. 1917) has identified Rumphius' plant as the species now considered. Also, Dr. Merrill has kindly supplied me with a tracing of Rumphius' figure. In a special paper on the species proposed by Burman f. (in Philip. Jour. Sci. **19:** 381. 1921), he says of *Ruellia anagallis*: "Burman's species is clearly identical with the very common and widely distributed form currently known as *Bonnaya veronicaefolia* Spreng." (As will be shown below, I think that Merrill was mistaken in identifying as this plant the older *Ruellia antipoda* L.; nor is it *Gratiola veronicifolia* Retz., either).

A common Indo-Malayan weed, extending east to New Guinea. This is the plant called *Ilysanthes veronicaefolia* (Retz.) Urb. by Schlechter (l. c. 108), who cites specimens from many parts of New Guinea, while I (in Brittonia **2:** 182. 1936, in Jour. Arnold Arb. **20:** 81. 1939) have cited further specimens from British New Guinea under the names "*veronicaefolia*" and "*antipoda*." Further collections are now at hand, viz. *Clemens 10830a* and *40615* (Mich) from the Morobe District of Northeastern New Guinea, and several specimens (GH) made by Netherlands collectors in western New Guinea.

7. **Lindernia ciliata** (Colsmann) comb. nov.

Gratiola ciliata Colsmann, Prodr. Descr. Grat. 14. 1793; repr. in Archiv Bot. **2:** 243. 1799. "E. Java. *Königius* non invenit." An excellent description of the species now considered.

A common Indo-Malayan plant that appears barely to reach New Guinea. This was reported by Schlechter (l. c. 109) as *Ilysanthes ciliata* from "Waighiou" Island, on the northern shore of Netherlands New Guinea.

8. **Lindernia antipoda** (L.) Alston.

Ruellia antipoda L. Sp. Pl. 635. 1753. "Habitat in Indiis." Based primarily upon account in L. Fl. Zeyl. 106. 1748. The latter careful description states that the leaves are oval, acutely and deeply serrate especially toward apex, at base narrowed, the stem is repent, the pediceled flowers several (5) to a raceme, the capsule thrice as long as the calyx, and the flowers relatively large (being like those shown in Rheede's Hort. Malabar. **9:** 113. *tab. 58.* 1689, but four times larger). All these details are clearly distinctive of the species now considered.

Gratiola veronicifolia Retz. Observ. Bot. **4:** 8. 1786. Clearly identical with *Ruellia antipoda,* as was recognized by Vahl, Enum. Plant. **1:** 98. 1805.

Gratiola ruelloides Colsmann, Prodr. Descr. Grat. 12. 1793; repr. in Archiv Bot. **2:** 243. 1799. "Habitat in Java et India orientali." Clearly distinctive of the species now considered. The name chosen leads me to suppose that Colsmann realized the identity of this with *Ruellia antipoda*. Based upon this is *Ilysanthes ruelloides* (Colsmann)[7] Schlechter in Bot. Jahrb. **59:** 109. 1924, the name used by him for the species now considered.

Gratiola reptans Roxb. Fl. Ind. cur. Carey **1:** 140. 1820. "A native of the Moluccas; from thence introduced into the [Calcutta] Botanic Garden." Descriptive of the species now considered, and giving the color as corolla "pale bluish pink," upper lip "of one pale segment," and lower lip as "broad, deeper coloured." *Bonnaya reptans* (Roxb.) Spreng., based upon this, has been the name longest used for this species.

A common Indo-Malayan weed, extending east to New Guinea. Re-

[7]With citation of "König" rather than "Colsmann."

ported by Schlechter (l. c. 109) from Netherlands and Northeastern New Guinea, and by me (in Jour. Arnold Arb. **20:** 81. 1939) from British New Guinea. Recently collected by Mrs. Clemens, at Wantoal, no. *41093* (AA), and at Boana, no. *41083* (Mich), both in the Morobe District of Northeastern New Guinea.

8. **Torenia** Linnaeus

This extensive Oriental genus is represented by at least three species in New Guinea.

Although a sharp line between *Lindernia* (in its present enlarged sense) and *Torenia* is not easy to draw, I think that the two should be considered as generically distinct. Usually they are readily distinguishable by the calyx consisting of separate or only slightly united plane sepals in *Lindernia,* whereas in *Torenia* the sepals are united nearly throughout and have the midvein of each raised into a ridge or a wing. But, in *Lindernia, L. crustacea* has sepals united over half their length, while in *Torenia* the sepal-ridges may be mere ribs, as in the case of *T. crenata,* below. In *Torenia* the corolla is usually larger and with angular open throat, whereas in *Lindernia* it is usually smaller and with flattened throat. Finally, in *Torenia* one finds in most species a racemose inflorescence or one contracted therefrom, in which the bracts are linear and much smaller than the foliage leaves, whereas in *Lindernia* the bracts are usually foliose. In our first species, *Torenia crenata,* the small flowers, unwinged calyx, and foliose bracts all led me to consider it a *Lindernia,* but I now incline to place generic value on another feature of the calyx. In *Lindernia* the sepals, whether distinct or joined, do not invest the capsule, but have their tips somewhat spreading, whereas in *Torenia* the sepals do invest the capsule, being curved about it and with their connivent tips projecting above it. On this understanding our first species will find its place in *Torenia.* It shows that in that genus too there is a tendency toward the suppression of the anthers of the anterior pair of stamens.

A. Calyx hirsute, the mid-veins of the sepals merely rib-like; corolla 7–8 mm. long, violet; attached portions of anterior filaments projecting as short knobs; pedicels over twice the length of the calyces; bracts foliaceous, the inflorescence clearly racemose; leaf-blades crenate, cuneately narrowed to the short petioles; stem erect, with ascending branches. . . . . .1. *T. crenata.*

AA. Calyx finely pubescent or glabrous, the mid-veins of the sepals raised into thin wings; corolla larger; attached portions of anterior filaments not projecting; pedicels less than twice the length of the calyces; bracts subulate, the inflorescence (by suppression of an internode) usually seeming a 4-flowered cyme; leaf-blades dentate, the larger truncate to petioles at least ⅓ length of blades.

B. Corolla 15–17 mm. long, violet or white; fruiting calyx narrowly ovoid, 15–16 mm. long, with 5 wings; leaf-blades acute, serrate-dentate, 3–4 cm. long; stem erect, laxly branched. . . . . .2. *T. violacea.*

BB. Corolla 10 mm. long, pink; fruiting calyx nearly circular, 6–8 mm. long, with 3 wings; leaf-blades obtuse, crenate-dentate, 1–2 cm. long; stem extensively repent, the flowering branches ascending or erect. . . .3. *T. polygonoides.*

1. **Torenia crenata** (Pennell) comb. nov. PLATE I, B.

Lindernia crenata Pennell in Jour. Arnold Arb. **20:** 79. 1939. Lake Daviumbu, Middle Fly River, British New Guinea, *L. J. Brass 7824.* Known only from the original collection.

2. **Torenia violacea** (Azaola) comb. nov.
Mimulus violaceus Azaolo ex Blanco, Fl. Filip. ed. 2. 357. 1845. "Descubierta y descrita por el *Sr. Azaola,* ex Calauan." For identification of the species now considered see Merrill, Species Blancoanae 347. 1918. Although not adopted by Merrill, his evidence makes it necessary to take this as the earliest described name.
Torenia exappendiculata Regel in Acta Hort. Petrop. **5:** 271. 1877. "Ex horto Parisiensi accepimus. Patria verosimiliter India orientalis." Described as with small white flowers.
Torenia peduncularis Benth. in Wall. Numer. List, no. 3956. 1831, *nomen nudum* ("Maulmyne in Martabanica 1827"); Hook. f. Fl. Brit. Ind. **4:** 276. 1884. The latter cites specimens from Nepal to Assam and Penang, and credits the species also to Java and the Philippine Islands. Flowers described as "pale blue," but with white-flowered synonym, *T. alba* Ham., from Wallich's List. *Torenia peduncularis* is the name under which our species has been universally known.

A weedy plant, widespread over the Indo-Malayan subregion, and doubtfully extending east to New Guinea. Reported by Schlechter (l. c. 104) from Netherlands and Northeastern New Guinea; a single collection from the vicinity of Manokoeari, Netherlands New Guinea (*R. F. Janowsky 506*), is in the Gray Herbarium. This, however, is a small plant, less than 1 dm. tall, more hairy, with smaller, narrower, more closely serrate leaf-blades, and smaller corollas (10–12 mm. long) and calyces (11–12 mm. long). Perhaps it will prove distinct from the Indo-Malayan species, as is suggested by Schlechter's comment that it seldom exceeds 1.5 dm. in height, a small stature for *T. violacea.* The only other specimen seen associable with it is from Bali (*C. R. G. J. van Steenis 7588*), at the Gray Herbarium. The problem can be solved only by someone with much more material for consideration than is available in this country.

3. **Torenia polygonoides** Benth.
Torenia polygonoides Benth. in Wall. Numer. List, no. 3897. 1830, *nomen nudum* ("Singapur 1822"), Scroph. Indicae 39. 1835. "Hab. ad Singapore, *Wallich.*"

A widespread Indo-Malayan species. Reported by Schlechter (l. c. 104) from Northeastern and by me (in Jour. Arnold Arb. **20:** 78. 1939) from British New Guinea.

9. **Detzneria** Schlechter

(Genotype, *D. tubata* Diels, of New Guinea)

A monotypic genus of Northeastern New Guinea.

1. **Detzneria tubata** Diels in Bot. Jahrb. **62:** 491. 1929.

Saruwaket Range, Northeastern New Guinea, at 3600 to 4000 meters altitude.

10. **Hebe** Commerson

This austral genus, so highly developed in New Zealand, is evidently one of the most characteristic groups of alpine heights in New Guinea. With the first species published in 1889 and only four described before 1930 the Archbold Expeditions have raised the number from New Guinea to twelve. Many more will appear as other alpine areas are reached, as each isolated highland has evidently developed its own species. The following key contrasts those known to date.

A. Leaf-blades serrate-dentate, the teeth obtuse or acutish; petioles more spreading; pubescence of stem and inflorescence of upcurved hairs.

B. Serrations spreading, the leaf-blades sharply toothed; peduncles 10–30 mm. long, less than twice length of bracts; sepals lanceolate to narrowly ovate, somewhat pubescent; corolla red or reddish.

C. Corolla red, its lobes as wide as or wider than long; sepals elliptic-ovate; peduncles spreading; leaf-blades narrowly elliptic, 1.5–2 cm. long, on evident spreading petioles; rachis and pedicels pubescent with upcurved brown hairs....................1. *H. rubra.*

CC. Corolla pale pink, its lobes longer than wide; peduncles ascending; sepals and leaf-blades elliptic-lanceolate, 0.5–1 cm. long, on ascending petioles; rachis and pedicels pubescent with upcurved brownish or grayish hairs....................2. *H. thymelaeoides.*

BB. Serrations ascending or appressed, the leaf-blades more obscurely toothed; leaves loosely set, the blades not or only slightly longer than the internodes; peduncles ascending, 30–50 mm. long, 2 to 4 times the length of the bracts; sepals narrowly obovate-elliptic to elliptic, glabrous; corolla white....................3. *H. albiflora.*

AA. Leaf-blades crenate-serrate to entire, the teeth rounded.

B. Leaf-blades oval to elliptic-oblong, evidently crenate-serrate or crenate.

C. Rachis and pedicels with brown spreading hairs; petioles very short and wide, ascending against stem;[8] leaves not glutinous.

D. Corolla and sepals externally pubescent; leaves lanceolate- to orbicular-ovate, 0.8–1.5 cm. long....................4. *H. Lendenfeldii.*

DD. Corolla externally glabrous; sepals glabrous or ciliate.

E. Corolla pinkish or white, 8–14 mm. long; peduncles 20–40 mm. long, the rachis elongating; leaf-blades flat.

F. Sepals partially ciliate to usually glabrous; pedicels equaling or longer than the bractlets; leaf-blades elliptic to elliptic-oblong, 7–16 mm. long; stem distally and inflorescence rufous-pubescent.

G. Racemes mostly 5–10-flowered, the pedicels short in small-fruited forms, becoming 15–18 mm. long in large-fruited forms; capsule no wider than long, its narrow basal portion flattened-constricted; leaf-blades crenate-serrate about ⅔ their length, the midrib evident....................5. *H. polyphylla.*

GG. Racemes fewer-flowered, the pedicels to 9 mm. long; capsule wider than long; leaf-blades crenate beyond the middle, the midrib scarcely evident....................6. *H. carstensensis.*

FF. Sepals ciliate throughout; pedicels shorter than the bractlets; leaf-blades oval or elliptic, 6–9 mm. long; stem and inflorescence more finely pubescent and with paler hairs....................7. *H. ciliata.*

EE. Corolla dark purple, 7–8 mm. long; racemes 1–3-flowered; peduncles 5–12 mm. long, the rachis short, the pedicels reaching 5–7 mm. long; capsule obovoid, rounded to base; leaf-blades crenate-serrate above the cuneate base, somewhat involute....................8. *H. rigida.*

CC. Rachis and pedicels with ascending or appressed hairs; leaves glutinous (at least in *H. Brassii* and *H. tenuis*).

D. Hairs of inflorescence brown, upcurved-ascending; sepals ciliate and pubescent on midrib externally; corolla red, 9–10 mm. long; leaf-blades 0.7–0.9 cm. long, the petioles very short, ascending-appressed, ciliate; stems stout, erect, 2–3 dm. tall, the leaves as long as the internodes....................9. *H. Brassii.*

[8]This assumed to be probably true for *Hebe Lendenfeldii,* described as with leaves "on very short stalks," and for *H. carstensensis* with leaves "sessile."

DD. Hairs of inflorescence grayish, minute, incurved-appressed;[9] sepals minutely ciliolate; leaf-blades 0.6–0.7 cm. long, the petioles more evident, ascending-spreading, glabrous; stem slender, diffuse, smaller, the leaves shorter than the internodes.

E. Corolla white, 6–7 mm. long; flowers several, in a pair of long-peduncled racemes at the apex of the uniformly finely pubescent stem..10. *H. tenuis.*

EE. Corolla purple (magenta), 8–9 mm. long; flower solitary[10] at the apex of the bifariously puberulent stem........11. *H. Vanderwateri.*

BB. Leaf-blades narrowly lanceolate, obscurely crenulate to nearly entire; corolla 12 mm. long; stems and branches densely foliose, shortly and densely pubescent..12. *H. diosmoides.*

1. **Hebe rubra** Pennell in Brittonia **2**: 184. 1936. PLATE II, A.

BRITISH NEW GUINEA: Mt. Albert Edward, *L. J. Brass 4295* (TYPE) and *5677;* Murray Pass, Wharton Range, *Brass 4620.*

2. **Hebe thymelaeoides** Pennell in Brittonia **2**: 186. 1936. PLATE II, B.

BRITISH NEW GUINEA: Mt. Albert Edward, *L. J. Brass 4296* and *4297* (TYPE).

*3. **Hebe albiflora** sp. nov. PLATE III, A.

Frutex ramosissimus, 6–9 dm. altus; caulis pilis adscendentibus-incurvis brunneus; folia oblongo-lanceolata, acuta, serrato-dentata, fere glabra, subtus pallida, majora 2 cm. longa, 7–8 mm. lata; racemi 6–8 floribus compositi; sepala 4–4.5 mm. longa, elliptico-oblanceolata, glabra; corolla 7–8 mm. longa, alba, late campanulata, glabra; capsula 4 mm. longa, globoso-ovoidea; semina 0.5 mm. longa, circularia, laevia, complanata.

Stiff, much-branched shrub, 6–9 dm. tall, loosely foliose. Stem distally pubescent with brownish upcurved hairs, the old bark becoming glabrate. Leaves numerous, not or only slightly longer than the internodes, the blades oblong-lanceolate, acute, serrate-dentate throughout with low teeth, flat, dark green and glabrous above, beneath pale and with pilose midrib, 2 cm. long, 7–8 mm. wide, at base rounded to pubescent petioles 2–3 mm. long. Racemes brown-pubescent (with incurved hairs), 6–8-flowered, elongated, the peduncle becoming 30 to 50 mm. long, the pedicels 5–8 mm. long, slightly exceeding the lance-oblong bractlets. Sepals 4–4.5 mm. long, elliptic-oblanceolate, acute, glabrous. Corolla 7–8 mm. long, white, widely campanulate, glabrous throughout, the upper lip obovate-circular, the three lower lobes slightly narrower, nearly elliptic. Stamens glabrous throughout, the anthers about half the length of the filaments. Capsule 4 mm. long, globose-ovoid. Seeds 0.5 mm. long, circular, flattened, brown.

NORTHEASTERN NEW GUINEA: Morobe District, Ulap Trail, Matap, alt. 1500–1800 m., *Mary S. Clemens 11347* (AA, TYPE), Feb.–April 1940, in flower.

4. **Hebe Lendenfeldii** (F. v. Muell.) Pennell in Brittonia **2**: 184. 1936.

Based upon *Veronica Lendenfeldii* F. v. Muell. in Trans. Roy. Soc. Victoria **1**(2): 29. 1889, describing a plant collected by Sir William MacGregor in 1889 on Mt. Victoria in British New Guinea.

*5. **Hebe polyphylla** sp. nov. PLATE III, B.

Frutex ramosissimus, 2–8 dm. altus; caulis pilis patentibus ferrugineus; folia multa, elliptico-oblonga, obtusa, crenato-dentata, glabra, majora 0.7–1.6 cm. longa, 5–7 mm. lata; racemi 5–10 floribus compositi; sepala

[9]Pedicels of *Hebe Vanderwateri* described as "fein bestäubt."

[10]"Semper?", asks Wernham.

4–5 mm. longa, oblonga, irregulariter ciliata; corolla 8–11 mm. longa, alba, late campanulata, glabra; capsula 2–4 mm. longa, obovoidea.

Stiff, much-branched shrub, 2–8 dm. tall, the upper branches ascending, densely foliose, the lower slender, diffusely spreading, with longer internodes and pairs of minute subulate leaves. Stem distally pubescent with ferruginous spreading hairs, below that bifariously so but on the proximal half glabrate or glabrous. Leaves numerous, and close-set by reason of the short internodes, the lower stem marked by the slightly raised petiole-rudiments of the fallen leaves: blades elliptic-oblong, obtusely rounded, crenate-dentate, flat, glabrous, 0.7–1.6 cm. long, 5–7 mm. wide, at base semi-petiolate (cuneately narrowed with entire ciliate margins) to a clasping base. Racemes brown-pubescent, 5–10-flowered, elongated, the peduncle becoming 20 to 40 mm. long, the pedicels 3–18 mm. long, about equaling to much longer than the linear-oblong bractlets. Calyx spongy (as judged by irregular wrinkling in drying) at base, the sepals (free above base) oblong, rounded, irregularly ciliate (mostly at apex), 4–6 mm. long. Corolla 8–15 mm. long, white, pinkish-tinged, widely campanulate, glabrous throughout, the upper lip nearly circular, the three lower lobes obovate-semicircular. Stamens glabrous, the anthers about ⅓ the length of the filaments. Capsule 2–6 mm. long, obovoid.

NETHERLANDS NEW GUINEA: 5 miles northeast of summit of Mt. Wilhelmina, alt. 3440 m., *L. J. Brass 9401* (AA, TYPE, ANSP), Aug. 1938, in flower and fruit (along streams in grassland); Snow Mountains, on and near Mt. Wilhelmina (seen also from 3 miles east of that summit), *Brass 9414* (AA, ANSP), and 7 km. northeast of summit, *Brass & Myer-Drees 9934* (AA, ANSP).

6. **Hebe carstensensis** (Wernham) Diels in Bot. Jahrb. **62**: 491. 1929.

Based upon *Veronica carstensensis* Wernham in Trans. Linn. Soc. II. Bot. **9**: 121. 1916, describing a plant collected by C. Boden Kloss in 1912–13 on Carstensz Peak, Snow Mountains (Nassau Range), Netherlands New Guinea.

*7. **Hebe ciliata** sp. nov. PLATE IV, A.

Frutex ramosus, 2–6 dm. altus; caulis pilis brevibus patentibus brunneus; folia multa, ovalia vel inferiora elliptica, obtusa, crenato-dentata, glabra glabratave, majora 0.6–0.9 cm. longa, 5–7 mm. lata; racemi 4–8 floribus compositi; sepala 4–5 mm. longa, obovato-oblonga, ciliata; corolla 7–8 mm. longa, pallide violacea vel alba, late campanulata, glabra; capsula 2–3 mm. longa, obovoidea.

Stiff shrub, 2–6 dm. tall, the rigid stems ultimately erect, the upper branches ascending-erect and densely foliose, the lower slender, diffusely spreading, with longer internodes and pairs of minute subulate leaves. Stem pubescent with short brown spreading hairs, proximally glabrescent or glabrate. Leaves numerous and close-set (the short internodes of the lower part of the stem marked as in the other species), the blades oval or the lower elliptic, obtusely rounded, crenate-dentate, flat, glabrous (or sometimes pubescent beneath on the obscure midrib), 6–9 mm. long, 5–7 mm. wide, at base widely cuneate to the ill-defined short entire ciliate petioles. Racemes brownish-pubescent, 4–8-flowered, elongated, the peduncle becoming 20–25 mm. long, the pedicels 2–5(–7) mm. long, mostly shorter than the obovate-oblong bractlets. Calyx spongy at base, the sepals 4–5 mm. long, obovate-oblong, obtusely rounded, ciliate throughout.

Corolla 7–8 mm. long, pale violet-purple to white, widely campanulate, glabrous throughout, the upper lip nearly circular, the three lower lobes nearly as large. Stamens glabrous, the anther less than half the length of the filament. Capsule 2–3 mm. long, obovoid.

NETHERLANDS NEW GUINEA: Mt. Wilhelmina, alt. 3400 m., *L. J. Brass & E. Myer-Drees 9682* (AA, TYPE, ANSP), Sept. 1938, in flower and fruit (rather wet grassy place along a small river, the whole plant apparently somewhat violet-tinged, the corolla being pale violet within and nearly white externally); Mt. Wilhelmina, alt. 3900–4250 m., alpine grassland, northern slopes, *Brass & Myer-Drees 10092, 10094* (both AA, ANSP), southern slopes, *Brass & Myer-Drees 10098, 10101, 10104* (all AA, ANSP). No. *10092* differs from the others in the ciliation of the sepals being shorter and partial (as in other species), but the leaf-blades are oval as in *H. ciliata*. No. *10094* is said to be "common on old rock screes," and no. *10101* "plentiful on rocky limestone slopes."

*8. **Hebe rigida** sp. nov. PLATE IV, B.

Frutex ramosissimus, rigidus; caulis pilis brevibus patentibus pubescens; folia multa, oblongo-elliptica, obtusa, crenato-dentata, glabra, majora 0.5–0.7 cm. longa, 3–4 mm. lata; racemi 1–3 floribus compositi; sepala 4–5 mm. longa, anguste oblonga, glabra; corolla 7–8 mm. longa, atro-purpurea, late campanulata, glabra; capsula 4 mm. longa, obovoidea.

Stiff shrub, 2–4 dm. tall, with many rigidly erect stems from the slightly spreading rhizomatous base, these distally with many ascending-erect blackish purple branches. Stem pubescent with short spreading hairs, tardily glabrescent below. Leaves numerous and close-set (the short internodes of the lower part of the stem marked as in the other species), the blades oblong-elliptic, obtuse, crenate-dentate, glabrous (with hardly evident midrib), 5–7 mm. long, 3–4 mm. wide, at base cuneate to the ill-defined short entire ciliate petioles, both blades and petioles involutely hollowed. Racemes pubescent with short hairs, 1–3-flowered, short, the peduncle 4–12 mm. long, the pedicels 3–5 mm. long, shorter than or equaling the linear-oblong bractlets. Calyx not spongy at base, the sepals 4–5 mm. long, narrowly oblong, obtusely rounded, the margin entire and glabrous. Corolla 7–8 mm. long, dark purple, widely campanulate, glabrous throughout, the upper lip nearly circular, the three lower lobes similar and nearly as large. Stamens glabrous, the anthers less than half the length of the filaments. Capsule 4 mm. long, obovoid.

NETHERLANDS NEW GUINEA: Northern slope of Mt. Wilhelmina, alt. 4100 m., *L. J. Brass & E. Myer-Drees 10090* (ANSP, TYPE, AA), Sept. 1938, in flower and fruit (common on tussock-grass slopes, often growing in moss-cushions).

9. **Hebe Brassii** Pennell in Brittonia **2:** 185. 1936. PLATE V, A.

BRITISH NEW GUINEA: Mt. Albert Edward, *L. J. Brass 4498* (TYPE).

*10. **Hebe tenuis** sp. nov. PLATE V, B.

Suffrutex repens, ramosus, 1–1.5 dm. altus; caulis pilis minutis incurvis pubescens; folia elliptica, rotundata, crenato-dentata, glabra, glutinosa, majora 0.7–0.9 cm. longa, 4–6 mm. lata; racemi 3–7 floribus laxe compositi; sepala 4 mm. longa, oblanceolata vel obovata, glabrata; corolla 7 mm. longa, alba, campanulata, glabra; capsula 4 mm. longa, obovoidea.

Suffrutescent and extensively repent, distally ascending, 1–1.5 dm. tall, laxly branched. Stems finely pubescent with minute incurved hairs, tardily glabrescent below. Leaves shorter than or about equaling the internodes (which are rather longer than those of the erect bushy species, and with nodes as clearly marked), the blades elliptic, rounded at apex, crenate-dentate, flat, glabrous (with evident midrib), somewhat glutinous, 7–9 mm. long, 4–6 mm. wide, at base cuneate to the short flattened ciliate petioles. Racemes finely appressed-pubescent (with minute incurved hairs), 3–7-flowered, lax, the peduncle becoming 30–40 mm. long, the pedicels 7–10 mm. long, about twice as long as the oblanceolate bractlets. Sepals 4 mm. long, oblanceolate to obovate, rounded, slightly ciliolate to glabrous. Corolla 7 mm. long, white, campanulate, glabrous throughout, the upper lip rounded, the three lower lobes slightly smaller, rounded. Stamens glabrous, the anthers about half the length of the filaments. Capsule 4 mm. long, obovoid.

NORTHEASTERN NEW GUINEA: Summit of Mt. Sarawaket, alt. 4100 m., *Mary S. Clemens 5642* (AA, TYPE), Apr. 8, 1937, in flower (among open grass and shrublets).

11. **Hebe Vanderwateri** (Wernham) Van Steenis in Bull. Jard. Bot. Buitenzorg III. **13:** 252. 1934.

Based upon *Veronica Vanderwateri* Wernham in Trans. Linn. Soc. II. Bot. **9:** 121. 1916, describing a plant collected by C. Boden Kloss in 1912–13 on Carstensz Peak, Netherlands New Guinea.

12. **Hebe diosmoides** (Schlechter) Pennell in Brittonia **2:** 184. 1936.

Based upon *Veronica diosmoides* Schlechter in Bot. Jahrb. **59:** 111. 1924, describing a plant collected by Sir William MacGregor in 1889 on Mt. Victoria in British New Guinea.

11. **Veronica** Linnaeus

Since *Veronica Archboldii* was described seven years ago, several more members of this genus have been noted in collections from New Guinea, all of them similarly pertaining to the group of *V. serpyllifolia* L. From that species and its more cosmopolitan subspecies *humifusa* (Dickson) Vahl these all differ in the less hairy capsules, and, excepting the diminutive *V. platycarpa,* in the relatively wider and more toothed leaf-blades as well. What may be somewhat arbitrarily accounted the species of *Veronica* in New Guinea differ as follows:

A. Capsule widest about midway of its length, often exceeded by the sepals; racemes becoming many-flowered; leaf-blades elliptic or slightly longer, crenate-dentate; stems 1–4 dm. tall. . . . . 1. *V. Archboldii.*

AA. Capsule widest near the base, exceeding the sepals; racemes few-flowered; leaf-blades oblong-elliptic, crenate-serrate with few teeth; stems less than 1 dm. tall, the whole plant smaller. . . . . 2. *V. platycarpa.*

1. **Veronica Archboldii** Pennell in Brittonia **2:** 182. 1936.

The following, tentatively considered as subspecies, may prove specifically distinct. In all the aspect is similar, and there is equal possibility that further collecting may break down the validity of the characters adduced. Analogous to the wide distribution of *Veronica serpyllifolia* and its subspecies, this is being considered as a single species occurring throughout the mountain ranges of New Guinea. The subspecies yet known may be distinguished as follows:

A. Sepals about the length of the capsule (slightly shorter to longer than); corolla pale blue or white; pubescence of stem distally and of pedicels consisting of minute ascending-incurved hairs; leaf-blades little longer than wide, more evidently crenate-dentate. . . . . 1b. Subsp. *ellipticophylla.*

AA. Sepals much longer than the capsule; leaf-blades with fewer and shallower dentations.
B. Leaf-blades slightly elongated, 1½–2 times as long as wide; pubescence of minute ascending-appressed hairs; corolla "pale purple, streaked with white." ....1a. Subsp. *typica*.
BB. Leaf-blades little longer than wide; pubescence of fine spreading hairs; corolla "blue"..1c. Subsp. *patulifera*.

1a. **Veronica Archboldii** subsp. **typica.**
Veronica Archboldii Pennell in Brittonia **2:** 182. 1936.

British New Guinea: Mt. Albert Edward, *L. J. Brass 4403* (type), and Murray Pass, Wharton Range, *Brass 4941*.

*1b. **Veronica Archboldii** subsp. **ellipticophylla** subsp. nov.

Caules 2–4 dm. longi, pilis adscendenti-incurvis minute pubescentes; folia elliptica, 0.7–1.5 cm. longa, 5–12 mm. lata; sepala 4–5 mm. longa, oblongo-lanceolata; capsula 3 mm. longa.

Stems widely repent, ascending distally, 2–4 dm. long, finely pubescent with minute ascending-incurved hairs. Leaf-blades elliptic, 7–15 mm. long, 5–12 mm. wide, dentate with low teeth. Pedicels slightly longer than calyces, finely pubescent with incurved-ascending hairs. Sepals oblong-lanceolate, becoming 4–5 mm. long. Corolla pale blue or white. Capsule 3 mm. long, 4 mm. wide, notched ¼ depth. Seeds 1 mm. long.[11]

Netherlands New Guinea: Lake Habbema, north of Mt. Wilhelmina, alt. 3225 m., *L. J. Brass 9313* (ANSP, type, AA), Aug. 1938, in flower and fruit (on burnt-over ground); 7–11 km. northeast of Mt. Wilhelmina, alt. 3400–3560 m., *Brass & Myer-Drees 9683, 9749, 9861* (all AA, ANSP), in grass and moss.

This appears to be the prevalent member of this group on and near Mt. Wilhelmina in the Snow Mountains of Netherlands New Guinea.

*1c. **Veronica Archboldii** subsp. **patulifera** subsp. nov.

Caules 1–2 dm. longi, pilis patentibus pubescentes; folia elliptica, 0.7–1 cm. longa, 5–7 mm. lata; sepala 4–5 mm. longa, lineari-oblonga; capsula parva.

Stems widely repent, ascending distally, 1–2 dm. long, distally finely pubescent with spreading hairs. Leaf-blades elliptic, 7–10 mm. long, 5–7 mm. wide, dentate with low teeth. Pedicels shorter than or the lower equaling the calyces, finely pubescent with spreading hairs. Sepals linear-oblong, becoming 4–5 mm. long. Corolla "blue." Capsule small, not seen mature (perhaps abnormally atrophied).

Netherlands New Guinea: Northern slope of Mt. Wilhelmina, alt. 4050 m., *L. J. Brass & E. Myer-Drees 10163* (AA, type, ANSP), Sept. 1938, in flower (on a wet tussock-grass slope).

2. **Veronica platycarpa** Pennell in Notulae Naturae **23:** 1. 1939.

Collected by Mary S. Clemens (no. *10120*) in 1939 on Mt. Sarawaket, Northeastern New Guinea.

12. **Sopubia** Buch. Ham.

One species represented, the Indo-Malayan *S. trifida* Buch. Ham., by *Brass 4819*, from British New Guinea (already reported in Brittonia

[11]About twice the length of the seeds of *Veronica serpyllifolia* L. and *V. serpyllifolia humifusa* (Dickson) Vahl. This is the only subspecies of *V. Archboldii* of which seeds have been seen.

2: 187. 1936), and *Mary S. Clemens 10736,* recently gathered near the Kajabit Mission in the Morobe District, Northeastern New Guinea.

13. **Centranthera** R. Brown

One species represented, the Indo-Malayan *C. cochinchinensis* (Lour.) Merr., reported by Schlechter in Bot. Jahrb. **59:** 112. 1924 (as *C. hispida* R. Br.), and by me in Brittonia **2:** 187. 1936 (for *Brass 3574 & 5703*) and in Jour. Arnold Arb. **20:** 81. 1939 (for *Brass 7815 & 8270*). All the cited collections are from British New Guinea.

14. **Buchnera** Linnaeus

Schlechter credited only a single species to New Guinea, but, as might be anticipated from the number westward in the Malay Archipelago and southward in northern Australia, there are several. Those now known may be distinguished as follows:

A. Corolla externally somewhat hairy; inflorescence densely hairy...1. *B. tomentosa.*
AA. Corolla externally glabrous; inflorescence less hairy.
  B. Calyx and bracts finely pubescent over entire surface, the calyx not ridged; middle and lower leaf-blades lance-oblong, dentate..........2. *B. urticifolia.*
  BB. Calyx and bracts hairy on ribs and margins, or else glabrous; middle leaf-blades lanceolate or nearly linear, the lowest wider and dentate.
    C. Bracts ciliate, at least the upper ovate; calyx finely 10-ribbed, the ribs usually evident by reason of the ascending scabrous hairs, but varying to glabrous; capsule equaling or slightly exceeding the calyx; flowers more than ten, usually approximating to form a rather dense spike..3. *B. ciliata.*
    CC. Bracts ciliolate, the upper ovate with a caudate tip; calyx not ribbed, glabrous except for minute ciliolation of lobes; capsule not seen; flowers less than ten, scattered in an open spike..................4. *B. rariflora.*

1. **Buchnera tomentosa** Blume, Bijdr. Fl. Nederl. Ind. 741. 1825.

Originally described from Java. By Schlechter (l. c. 113) this was considered to be the only species in New Guinea, specimens being cited from Netherlands and Northeastern New Guinea, and from the Bismarck Archipelago. None of these collections have been seen and they may not all fit the concluding note, which characterizes the Papuan plant as differing from *B. urticifolia* in its larger flowers and its stronger hairiness, the hairs being mostly very thick on the rachis of the inflorescence.

NETHERLANDS NEW GUINEA: Morobe District, in grassland, alt. less than 1500 m., Boana, *Mary S. Clemens 41619;* Wantoat, *Clemens 11208, 40864* (flowers varying from white to pink).

2. **Buchnera urticifolia** R. Brown, Prodr. Fl. Nov. Holl. **1:** 437. 1810.

Originally described from the tropical coastland of northeastern Australia, the present Queensland. Occurs in both western and eastern New Guinea, on open grassland at low altitudes.

NETHERLANDS NEW GUINEA: Cyclops Mts., *K. Gjellerup 500* (GH); Merauke, *G. Versteeg 1837* (GH). NORTHEASTERN NEW GUINEA: Morobe District, Kajabit Mission, *Mary S. Clemens.* BRITISH NEW GUINEA: Urunu, *Brass 4821;* Fly River, *Brass 7813, 8253.*[12]

[12]Already reported in Jour. Arnold Arb. **20:** 82. 1939. These are the plants covered by contrast "A" of the key.

*3. **Buchnera ciliata** sp. nov.

Caulis 3–5 dm. altus, laxe pubescens glabratusve, simplex vel pauci-ramosus; folia scabro-pubescentia, tricostata, integra dentatave, infima fere ovalia et brevia, intermedia majora, saepe oblonga, 4 cm. longa, superiora lineari-lanceolata; spica tenuis, 10–15 paribus florum composita; bracteae 3–4 mm. longae, ovatae, acuminatae, ciliatae; calycis tubus 4 mm. longus, 10-costatus, costis scabro-pubescentibus vel glabris, lobis 1 mm. longis, ovato-lanceolatis, ciliolatis; corolla extus glabra, tubo 6–7 mm. longo ore intus villuloso, lobis oblanceolatis, inferioribus 3–4 mm. longis; capsula 5 mm. longa; semina 0.5 mm. longa.

Stem 3–5 dm. tall, loosely pubescent to glabrate, simple or distally slightly branched. Lowest leaves nearly oval, short, entire or dentate; middle leaves larger and longer, often nearly oblong, about 4 cm. long and 10 mm. wide, obtuse, entire or somewhat dentate; upper leaves linear-lanceolate, 5–6 cm. long, attenuate, the uppermost slightly smaller and slightly more remote, but seemingly continuous nearly or quite to the inflorescence; leaves scabrous-pubescent on both surfaces, 3-ribbed beneath. Spike slender, rather dense (the ascending fruiting calyces nearly or quite contiguous), of 10 to 15 pairs of flowers. Bracts 3–4 mm. long, ovate, acuminate or the upper acute, strongly ciliate (hairs 0.3–0.4 mm. long). Calyx-tube 4 mm. long, finely 10-ribbed, with short ascending scabrous hairs on ribs or sometimes glabrous; lobes 1–1.2 mm. long, ovate-lanceolate, attenuate, obscurely ciliolate. Corolla "pink," externally glabrous, the tube 6–7 mm. long, its orifice finely villose with white hairs, the lobes oblanceolate, truncate or nearly so, the lower longer, reaching 3–4 mm. long, the upper 2–3 mm. long. Capsule 5 mm. long, cylindric, equaling or slightly exceeding the calyx. Seeds about 0.5 mm. long, triangular-conic, brown, obscurely longitudinally lined.

NETHERLANDS NEW GUINEA: Balim River, northeast of Mt. Wilhelmina, alt. 1600 m., *L. J. Brass 11725* (ANSP, TYPE, AA), Dec. 1938, in flower and fruit (occasional on grassy deforested slope); "Zuid Nieuw Guinea pr. O. Kaba," *Branderhorst 89* (GH).

*4. **Buchnera rariflora** sp. nov.

Caulis 5–6 dm. altus, bifariam puberulentus, simplex; folia supra glabra, subtus scabrella, tricostata, fere integra, infima fere ovalia et brevia, intermedia etiam parva, oblongo-lanceolata, 2–2.5 cm. longa, superiora lineari-lanceolata, suprema brevissima et remota; spica tenuissima, circa 3 paribus florum composita; bracteae 3 mm. longae, lanceolato-ovatae, acuminatae, parum ciliolatae; calycis tubus 4 mm. longus, ecostatus, glaber, lobis 1 mm. longis, lanceolato-attenuatis, obscure scabrello-ciliolatis; corolla extus glabra, tubo 6–7 mm. longo ore intus villoso, lobis oblanceolatis, inferioribus 3–4 mm. longis; capsula non visa.

Stem 5–6 dm. tall, bifariously puberulent, simple throughout. Lowest leaves nearly oval, short, entire or dentate; middle leaves scarcely or not larger, oblong-lanceolate, 2–2.5 cm. long, 5 mm. wide, acute, entire; upper leaves linear-lanceolate, 2–2.5 mm. long, attenuate, the uppermost very short and remote, the inflorescence seeming long-peduncled; leaves above glabrous or slightly scabro-pubescent distally, beneath slightly scabrous, especially on the three ribs. Spike very slender, lax (the calyces less than or barely half length of internodes), of about 3 pairs of somewhat scattered flowers. Bracts 3 mm. long, lance-ovate or the upper ovate, acuminate to slightly caudate, obscurely ciliolate (hairs less than 0.05 mm. long).

Calyx-tube 4 mm. long, not evidently ribbed, glabrous; lobes 1 mm. long, lanceolate-attenuate, obscurely scabrellous-ciliolate. Corolla "pink," externally glabrous, the tube 6–7 mm. long, its orifice coarsely villose with projecting white hairs, its lobes oblanceolate, retuse, the lower longer, reaching 3–4 mm. long, the upper 2–2.5 mm. long. Capsule not seen.

BRITISH NEW GUINEA: Western Division, Tarara, Wassi Kussa River, *L. J. Brass 8571* (ANSP, TYPE, AA), Dec. 1936, in flower (rare in savanna-forest), *Brass 8597* (AA, ANSP).[13]

15. **Striga** Loureiro

In this Journal for 1939 (**20:** 83) I discussed the probability of there being valid color-distinctions between the various species of this genus. This view seems to be sustained by the further collections now reported. Also, as there prove to be objections to using either of the specific names employed by Schlechter for the two species of his enumeration in 1924, it becomes advisable to present a new summary of the species occurring in New Guinea.

A. Calyx 5-ribbed; upper lobes over half the length of lower lobes of corolla.
  B. Corolla white, 12–15 mm. long, externally evidently pubescent, the throat distinctly wider than the tube and only slightly decurved; posterior calyx-lobe much shorter than the others. . . . . 1. *S. alba.*
  BB. Corolla brightly colored, smaller.
    C. Corolla orange-yellow; stems relatively tall and weak, much-branched. . . . . 2. *S. Schlechteri.*
    CC. Corolla reddish purple, 7–8 mm. long, externally minutely pubescent, the throat ill-defined though slightly longer than the tube, rather strongly decurved; posterior calyx-lobe as long as the others. . . . . . 3. *S. parviflora.*
AA. Calyx 10–15-ribbed; upper lobes less than half the length of lower lobes of corolla.
  B. Corolla yellow, unlined, the anterior lobes reaching 3 mm. long; calyx 5 mm. long; plant 1–3 dm. tall. . . . . 4. *S. lutea.*
  BB. Corolla white, venose-lined, the anterior lobes reaching 13 mm. long; calyx 10 mm. long; plant taller. . . . . 5. *S. Masuria.*

*1. **Striga alba** sp. nov.

Caulis 7–8 dm. altus, scabro-pilosus, ramosus; folia linearia, obtusa, scabro-pubescentia, majora 2–4 cm. longa; spicae elongatae, multiflorae; bracteae lineares, attenuatae, 5–6 mm. longae; bracteolae filiformes, 3.5–5 mm. longae; pedicelli brevissimi; calyx 6 mm. longus, tubo prominente 5-costato (costis scabro-pubescentibus), lobis subulatis scabris, supremo lobo caeteris breviore; corolla 13–15 mm. longa, alba, violaceo-lineata, tubo tenui, fauce tubulari-campanulato, extus pubescente, parum decurvo, labio superiore 2–3 mm. longo pubescente, labio inferiore 3.5–4.5 mm. longo glabrato; capsula 2.5 mm. longa, ovoidea; semina 0.5 mm. longa.

Stem 7–8 dm. tall, scabrous-pilose with short broad-based stiff spreading hairs, slightly branched distally. Leaves ascending, linear, obtuse, scabrous-pubescent, the largest 2–4 cm. long, 1–1.5 mm. wide. Spikes elongated, scabro-pubescent, that of the main stem of more than 20 opposite or sub-opposite pairs of flowers. Bracts linear, attenuate, mostly 5–6 mm. long, about ⅔ the length of calyx, the lower long and exceeding calyx. Bracteoles filiform, 3.5–5 mm. long. Pedicels scarcely 0.5 mm. long. Calyx 6 mm.

[13]Already reported in Jour. Arnold Arb. **20:** 83. 1939, as a variant of *Buchnera urticifolia*. These are the plants covered by contrast "AA" of the key.

long, its tube with 5 very prominent scabro-pubescent ridges that become distally the subulate scabro-pubescent calyx-lobes, four of which are equal, 2–2.5 mm. long, but the mid-posterior is more slender and short, 1.5 mm. long; intervening surface of the tube membranous, sparsely minutely pilose, cut more deeply on posterior side, so that the shortest calyx-lobe is free proximad to the others. Corolla 13–15 mm. long, white, the throat and lobes finely violet-lined, the tube slender and about equaling calyx (5–6 mm. long), glabrous within calyx; throat tubular-campanulate, slightly enlarged on upper side, 4–5 mm. long, slightly decurved, externally pubescent, the hairs seemingly slightly gland-tipped; upper lip 2–3 mm. long, arched, its lobes united over half their length, free and laterally upcurved, externally slightly glandular-pubescent, internally pubescent with appressed glandless hairs; lower lip 3.5–4.5 mm. long, deflexed-spreading (its laterally spreading lobes distinct from near base of lip), externally slightly glandular-puberulent, internally glabrous. Capsule 2.5 mm. long, ovoid, glabrous, enclosed within calyx-tube. Seeds about 0.5 mm. long,[14] irregularly tetrahedral, brown.

British New Guinea: Gaima, east bank of Lower Fly River, *L. J. Brass 8256* (ANSP, type, AA), Nov. 1936, in flower and fruit (common in thick grass, open savanna-forest, in lowland).

In 1939 (Jour. Arnold Arb. **20:** 83) I identified this plant as *Striga curviflora* (R. Br.) Benth., an opinion I wish now to reconsider. Robert Brown's brief description of *Buchnera curviflora* (Prodr. Fl. Nov. Holl. 438. 1810) should first be quoted: "*Buchnera curviflora,* scaberrima, foliis elongato-linearibus integerrimis patentibus, calycibus 5-striatis, labio superiore corollae retuso: inferiore 3-partito ter breviore." Our plant differs from this in its leaves being ascending rather than spreading, and in its upper lip being ⅔ instead of ⅓ the length of the lower lip of the corolla. In 1835 (in forming the combination *Striga curviflora* in Compan. Bot. Mag. **1:** 362) Bentham, who had seen only Brown's specimens for his account, called the leaves subspreading ("subpatentibus"), thus indicating that they were likely somewhat ascending, and added that the corolla-tube was pubescent, while he retained in full force the statement about the relatively small upper lip of the corolla. Years later, with the help of more collections, Bentham again treated the matter in his Flora Australiensis (**4:** 517) in 1869. There we learn that Brown's plant, the type of the species, was gathered on islands in the Gulf of Carpenteria in North Australia, and that the species is now known both in that province and in Queensland. Again we have the emphasis placed upon the shortness of the upper corolla-lip as a main criterion ("less than half as long as the lower"), while the length of the corolla is now given as "nearly or fully ¾ in.," a size too large for our plant. On Bentham's key of 1869 our species fits better the characterization of *S. multiflora,* which reads: "Corolla above ½ in. long, the upper lip more than half as long as the lower," except that the corolla is exactly ½ inch. But from *S. multiflora* Benth. of North Australia (as originally defined in Compan. Bot. Mag.

[14]Imperfect seeds, shaken from a capsule, are only 0.2–0.3 mm. long, but those lying in folder with specimen and presumably of this species have been described.

1: 363. 1835) our plant differs in not being much-branched, its leaves not spreading, its corolla not glabrous, and its habit not semi-decumbent. Finally, as to *S. curviflora* again, the scarcely decurved corolla of our plant must differ from that which suggested this name to Brown. On all these counts I think that our plant from New Guinea is different from either of these Australian species. Likely it differs in other characters as well, for Brown's description is meagre and Bentham's far from complete.

2. **Striga Schlechteri** sp. nov.

Caulis ramosissimus, debilis; folia longa; calyx 5-costatus; corolla lutea.

Stems much-branched, weak and rather tall (relative to *S. lutea*), the leaves longer, the calyx 5-ribbed, the corolla bright orange-yellow (but drying dark blue-gray), and both corolla and capsule smaller.

NORTHEASTERN NEW GUINEA: Constantinhafen, *R. Schlechter 14246* (TYPE, presumably in the Berlin Botanical Garden), March 1902, in flower and fruit.

Other collections cited by Schlechter show this as occurring elsewhere in Northeastern New Guinea.

This brief characterization is all that is given by Schlechter (in Bot. Jahrb. **59:** 114. 1924), but it seems sufficient to mark this as another new species. Certainly it can hardly be *Striga multiflora* Benth., above-mentioned, to which Schlechter assigned the plant, since Bentham's account of this in his Flora Australiensis (**4:** 517. 1869) gave the corolla as over ½ inch long, a size much above that of *S. lutea*. On the other hand it is just possible that Schlechter's plant was *S. parviflora*, but his identification of it as *S. multiflora* and the different color assigned to the flowers lead me to suppose that it is something else. *S. multiflora* was originally described as having a glabrous corolla, a detail so modified in the Flora Australiensis as to lead to the suspicion that several things were included in the latter account.

3. **Striga parviflora** (R. Brown) Benth. in Compan. Bot. Mag. **1:** 362. 1835.

Based upon *Buchnera parviflora* R. Brown, Prodr. Fl. Nov. Holl. **1:** 438. 1810, of tropical Australia, the type being stated by Bentham, Fl. Austral. **4:** 517. 1869, to have come from Keppel Bay, Queensland.

As previously reported (in Jour. Arnold Arb. **20:** 84. 1939), this was collected in British New Guinea at Port Moresby (*Brass 8780*), and now we may add several collections from near Kajabit Mission in the Morobe District, Northeastern New Guinea (*Mary S. Clemens 10676, 10745, 41170*).

4. **Striga lutea** Loureiro, Fl. Cochinch. 22. 1790.

Type actually from Canton, China. Merrill (in Trans. Amer. Philos. Soc. II. **24**(2)**:** 353. 1935) puts this in the synonymy of *Striga asiatica* (L.) Kuntze, but Linnaeus' *Buchnera asiatica* was a composite of whatever *Strigae* he knew, although his allusion to the corolla-limb being purple will likely prove distinctive. With which component to associate this earliest name must await more thorough revision.

To collections cited by Schlechter (l. c. 115), all from Northeastern

New Guinea, may be added a recent one from the Kajabit Mission in the Morobe District (*Mary S. Clemens 40771*).

5. **Striga Masuria** (Buch. Ham.) Benth. in Compan. Bot. Mag. **1**: 364. 1835.

In Wallich's Numerical List of Plants in the Museum of the East India Company, this species appears as numbers 3876 *Buchnera Wallichii* Benth. and 3877 *B. Masuria* Ham., under date of 1830. Both names were *nomina subnuda* (localities only being given), but the latter was validated by publication with description by Bentham in his Scrophularineae Indicae (p. 41) in 1835. Schlechter in 1924 (l. c. 115) seems to have been the first to validate the former, but his *Striga Wallichii* (Benth.) Schlechter does so only by including Bentham's account of the other as a synonym. The correct name for the species therefore remains *Masuria,* the name generally used since 1835.

A widespread oriental species that extends eastward to New Guinea, where it was reported by Schlechter from the northeastern part and has recently been gathered slightly farther south at the Kajabit Mission, Morobe, Northeastern New Guinea, by *Mary S. Clemens* (*10547a, 40658, 40772*).

16. **Euphrasia** Linnaeus

This proves to be one of the characteristic genera of alpine heights throughout New Guinea. Like *Hebe* in the same situations, the kinship of the Papuan species is definitely with the flora of New Zealand. Also like *Hebe,* the genus will prove to be a large one in New Guinea, with many species locally endemic to various mountain areas.

The clarity of the taxonomy of *Euphrasia* in New Guinea has been a welcome surprise to one who has puzzled over the difficult task of distinguishing its species in the North Temperate Zone. The boreal species, all of which are annual, are closely similar in corollas, stamens, capsules, seeds, calyces, and leaves, so that one must appeal to secondary features of leaf-dentation, indumentum, and size to distinguish the many local entities. But in New Guinea the characters are as consequential and well-marked as in any other genus of this family. The species are perennial, the habit either erect or repent, the corolla with short or long tube, the calyx-lobes rounded or acuminate, and the anthers distinct or coherent, uniformly or unequally awned. Those as yet known from New Guinea may be distinguished as follows:

A. Corolla externally glabrous, 10–11 mm. long, the lips as long as or longer than the tube; anthers glabrous, exserted; leaf-blades 3–5-lobulate; stem to 2 dm. tall . . . . 1. *E. papuana.*

AA. Corolla externally pubescent; anthers included, at least the orifices ciliate; leaf-blades 3-lobed, or the lower or all entire (all only in *E. culminicola*).

B. Leaf-blades longer than wide, the lateral lobes less than ⅓ the length of the wide median lobe; lower lip deflexed, usually exceeding the upper lip of the corolla; stem ascending or erect.

C. Stems shrubby, 1–3 dm. tall; calyx-lobes obtuse; corolla 12–14 mm. long, white to yellow, externally sparsely puberulent, the lower (8 mm.) slightly longer than the upper (6–7 mm.) lip . . . . 2. *E. Lamii.*

CC. Stems suffruticose, less than 1 dm. tall; corolla violet to purple, evidently hairy externally.

D. Anthers cohering, one awn of anthers of shorter stamens much longer and thicker than the other anther-awns; corolla 12–15 mm. long, the campanulately widened throat and lips as long as or longer than the narrow tube; leaves glabrous.
E. Lower distinctly exceeding upper lip of corolla, its length about that of the straight corolla-tube and -throat.
F. Calyx-lobes obtuse or obtusish.
G. Leaf-blades with a pair of short tooth-like obtuse lobes; corolla purple. . . . . 3. *E. cucullata.*
GG. Leaf-blades entire, spatulate or obovate. . . . 4. *E. culminicola.*
FF. Calyx-lobes acuminate; corolla white or very pale pink. . . . . 5. *E. mirabilis.*
EE. Lower scarcely exceeding upper lip of corolla, its length about half of that of the decurved corolla-tube and -throat; calyx-lobes acuminate. . . . . 6. *E. curviflora.*
DD. Anthers distinct, the awns all equal in length, short; corolla 9–11 mm. long, the slender throat gradually or not widening from the tube, which together are at least twice as long as the lobes.
E. Tube of corolla gradually widening to apex, its orifice not constricted; plant much-branched at base.
F. Calyx-lobes acuminate; corolla pale violet, the galea straight continuously with the tube; capsule little shorter than calyx; leaves 5–6 mm. long, glabrous. . . . . 7. *E. rectiflora.*
FF. Calyx-lobes rounded at apex; corolla lavender to dark violet, the galea shorter and curved continuously with the tube; capsule shorter than calyx (not surpassing the mid-portion of its lobes); leaves 3–4 mm. long, puberulent. . . . . 8. *E. spatulifolia.*
EE. Tube of corolla constricted at mouth; leaves 3.5 mm. long, glabrous; stems simple or sparsely branched. . . . . 9. *E. scutellarioides.*
BB. Leaf-blades as wide as long, the lateral lobes ⅓ to ½ the length of the wide median lobe; lower lip deflexed-spreading, not or scarcely exceeding the upper lip of the pale corolla; anthers distinct, one awn of anthers of shorter pair slightly longer than the other anther-awns; stem repent.
C. Corolla 8–10 mm. long, slightly and mostly sparsely pilose externally; orifice of anther-cells ciliolate (the hairs less than ¼ the width of the cell): calyx pilose to glabrate, the lobes obtuse with margins slightly revolute, not callose; leaves 2–4 mm. long, glabrate, the margin like that of the calyx-lobes; stems extensively repent, bifariously pubescent with recurved hairs. . . . . 10. *E. humifusa.*
CC. Corolla 4–5 mm. long, hirsute-pubescent externally; orifice of anther-cells ciliate (the hairs over half the width of the cell); calyx more densely white-pubescent, the lobes rounded with margin strongly revolute and callose; leaves 1–3 mm. long, pubescent, ultimately glabrous, the margin like that of the calyx-lobes; stems more shortly spreading. . . . . 11. *E. callosa.*

1. **Euphrasia papuana** Schlechter in Bot. Jahrb. **59:** 116. 1924.

Collected by Sir William MacGregor in 1889 on Mt. Victoria in British New Guinea.

2. **Euphrasia Lamii** Diels in Nova Guinea Bot. **14:** 538. 1928.

Collected by H. J. Lam in 1920 at Doorman Peak, Netherlands New Guinea; two specimens cited but neither designated as type. *Lam 1587*, very abundant on flat sterile moorland, 3250 meters altitude, is also shown in his photograph in Die Vegetationsbilder **15:** *tab. 33.* 1924, and evidently reaches the proportions given in the original description of 1928. Accordingly, I take it as the type. The published field-note states that the corolla was white or bright yellow, sometimes with lilac spots on the lips, and was yellow on the throat. In contrast, *Lam 1644*, gathered among stones on open alpine slopes at 3520 meters altitude, was noted in the field as with corolla white, occasionally bright yellow, yellow at the throat, and the tube with violet stripes to the margin of the upper lip; I suspect from the allusion to striping as well as the different environment that no. *1644* is a different species and is probably the plant that I am now describing as *Euphrasia cucullata,* although unfortunately Mr. Brass has not told us the color-pattern of the latter. If so, the occasional bright yellow-flowered individuals may well be interspersed specimens of *E. Lamii,* such as might take slightly wetter spots. From Lam's map in Die Vegetationsbilder, Doorman Peak is less than a degree northwest of Wilhelmina Peak.[15]

*3. **Euphrasia cucullata** sp. nov.

Suffruticosa, ramosissima, diffusa, 5–10 cm. alta; caulis retrorse pubescens; folia obovato-spathulata, 5–6 mm. longa, glabra, margine apicem versus valde revoluta (cucullata), utrinque pari loborum triangulari-rotundatorum onusta, basi cuneata; flores pauci, axillares; calyx minute pilosus, 6–7 mm. longus, lobis ovatis rotundatis 2 mm. longis; corolla purpurea, extus hirsuto-pubescens, tubo 7–8 mm. longo angusto, labio superiore 5 mm. longo, inferiore 7–9 mm. longo lobis retusis aucto; antherarum cohaerentium thecae aristas inaequales ferentes, orificiis ciliatae; stylus pubescens; capsula 7 mm. longa, glabra; semina 1.5 mm. longa.

Suffruticose, much-branched below, the stems less than 1 dm. tall, pubescent with recurved hairs, diffusely ascending or decumbent. Leaves glabrous, obovate-spatulate, cuneate to base, about midway of length with a pair of triangularly rounded short lobes,[16] the median distal portion obovate (much wrinkled in drying), rounded, the margin so strongly revolute as to appear cucullate; larger leaves 5–6 mm. long, 2–3 mm. wide. Inflorescence of a few pairs of axillary flowers, these not closely successive. Pedicels 2 mm. long, pubescent. Calyx 6–7 mm. long, minutely pilose, the lobes 2 mm. long, ovate, rounded but with margin so recurved as at times to appear acutish. Corolla "purple," externally hirsute-pubescent, but glabrous beneath throat and on lobes distally, internally finely pubescent below posterior sinus,[17] elsewhere glabrous (except perhaps at base of tube), the tube 7–8 mm. long, narrow, slightly exceeding the calyx; upper lip 5 mm. long, slightly arched and hooded, the lobes free slightly (0.5 mm.) at apex; lower lip 7–9 mm. long, deflexed-spreading, the mid-anterior obovate, slightly longer than the semirectangular antero-lateral lobes, all retuse. Filaments glabrous (except probably at base); anthers all coherent, the

[15]If the anthers of *Euphrasia Lamii* had been described in detail, probably it would have been possible to associate it with some of the following species. At present it is impossible to identify its variety *Versteegii* Diels (in Nova Guinea Bot. **14**: 539. 1928), collected by Versteeg (no. *2473*) in 1913 on the Orange Mountains ("Oranje-Gebirge") in Netherlands New Guinea.

[16]These are shorter and less divaricate than in *Euphrasia mirabilis,* the lobes of which are also placed about the middle of the leaf's length (not so distally as is implied in my original description of that plant). The leaf-blade is distally more strongly cucullate in *E. cucullata* than in *E. mirabilis.*

[17]Such fine pubescence beneath sinus near apex of upper lip is developed also in *E. mirabilis.*

cells ciliolate at margins of orifices, all awned (one awn of each posterior anther 0.5 mm. long, the other awns 0.2 mm. long,[18] the long awn stouter and projecting farther down into the orifice of the corolla). Style distally pubescent. Capsule 7 mm. long, 5 mm. wide, widely obovoid and somewhat flattened, retuse, glabrous. Seeds at least 1.5 mm. long, brownish, with longitudinal thin white ridges.

NETHERLANDS NEW GUINEA: Mt. Wilhelmina, 2 km. east of summit, alt. 3800 m., *L. J. Brass & E. Myer-Drees 10118* (ANSP, TYPE, AA), Sept. 1938, in flower (alpine grassland, plentiful in sterile shallow soil of sandstone crests); 3 miles east of summit, Mt. Wilhelmina, alt. 3650 m., *Brass 9412* (AA, ANSP) (scattered over black boggy slopes).

4. **Euphrasia culminicola** Wernham in Trans. Linn. Soc. II. Bot. **9:** 121. 1916.

Collected by C. Boden Kloss in 1912–13 on Carstensz Peak, in Netherlands New Guinea.

5. **Euphrasia mirabilis** Pennell in Brittonia **2:** 188. 1936.

Collected by L. J. Brass, no. *4271,* in 1933 on Mt. Albert Edward, in British New Guinea.

*6. **Euphrasia curviflora** sp. nov.

Caules laxi, 8 cm. et ultra longi, pilis patentibus hirsutuli; folia glabra, oblanceolata vel obovato-spathulata, 5 mm. longa, margine apicem versus revoluta, utrinque pari loborum lanceolato-oblongorum brevium onusta, basi anguste cuneata; flores pauci, axillares; calyx glabratus, 7.5 mm. longus, lobis ovatis acuminatis 3.5 mm. longis; corolla violaceo-purpurea, extus pubescens, tubo 5 mm. longo angusto, labio superiore 4 mm. longo, inferiore vix longiore lobis retusis aucto; antherarum cohaerentium thecae aristas inaequales ferentes, orificiis ciliolatae; capsula 6 mm. longa, glabra; semina non visa.

Stems lax, at least 8 cm. long, probably ascending, finely hirsute with spreading hairs. Leaves glabrous, oblanceolate to obovate-spatulate, narrowly cuneate to base, about midway of length with a pair of lance-oblong short lobes, the median distal portion rounded-ovate, the margin somewhat revolute and slightly cucullate, those seen 5 mm. long, 2–2.5 mm. wide. Inflorescence of a few pairs of axillary flowers. Pedicels scarcely 1 mm. long, apparently glabrate. Calyx 7.5 mm. long, minutely pubescent below sinuses, becoming glabrous throughout, the lobes 3.5 mm. long, ovate, acuminate, slightly revolute. Corolla externally pubescent, hirsutely so on tube and minutely villose on galea, the lobes distally glabrate, internally pubescent below posterior sinus, the tube 5 mm. long, narrow, about equaling the calyx, distally campanulate, widening to a throat 4 mm. long; upper lip 4 mm. long, arched, the lobes free slightly at apex and laterally recurved 0.5 mm.; lower lip scarcely longer, deflexed-spreading, the mid-anterior slightly the widest, all retuse. Filaments glabrous (at least distally); anthers all coherent, the cells ciliolate at margins of orifice, all awned (one awn of each posterior anther 0.3 mm. long, the others 0.1 mm. long, the long awn stouter and projecting farther down into the orifice of the corolla). Capsule 6 mm. long, 4 mm. wide, obovate-rounded to apex, flattened, glabrous. Seeds not seen.

NORTHEASTERN NEW GUINEA: Morobe District, Rawlinson Range, alt. over 3600 m., *Mary S. Clemens s. n.* (ANSP, TYPE), July 1941, in flower (open wet hills and dale).

[18]About twice as long as the corresponding awns of *E. mirabilis.*

Of this I have seen only a few pieces, including a flower, a nearly ripe capsule, and another capsule long past dehiscence, all culled from the only collection of *Euphrasia callosa,* to be described below. As to color, the common label states: "mixture, purple & white, tube yellow of big fl.," whence we know that this, the big flower, had a yellow corolla-tube, a color still evident on the anterior side of the throat. The edge of the lower corolla-lobes seems still a dark violet, whence I infer that the main part of the corolla was violet-purple.

*7. **Euphrasia rectiflora** sp. nov.

Suffruticosa, basi ramosa, erecta vel diffusa, 1–7 cm. alta; caulis retrorse pubescens vel glabrata; folia glabra, oblanceolato-spathulata, 5–6 mm. longa, margine apicem versus revoluta, utrinque pari loborum triangulari-oblongorum rotundatorum onusta, basi cuneata; flores pauci, axillares; calyx glaber, 7 mm. longus, lobis lanceolatis acuminatis 3 mm. longis; corolla violacea, extus minute pubescens, tubo 10 mm. longo angusto elongato, labiis 3 mm. longis, inferiore lobis rotundato-truncatis aucto; antherarum distinctarum thecae aristas aequales ferentes, orificiis ciliolatae; stylus minute pubescens; capsula 5–6 mm. longa, glabra; semina non visa.

Suffruticose, less than 7 cm. tall, often minute, much-branched at base, the stems erect or diffuse-decumbent, finely pubescent with recurved hairs to glabrate. Leaves glabrous, oblanceolate-spatulate, the upper nearly obovate, cuneate to base, about midway of length with a pair of triangular-oblong rounded lobes, the mid-blade distally broadly rounded, its margin revolute (but hardly cucullate) and becoming indurated, the larger leaves 5–6 mm. long, 2–3 mm. wide. Inflorescence of a few (1 or 2) pairs of axillary flowers, borne contiguously at the summit of the stems. Pedicels less than 1 mm. long, glabrous. Calyx becoming 7 mm. long, glabrous, the lobes 3 mm. long, lanceolate, acuminate, the margin strongly revolute. Corolla "pale violet with yellow spot inside,"[19] apparently lined, externally finely pubescent, the tube anteriorly and the lower lobes glabrous, internally minutely pubescent below posterior sinus, the tube 10 mm. long, narrow, gradually widening distally, over twice the length of the calyx; upper lip 3 mm. long, narrowly arched, scarcely or not hooded, the lobes free slightly at apex (0.5 mm.), tending to spread laterally; lower lip 3 mm. long, widely deflexed-spreading, the lobes 2 mm. long, rounded-truncate, slightly widening distally. Filaments glabrous (except perhaps at base); anthers distinct, the cells ciliolate at margins of orifice, all equally awned (awns slender, 0.3 mm. long). Style distally finely pubescent. Capsule 5–6 mm. long, 4 mm. wide, obovate, flattened. Seeds not seen.

NETHERLANDS NEW GUINEA: Lake Habbema, north of Mt. Wilhelmina, alt. 3225 m., *L. J. Brass 9192* (AA, TYPE, ANSP), Aug. 1938, in flower and fruit (among dwarf grasses of exposed boggy slopes); 7 km. northeast of Mt. Wilhelmina, alt. 3560 m., *Brass & Myer-Drees 9794* (AA, ANSP) (on very wet peat in grassy valley).

*8. **Euphrasia spatulifolia** sp. nov.

Suffruticosa, caespitosa, diffusa, 1–7 cm. alta; caulis pilis patentibus pubescens; folia minute pubescentia, oblanceolato-spathulata, 3–4 mm. longa, margine apicem versus valde revoluta (cucullata), utrinque pari

[19]From label of no. *9794;* for no. *9192* stated as "pale purple-pink."

loborum oblongorum onusta, basi cuneata; flores pauci, axillares; calyx hispidulus, 7 mm. longus, lobis oblongis rotundatis 3 mm. longis; corolla violacea, extus pubescens, tubo 9 mm. longo tenui elongato, labio superiore 2 mm. longo, inferiore 4 mm. longo lobis rotundato-truncatis aucto; antherarum distinctarum thecae aristas aequales ferentes, orificiis ciliatae; stylus minute pubescens; capsula 4–5 mm. longa; semina non visa.

Suffruticose, forming clumps up to 1 dm. in diameter. Plant less than 7 cm. tall, branched throughout, the stems diffuse from base and ascending, pubescent with spreading slightly recurved hairs. Leaves minutely pubescent, oblanceolate-spatulate, cuneate to base, about midway of length with a pair of oblong rounded or obtuse lobes, the mid-blade distally broadly rounded, its margin strongly revolute and somewhat hooded, the larger leaves 3–4 mm. long, 1.5–2 mm. wide. Inflorescence of a few (1 or 2) pairs of axillary flowers. Pedicels 1 mm. long. Calyx becoming 7 mm. long, minutely pilose with stiff hairs, the lobes 3 mm. long, oblong, truncately rounded, the margin narrowly revolute. Corolla "lavender" (no. *10044*) or "dark violet" (no. *9731*), with the "lowest petal orange at base," externally grayish-pubescent, the throat anteriorly and the lobes distally glabrous, internally minutely pubescent below posterior sinus, the tube 9 mm. long, narrow, proximally very slender, distally widening to form throat and somewhat decurved, over twice the length of the calyx; upper lip 2 mm. long, arched and decurved 1 mm., then the lobes widely spreading, rounded; lower lip 4 mm. long, deflexed-spreading, the lobes 2–2.5 mm. long, rounded-truncate, slightly widening distally. Filaments glabrous (at least distally); anthers distinct, the cells ciliate at margins of orifice, all equally awned (awns slender, 0.2 mm. long). Style distally finely pubescent. Capsule 4–5 mm. long, 2–3 mm. wide, obovate, flattened. Seeds not seen.

NETHERLANDS NEW GUINEA: Northern slopes of Mt. Wilhelmina, alt. 3950 m., *L. J. Brass & E. Myer-Drees 10044* (AA, TYPE, ANSP), Sept. 1938, in flower and old fruit (shallow soil of old grassy scree); 11 km. northeast of summit of Mt. Wilhelmina, alt. 3400 m., *Brass & Myer-Drees 9731* (AA, ANSP) (on rather wet sandy slope).

9. **Euphrasia scutellarioides** Wernham in Trans. Linn. Soc. II. Bot. **9:** 122. 1916.

Collected by C. Boden Kloss in 1912–13 on Carstensz Peak, Netherlands New Guinea.

*10. **Euphrasia humifusa** sp. nov.

Herba perennis, effusa, repens; caulis 1 dm. longus, bifariam retrorse pubescens; folia glabra vel proxime pilosa, late ovata, 2–3 mm. longa, margine apicem versus parum revoluta, utrinque pari loborum oblongorum obtusorum onusta, basi anguste cuneata; flores pauci, irregulariter axillares; calyx hispidulus vel glabratus, 3–4 mm. longus, lobis ovatis vel ovato-oblongis 1.5 mm. longis; corolla rubescens, extus villosulo-pubescens, tubo 5 mm. longo angusto recto; labio superiore 2.5 mm. longo, inferiore 3 mm. longo lobis retusis aucto; antherarum distinctarum thecae aristas subaequales ferentes, orificiis ciliolatae; stylus glabratus; capsula 4 mm. longa, glabra; semina 1 mm. longa.

Perennial, widely effuse. Stems up to 1 dm. long, wholly prostrate, partially repent, much-branched, bifariously pubescent with recurved-appressed hairs. Leaves glabrous or pilose proximally above on midrib or with a few hairs at tip of blade or lobes, widely ovate in inclusive outline, narrowly cuneate to a semi-petiolate or fully petiolate base, about midway of length with a pair of divergent oblong obtuse lobes, the mid-blade distally oval or rounded-ovate, its margin relatively slightly revolute; larger leaf-blades 2–3 mm. long and wide, the petioles sometimes reaching 1 mm. long. Calyx 3–4 mm. long, pilose with stiff hairs to usually glabrate, the lobes 1.5 mm. long, ovate or ovate-oblong, obtuse, so revolute as at times to appear acute. Corolla externally pinkish, internally white, the lips (or perhaps only lower lip) pink,[20] externally finely pubescent (usually villosely so), the throat anteriorly and the lobes distally glabrous, internally minutely pubescent below posterior sinus, the tube 5 mm. long, narrow, straight, nearly twice length of calyx, distally abruptly widening to a campanulate throat 2 mm. long; upper lip 2.5 mm. long, straight or slightly decurved, arched, the lobes free only near apex (0.2–0.3 mm. long), upcurving; lower lip 3 mm. long, deflexed-spreading, the lobes 2–2.3 mm. long, oblong, retuse. Filaments glabrous (at least distally); anthers distinct, the cells ciliolate on margins of orifice, the awns slightly unequal (awns slender, 0.1 mm. long, except one of the shorter pair of anthers which is about 0.2 mm. long). Style distally nearly glabrous (obscurely sparsely puberulent). Capsule 4 mm. long, 3 mm. wide, flattened, obovate-rounded, emarginate, the valves in dehiscence strongly recurved-spreading. Seeds 1 mm. long, oval with distally flattened end, blackish, with white longitudinal wing-like ridges.

NETHERLANDS NEW GUINEA: 4 km. northeast of summit of Mt. Wilhelmina, alt. 3650 m., *L. J. Brass & E. Myer-Drees 9971* (ANSP, TYPE, AA), Sept. 1938, in flower and fruit (in shade of tussock grasses); 2 km. east of summit of Mt. Wilhelmina, *Brass & Myer-Drees 10187* (AA, ANSP) (in alpine grassland).

*11. **Euphrasia callosa** sp. nov.

Herba perennis, effusa, prostrata; caulis 5 cm. longus, ramosus, hirsuto-pubescens; folia glabra glabratave, late ovata, 1–3 mm. longa, margine callosa apicem versus valde revoluta (cucullata), utrinque pari loborum oblongorum ovatorumve onusta, basi cuneata; flores pauci, irregulariter axillares; calyx hirsuto-pubescens, 3–4 mm. longus, lobis oblongis ovatisve 1 mm. longis; corolla albida, extus pubescens, tubo 2.5–4 mm. longo recto, labiis 1.5–2.5 mm. longis, inferiore lobis truncatis aucto; antherarum distinctarum thecae aristas subaequales ferentes, orificiis ciliatae; stylus minute pubescens; capsula 3 mm. longa, glabra; semina 0.7 mm. longa.

Perennial, widely effuse. Stems up to 5 cm. long, wholly prostrate, hirsute-pubescent on all sides with spreading hairs. Leaves glabrous, or slightly pubescent beneath laterally, widely ovate in inclusive outline, cuneate to a semipetiolate base, about midway of length with a pair of divergent oblong or ovate rounded lobes, the mid-blade distally ovate-rounded, the margin strongly revolute, even somewhat hooded, that of the lobes also revolute, all revolute margins and sometimes most of blade strongly callose; larger leaves 1–3 mm. long and wide. Inflorescence of several axillary flowers, occurring irregularly at various nodes. Pedicels 1–2 mm. long, hirsute-pubescent. Calyx 3–4 mm. long, hirsute-pubescent on ribs, the lobes 1–1.2 mm. long, oblong to ovate, distally acutish to rounded, with revolute strongly callose margin. Corolla probably white

[20]Field-note to label for no. *9971*: "fls. white within, the outside tinged with pink"; for no. *10187*: "fls. very pale pink, lip darker."

or whitish,[21] externally pubescent, the throat anteriorly and the lobes distally glabrous, internally minutely pubescent below posterior sinus, the tube (and throat) 2.5–4 mm. long, straight, little longer than calyx; upper lip 1.5–2.5 mm. long, straight or nearly so, the lobes slightly distinct and recurved near apex; lower lip about as long, deflexed-spreading, the lobes 1–1.5 mm. long, truncate or shallowly retuse. Filaments glabrous (at least distally); anthers distinct, the cells ciliate on margins of orifice, the awns slightly unequal (as in *E. humifusa*). Style distally finely pubescent. Capsule 3 mm. long and wide, flattened, rounded, glabrous. Seeds 0.7–0.8 mm. long, grayish, with longitudinal white ridges.

NORTHEASTERN NEW GUINEA: Morobe District, Ulap Trail, *Mary S. Clemens 41137* (ANSP, TYPE, AA), Apr. 6, 1940, in flower and fruit.

Presumably this locality is in the Rawlinson Range, from which Mrs. Clemens has sent to the Academy another collection made in July 1941, on "open wet hills and dale" at over 3600 meters altitude; it was this collection from which the few pieces of *Euphrasia curviflora* have been extracted. Still another collection, her no. *6047*, gathered March 29, 1937, and credited only to the Morobe District at the surprisingly low altitude of 2400 to 2700 meters ("8–9000 ft.") is at the Arnold Arboretum.

EXPLANATION OF PLATES

All plates are photographs of herbarium specimens and are reproduced slightly over ¼ actual size.

PLATE I

A. *Lindernia papuana;* type. B. *Torenia crenata;* type.

PLATE II

A. *Hebe rubra;* isotype. B. *Hebe thymelaeoides;* isotype.

PLATE III

A. *Hebe albiflora;* type. B. *Hebe polyphylla;* type.

PLATE IV

A. *Hebe ciliata;* type. B. *Hebe rigida;* type.

PLATE V

A. *Hebe Brassii;* isotype. B. *Hebe tenuis;* type.

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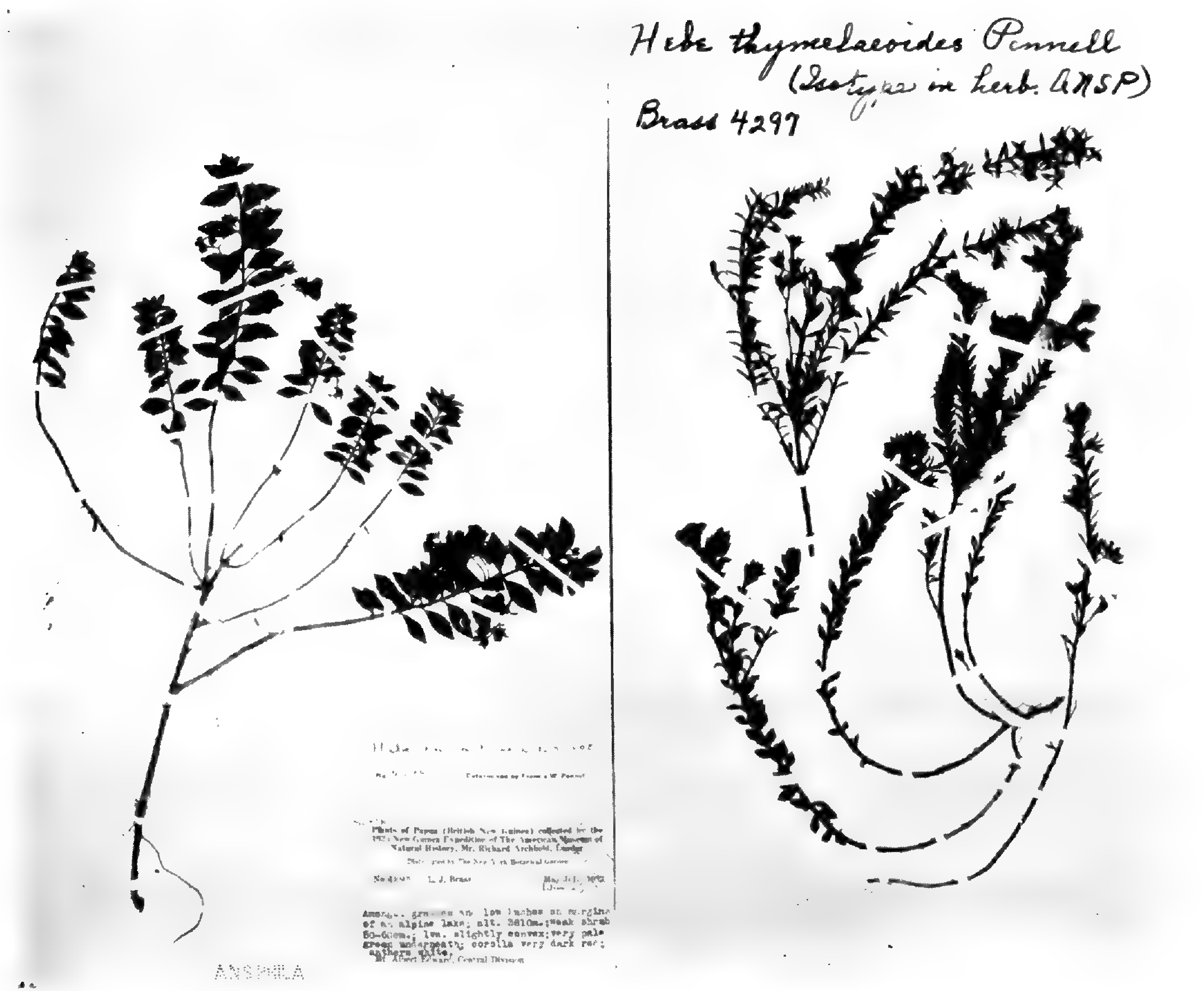
[21] Type collection labeled "fls. white with purple," probably meaning white with purple lines. As to other collection, intermixed with *Euphrasia curviflora,* I take the present species to be the pale-flowered component; see discussion under that species.

A. LINDERNIA PAPUANA

B. TORENIA CRENATA

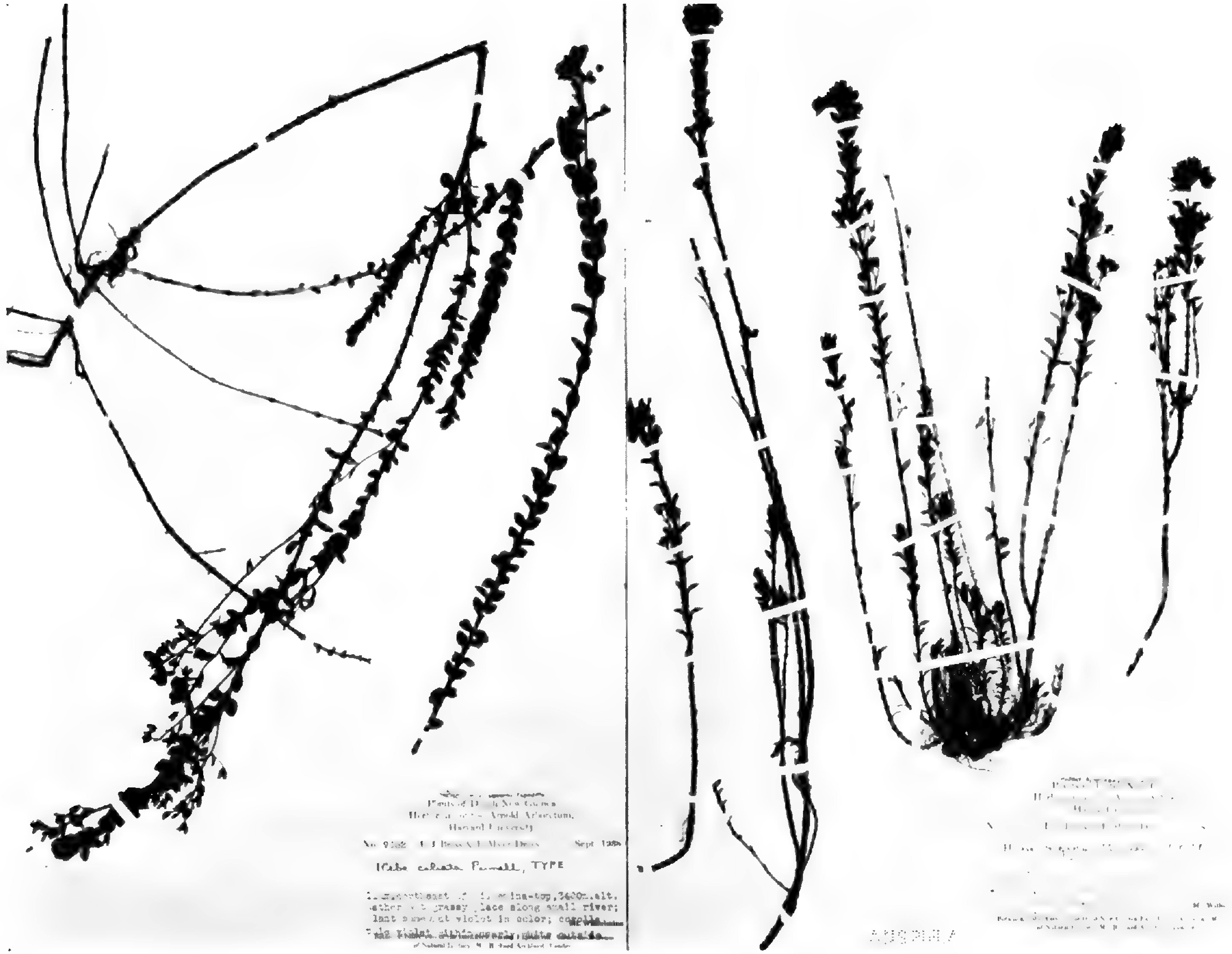


A. HEBE RUBRA

B. HEBE THYMELAEOIDES

A. Hebe albiflora

B. Hebe polyphylla



A. Hebe ciliata

B. Hebe rigida

A. HEBE BRASSII

B. HEBE TENUIS

A STUDY OF CYTOLOGY AND SPECIATION IN THE GENUS POPULUS L.

E. CHALMERS SMITH[1]

With four plates

INTRODUCTION

A STUDY of the extent of interspecific hybridization within a genus has both practical and theoretical importance. It is of value in showing to what degree hybridization may be utilized within a genus to establish improved types and, at the same time, it is indicative of the relationships of the species themselves. In order that the study of the extent of hybridization within the genus shall prove of maximum value, data on behavior of the F_1 and F_2 generations under controlled conditions should be available. Due to the time factor involved, such data are not available in most cases when dealing with forest trees.

The study of genetic behavior of interspecific hybrids is of greatest value when coupled with a comparative study of the cytology of those hybrids. Studies of this sort have yielded many pertinent facts, particularly as critical evidence for the establishment of probable interspecific relationships. In addition it has led to a better understanding of the actual methods by which isolation and speciation have taken place. The basic assumption underlying this method of approach to the problem of interrelationships of species is that the pairing of the parental chromosomes is a criterion of chromosome homology. This criterion of chromosome homology, based on a study of pairing relationships at meiosis in F_1 species hybrids, is particularly valuable when supplemented with a study of chiasmata frequencies, chromosome configurations, and pollen sterility.

The study of chromosome numbers, microsporogenesis, and the development of the male gametophyte of species within the genus supplements this program of research, making it more valuable from both points of view. The study of chromosome behavior and pollen sterility of the pure species serves as a basis with which to compare the cytological behavior of the hybrids. The chromosome numbers will indicate the degree of polyploidy within the genus and indicate the probable success of any attempt to induce polyploidy.

The present investigation is a study of the cytology of the genus *Populus* L. in general, and as such it is subject to the limitations imposed by the unavailability of certain species and hybrids for study. With these limitations in mind it is a study in particular of chromosome numbers and chromosome behavior in pure species and inter-specific hybrids, especially as these data are related to speciation within the genus.

[1]Maria Moors Cabot Foundation Fellow.

MATERIALS AND METHODS

The materials used in this study were obtained from two sources: (1) the *Populus* collection of the Arnold Arboretum, and (2) the *Populus* plantations of the Northeastern Forest Experiment Station at Frye, Maine. Cytological material of species and natural hybrids were obtained from the former location and material of artificial hybrids from the latter.

Branches with flower buds attached were collected during the latter part of February and early March, placed in the greenhouse, and allowed to develop. Catkins were collected at appropriate times and fixed in 3:1 alcohol acetic and stored in the fixative at 2° C. until needed. Male catkins of *Populus* make exceptionally favorable material for cytological study, since one catkin contains many successive stages in the development of the pollen grain.

Aceto-carmine smear preparations were used entirely in the study of meiotic chromosomes. Pollen mother cells in prophase stages were difficult to stain, and those having the chromosomes advantageously placed for study were rare. When favorable cells were found, the chromosomes were drawn with the aid of a camera ludica. The length of the chromosomes was then measured by the use of waxed threads.

For root tip studies, cuttings from the desired species were rooted in water or sand, the root tips collected and fixed in Navaschin's solution, embedded in paraffin, sectioned at 10μ and stained with crystal violet. A similar procedure of fixation, embedding, and sectioning was followed in the study of the development of the male gametophyte, except in this case the sections were stained with Haidenhain's iron-haematoxylin.

In the study of the development of the pollen tube, freshly shed pollen was sprinkled on slides which had received a thin coating of a sugar, agar, gelatin, and water mixture. The preparation of these slides has been described by Newcomber (1938). In this case a mixture of 2 gm. sugar, 0.5 gm. agar, and 0.5 gm. gelatin to 25 cc. of water was found to be satisfactory. After the pollen was planted, the slides were placed in a moist chamber until the pollen had germinated. It was then fixed with 3:1 alcohol acetic and stained with aceto-carmine.

CHROMOSOME NUMBER AND MORPHOLOGY

The first investigation of the chromosomes of *Populus* was made by Graf in 1921. He found the reduced chromosome number in *P. tremula* and *P. canadensis,* as determined from reduction divisions in the embryo sac mother cells, to be four. These counts have since proved to be erroneous. In 1924 Blackburn and Harrison, on the basis of chromosome number in seven species of *Populus* and seventeen species of *Salix,* established the fundamental reduced chromosome number in the Salicaceae as nineteen. In *Salix,* a polyploid series based on multiples of two, four and six was found. Since 1924 various workers have studied chromosome numbers in *Populus*. Table I summarizes the chromosome numbers which have been determined up to this time and lists the authority for each

TABLE 1.

PREVIOUSLY DETERMINED CHROMOSOME NUMBERS OF POPULUS SPECIES, WITH AUTHORITY AND DATE.

Species	Diploid Number	Authority
*P. alba	38	Von Wettstein (1933)
*P. alba	57	Peto (1938), van Dillewijn (1940)
P. alba var. nivea aureo-intertexta	57	Peto (1938)
P. balsamifera[1]	38	Meurman (1925)
P. canescens	38	Peto (1938)
P. canescens	57	Peto (1938)
P. deltoides var. missouriensis	38	Van Dillewijn (1940)
*P. Eugenei[2]	38·	Blackburn (1926), Peto (1938)
P. gelrica	38	Van Dillewijn (1940)
*P. generosa	38	Blackburn (1926)
*P. grandidentata	38	Peto (1938)
P. lasiocarpa	38	Von Wettstein (1933)
*P. nigra	38	Blackburn and Harrison (1924), van Dillewijn (1940)
*P. nigra var. italica	38	Van Dillewijn (1940)
*P. robusta	38	Van Dillewijn (1940)
P. serotina[3]	38	Blackburn (1926)
*P. serotina	38	Van Dillewijn (1940)
P. Sieboldii	38	Nakajima (1937)
*P. Simonii	38	Meurman (1925)
P. tremula	38	Blackburn and Harrison (1924)
P. tremula	38	Von Wettstein (1933), Muntzing (1936)
P. tremula	57	Muntzing (1936), Tometorp (1937)
*P. tremuloides	38	Erlanson and Hermann (1927), Peto (1938)
*P. trichocarpa	38	Meurman (1927)

* Count confirmed in the present study.
[1] P. balsamifera L. = P. deltoides Marsh. var. missouriensis Henry.
[2] P. Eugenei probably = ×P. canadensis Moench, var. Eugenei (Simon-Louis) Schelle
[3] P. serotina Hartig = ×P. canadensis Moench, var. serotina (Hartig) Rehd.

count. Table II shows the distribution of chromosome numbers among the sections of the genus. Those determined by the writer are indicated in this table. In all, some forty-five species, varieties, and natural hybrids have been investigated.

An examination of these numbers reveals that no polyploid series similar to that found in *Salix* exists in *Populus*. All species exist in the diploid form with the diploid number of chromosomes equal to thirty-eight. However, in the section *Leuce,* three species are found which possess triploid forms also, with the unreduced chromosome number of fifty-seven.

It should be pointed out that, in most cases, the chromosome numbers for any particular species have been determined from the examination of but one or, at the most, a few specimens of the species. It is possible that the examination of a species throughout its entire range might reveal

TABLE 2.

A LIST OF CHROMOSOME NUMBERS OF POPULUS SPECIES AND VARIETIES, SHOWING THE DISTRIBUTION OF THESE NUMBERS AMONG THE SECTIONS OF THE GENUS.

Section	Species	Chromosome Number, 2N
Leuce	P. alba L.	38, 57
	P. alba var. nivea aureo-intertexta	57
	*P. adenopoda Maxim.	38
	P. canescens (Ait.) Sm.	38, 57
	P. grandidentata Michx.	38
	P. Sieboldii Miq.	38
	P. tremula L.	38, 57
	P. tremuloides Michx.	38
	*P. tomentosa Carr.	38
Leucoides	P. lasiocarpa Oliv.	38
Tacamahaca	*P. acuminata Rydb.	38
	**P. angustifolia James	38
	**P. candicans Ait.	38
	*P. cathayana Rehd.	38
	×P. generosa Henry	38
	*×P. Jackii Sarg.	38
	*P. koreana Rehd.	38
	*P. laurifolia Ledeb.	38
	**P. Maximowiczii Henry	38
	P. Simonii Carr.	38
	**P. Tacamahaca Mill.	38
	*P. Tacamahaca var. Michauxii (Dode) Farwell	38
	P. trichocarpa Hook.	38
	**P. trichocarpa var. hastata Henry	38
	*×P. Woobstii (Reg.) Dode	38
Aegeiros	*×P. Andrewsii Sarg.	38
	**P. angulata Ait.	38
	×P. barbantica Houtz.	38
	*×P. berolinensis Dipp.	38
	*×P. canadensis Moench	38
	*×P. canadensis var. erecta (Selys-Longchamps) Rehd.	38
	×P. canadensis var. Eugenei (Simon-Louis) Schelle	38
	*×P. canadensis var. marilandica (Poir.) Rehd.	38
	*×P. canadensis var. regenerata (Schneid.) Rehd.	38
	×P. canadensis var. serotina (Hartig) Rehd.	38
	*P. deltoides Marsh.	38
	P. deltoides var. missouriensis Henry	38
	×P. gelrica Houtz.	38
	P. nigra L.	38
	P. nigra var. italica Muenchh.	38
	*P. nigra var. betulifolia (Pursh) Torr.	38
	*P. nigra var. plantierensis (Simon-Louis) Schneid.	38
	×P. robusta Schneid.	38
	**×P. Rasumowskyana Schneid.	38
	*×P. Sargentii Dode	38

** Determination made by the writer from root tip preparation.
* Determination made by the writer from meiotic preparations.

polyploidy within that species. In Sweden, where *P. tremula* has been studied most extensively, nine clones of the triploid form have been discovered (Nilsson-Ehle, 1936; Muntzing, 1936; Blomquist, 1937; Tometorp, 1937; Johnsson, 1940). One tetraploid form of *P. balsamifera* (= *P. deltoides?*) was reported by Blackburn and Harrison in 1924. Meurman (1925) thinks it likely that some species other than *P. balsamifera* was examined. Although it is true that workers since 1924 have found this species to be a diploid, it is possible that it may also exist in the tetraploid form. Johnson (1939) lists *P. Simonii* as having the unreduced number of seventy-six chromosomes. However, Meurman (1925), who first investigated this species, stated that it is probably a hybrid and due to this fact frequently shows thirty-eight univalent chromosomes at meiotic metaphase. Material investigated in the present study showed a reduced number of nineteen.

Polyploid forms of *P. tremula* have been produced by different investigators. A tetraploid form of this species resulted from the crossing of two triploid forms (Nilsson-Ehle, 1938). Similarly, tetraploids and individuals possessing all the chromosome numbers from nineteen to thirty-eight have been obtained from crosses of diploid and triploid forms of *P. tremula* (Johnsson, 1940).

The chromosomes of *Populus* are small and of varying size. Blackburn and Harrison (1924) made the first observations on size of meiotic chromosomes in *P. tremula*. Here they found that the chromosomes were ". . . of unequal dimensions; nine were small ones of more or less uniform size; nine others, larger than these, formed a graded series beginning with a member of just a little greater volume than the individual of the first group, and ending with one more than four times its volume. Lastly there was a single chromosome, obviously compound in structure, nearly always appearing in a flat plate as four-lobed, equalling in volume, if not exceeding, that of any two of the other eighteen." These observations were found to apply to *P. nigra* also. The studies were made on meiotic chromosomes at metaphase and anaphase I. Meurman (1925) thought there were two groups of nine chromosomes, nine smaller and nine larger, each group varying within itself. In *P. balsamifera* and *P. trichocarpa* one of the chromosomes was noted as being twice the size of any of the rest. Erlanson and Hermann (1927) saw a similar size classification in *P. tremuloides*. Muntzing (1936) and Johnsson (1940) agree that in *P. tremula* one of the bivalents is much larger than other chromosomes of the set. Nakajima (1937) speaks of a particularly long chromosome in *P. Sieboldii*, while van Dillewijn finds a "giant chromosome" in the meiotic configurations of *P. nigra*, *P. nigra* var. *italica*, *P. brabantica*, *P. gelrica*, *P. robusta*, *P. deltoides* var. *missouriensis*, *P. serotina*, and *P. alba*.

No measurements have been made during this investigation of the size of mitotic chromosomes of *Populus*. However, an examination of root tip chromosomes of *P. tremula*, as illustrated by Muntzing (1936) and Johnsson (1940), would indicate that they range in size from approximately 0.75 to 2.1μ. Since the chromosomes are quite small and numerous, studies of chromosome morphology at mitotic divisions are extremely difficult. An attempt was therefore made to study the prophase stages of meiosis. *Fig. 1* shows a pachytene stage in the hybrid *P. nigra* × *P. trichocarpa*. Due to the difficulties involved in making accurate measurements, the lengths are to be regarded as approximations. However, it can be seen from the idiogram (*Fig. 2*) that there is no "giant chromosome" apparent at this stage. Neither can there be any division of the chromosomes into two groups of nine, one composed of small and one of large chromosomes. There is, rather, a gradual increase in size from about 8.5 to about 30.6μ in length at this stage. There are one group of three chromosomes and two groups of two chromosomes which are of exactly the same length, a fact which may be of some significance. The discrepancy in reports on the comparative lengths of prophase and metaphase meiotic chromosomes may be due to a differential rate of contraction of the chromosome during the prophase stages. The preparations did not stain in such a way as to show the spindle insertion point.

The genus *Populus* is dioecious. For this reason it might be expected to be the subject of investigation seeking to determine whether or not sex-chromosomes are present in plants. Blackburn and Harrison (1924) first described a heteromorphic chromosome pair in the meiotic chromosomes of *P. tremula* as consisting of a medium sized and a small member. In subsequent investigations the same was found to be true in the case of *P. nigra*. Meurman (1925) seems to have been the first to designate the larger of this chromosome pair as an X chromosome and the smaller as a Y. Thus the male in *Populus* is XY, the female XX, making the condition existing in this genus analogous to that prevailing in most animals. He was able to demonstrate a heteromorphic chromosome pair in the male trees of the species *P. trichocarpa*, *P. balsamifera*, and *P. Simonii*. Erlanson and Hermann (1927), investigating the cytology of perfect flowers in a specimen of *P. tremuloides*, found a heteromorphic pair present at the meiotic divisions similar to that which they saw in the monoecious form of the same species. Nakajima (1937) found that a heteromorphic chromosome pair exists in *P. Sieboldii*.

Muntzing (1936) points out that, since the triploid forms which exist in certain species of *Populus* must have arisen from the union of two gametes, one reduced and one unreduced, we might expect intersexual forms. None, however, has been found. Peto (1938) found no heteromorphic chromosome pair which was present consistently. However, heteromorphic pairs were found in hybrids, and in such instances he thinks that their presence might be explained on the basis of structural differences involved in species differentiation.

Although a special study of sex-chromosomes has not been made a part of this investigation, it may be said that no definitely heteromorphic chromosome pair has been found consistently in any of the species or hybrids studied. *Fig. 10* shows what appears to be a heteromorphic bivalent similar to those used as illustrations of sex-chromosomes in *Populus* by different authors. It would seem that a demonstration of the presence or absence of a heteromorphic pair at meiosis in a pistillate tree might offer some proof of the existence of sex-chromosomes in this genus. Only one investigation of female trees has been made with this point in mind. Blackburn (1926) states, in reference to *P. tremula,* "I am able to state in regard to the female only that all pairs appear to be equal." A study of meiotic prophase chromosomes, where conditions are most favorable for the detection of morphological differences among the chromosomes, has thus far revealed no strikingly different homologues.

Lawrence (1931) suggests that in general those families with high chromosome numbers, such as the Salicaceae, will be found to be secondary polyploids. Secondary polyploids, according to the definition of Darlington and Moffett (1930), are ". . . homozygous allopolyploids in which some chromosomes of the basic set are present more frequently than others." Some examples of such genera are *Pyrus* (Darlington and Moffett, 1930), *Acer* (Meurman, 1933), and *Dahlia* (Lawrence, 1931).

Cytologically, secondary polyploids may be recognized by the appearance of a secondary association of chromosomes at either pro-metaphase I or II of the meiotic divisions. The presence of more than two genetically similar chromosomes will result in the formation of occasional multivalent chromosome configurations at the meiotic metaphase I. Further, if these chromosomes are genetically similar it might be expected that they would be morphologically similar, also.

Lawrence (1931) found evidence of secondary association of chromosomes on examination of illustrations of the meiotic chromosomes of species of *Salix* published by Blackburn and Harrison (1924). Van Dillewijn (1940), working on *Populus,* found secondary association of chromosomes in the case of *P. nigra* and *P. nigra* var. *italica.* On this basis he divides the chromosomes into three groups of three each, four groups of two each, and an additional group composed of the "giant chromosome" associated with a smaller chromosome. From this latter association he concludes that the giant chromosome is formed from the union of two smaller chromosomes and that the group as a whole is a group of three. There are thus eight groups in all, giving a basic ancestral number of eight to this genus. Of the original eight chromosomes, four have been duplicated and four triplicated, while within one group of three chromosomes, two have become fused.

Additional evidence that *Populus* is a secondary polyploid is given by the rare occurrence of trivalent formations in the meiotic metaphase of certain diploid hybrids (Table VIII) and the similar occurrence of occasional quadrivalents in the triploid form of *P. alba* (Table III). An examination of the idiogram (*Fig. 2*) does not reveal the similarity in chromosome size which one would expect from van Dillewijn's account of secondary association. Certain members of the chromosome complement are of exactly the same length. However, on a purely morphological basis it is impossible to obtain the grouping of chromosomes to give eight as the basic number.

There seems to be evidence that the genus *Populus* is of polyploid origin, but obviously there must be a more detailed study before the actual basic number can be determined with any certainty.

CYTOLOGY OF SPECIES

According to Chamberlain (1897), the stamens of *Salix* pass the winter in the spore mother cell stage. He inferred that this was likewise the case in *Populus*. The present work confirms this, for catkins collected in December and early February of 1940 showed the pollen mother cells in a resting condition.

The rate of the meiotic divisions in all species is quite rapid. All stages from first meiotic division to the stage where free immature pollen grains are seen may take place within a space of from twenty-four to thirty-six hours.

The instigation of the meiotic divisions is usually correlated in this genus with the development of anthocyanin pigment in the anthers. Further, the sequence of these divisions and consequently of pollen formation within the catkin seems to be constant within the species and even within the sections of the genus. Erlanson and Hermann (1927) noted that in normal male catkins of *P. tremuloides* the divisions began in the stamens at the base of the catkin and continued regularly toward the tip.

In general there seem to be two types of order of flowering. In type I the meiotic divisions are instigated at either a central or basi-central position and proceed toward the tip and base of the catkin. In type II the divisions begin at the tip of the catkin and proceed toward the base. In the seventeen species and varieties examined, the type was constant within a section of the genus. Type I was found in the sections *Leuce* and *Tacamahaca,* while type II was typical of the section *Aegeiros*. The natural hybrid × *P. berolinensis* was aberrant, for while belonging to the section *Aegeiros* it was of type I.

Observations made at the time of anther dehiscence bear out these results, for it was noted that those species belonging to type I shed the pollen at the basal end of the catkin first, while in type II the reverse was true. Meiotic divisions within a pollen sac are usually at the same stage, although two successive stages may be present. In general, the same may be said of all the anthers in one flower. However, in hybrids some irregularities have been observed. Meurman (1925) noted that in *P. Simonii,* which is probably a hybrid, stages from prophase I to telophase I inclusive were often found in the same anther sac. Erlanson and Hermann (1927) found a similar condition in the anther sacs of perfect flowers in *P. tremuloides*.

The first and second meiotic divisions, with few exceptions, are regular in the true species of *Populus* (*Figs. 8–15*). The picture is diagrammatic in its simplicity and regularity.

TABLE 3.

CHROMOSOME PAIRING AND POLLEN STERILITY IN POPULUS SPECIES.

Species	Pairing Relationship I	II	III	IV	Sterility %
P. acuminata	0.80	18.60	0	0	45
P. adenopoda	0.40	18.80	0	0	19
P. alba (diploid)	0	19.00	0	0	3
P. alba (triploid)	10.56	13.52	5.56	0.68	23
P. deltoides	0	19.00	0	0	2
P. grandidentata	0	19.00	0	0	2
P. koreana	0.50	18.75	0	0	12
P. laurifolia	0.40	18.80	0	0	40
P. nigra	0	19.00	0	0	3
P. nigra var. italica	0	19.00	0	0	4
P. Sargentii	0	19.00	0	0	7
P. tremuloides	0	19.00	0	0	2

TABLE 4.

CHROMOSOME PAIRING AND POLLEN STERILITY IN A SPECIES OF POPULUS FROM WHICH FLOWERING BUDS WERE FORCED IN THE GREENHOUSE FOR DIFFERENT PERIODS OF TIME.

Date of collection	Date at which meiosis took place	Chromosome pairing at meiosis I	II	III	Pollen sterility %
January 24	February 2	7.92	15.04	0	70
March 9	March 12	7.32	15.28	0.04	72
March 23	March 23	7.80	15.10	0	65

Table III gives the pairing relationships observed in a number of species. The counts are based on the study of twenty-five metaphase or late diakinesis configurations for each species, while the sterility counts were made on the basis of a count of one thousand pollen grains for each species.

The material for study was obtained from the *Populus* collection in the Arnold Arboretum. Flowering branches were brought into the greenhouse over the period of February to April and forced into flower. The results might be criticized on the basis that forced material might not behave as normally developed material. However, Nohara (1924) found in pollen studies of *Salix* sp. that results obtained from forced pollen did not differ either in percentage of perfect grains or in viability from that collected in the field. That forcing does not affect chromosome pairing and pollen sterility in *Populus* may be seen from Table IV, where collections of *Populus* sp. (probably a hybrid) made over the period January to March are compared in regard to chromosome behavior and pollen sterility.

Chromosome pairing was complete in most cases where pure species were studied. This pairing was so intimate that the different members of the pair could be distinguished only with difficulty. Occasional univalent chromosomes were encountered, as for example in *P. laurifolia* and *P. adenopoda*. Apparently this lack of pairing at metaphase I was the result of a precocious separation due to failure or early terminalization of chiasmata rather than to lack of homology between the chromosomes concerned. In this connection Johnsson (1940) reports that in sixteen clones of diploid *P. tremula* examined, four clones showed metaphase I plates having varying numbers of univalents. This is attributed to the influence of external conditions, such as temperature, on meiosis.

Diakinesis proved to be an advantageous stage for study, for at this stage the chromosomes are widely scattered over the entire area of the cell. The nucleolus is usually still present at this stage (*Fig. 8*) and may in some cases remain visible until the early metaphase. However, in those cases where the nucleolus persists until late diakinesis, it shows an irregular outline and a light staining reaction indicative of dissolution. Van Dillewijn (1940) finds that in *P. brabantica*, a natural hybrid, the nucleolus is still visible at the metaphase in some cells, either on the plate or near the plate, in the cytoplasm.

One chromosome is invariably associated with the nucleolus (*Figs. 1, 8, 16*) and is easily distinguished from the remaining chromosomes of the complement, since it is somewhat condensed and darker staining than the rest. The association of one particular chromosome of the complement with the nucleolus has been described by several writers, including Heitz (1931), Sax (1932), and Smith (1933).

In many of the species studied it was noted that the nucleolus possessed a protuberance or knob. Rarely more than one of these was present per nucleolus. A similar condition was described in *P. nigra* by van Dillewijn (1940). According to this writer no protuberance is visible on the nucleolus in the early prophase, but as the prophase progresses a bud develops until it sometimes reaches the dimensions of a nucleolus itself. It seems to the present writer that the knob is first visible in very early prophase and that it reaches its maximum development at approximately the pachytene stage. No difference in size of the knob was noticed between pachytene and early diakinesis. By late diakinesis the knob began to disappear along with the nucleolus proper. In all cases where the nucleolus possesses a knob, the associated chromosome is located at the junction of the knob and nucleolus (*Fig. 1*).

The percentage of nucleoli which showed knobs differs in different species. In *P. deltoides* about seventy-seven per cent, in *P. alba* (diploid) about forty per cent, and in *P. nigra* about eighty percent showed knobs. In *P. alba* the knobs are quite small and rarely approach those of *P. nigra* and *P. deltoides* in size.

The situation where one finds a knobbed protuberance of the nucleolus has been reported but rarely in the flowering plants. Selim (1930), Nandi (1936), and Parthasarathy (1938) report a somewhat similar condition in *Oryza,* as do Paul (1937) in *Tamarindus* and Iyengar (1939) in *Cicer*. McClintock (1934) reports a reciprocal interchange in *Zea Mays,* produced by x-ray treatment involving the nucleolus organizer, which produces a condition similar in appearance to that described here.

Following telophase I the nuclei are reorganized and the second meiotic division follows in a regular manner.

As is the case in simultaneous pollen cell formation, the cell wall is formed by a furrowing process. This is the method most commonly found in the flowering plants. A condition similar to that which occurs in *Populus* has been described in *Nicotiana* by Farr (1916). The furrows form along the equator of each spindle, extending from the periphery to the center of the pollen mother cell, eventually cutting it into four microspores. Previous to the appearance of these furrows, there appears to be a more or less hyaline area present in the center of the cell, presumably caused by a migration of the protoplasmatic granules away from this particular region. This hyaline area extends in four arms from the center to the periphery, marking the future position of the furrows. This seems somewhat comparable to the condition found in *Melilotus* (Castetter, 1925), where similar hyaline areas appeared, caused by a vacuolation of the cytoplasm. Whether or not the hyaline area in *Populus* is caused by a vacuolation must be determined by a more critical examination aided by differential staining methods.

The furrowing process seems to be easily upset. In many cases in hybrid material and in the triploid form of *P. alba* it appears that only one furrow formed, thereby cutting the pollen mother cell into dyads instead of tetrads, although the dyads are themselves binucleate. Occasionally the furrowing process was observed to fail entirely, or it was of such a nature that three microspores instead of the usual four were formed. The significance of such aberrant furrowing is indeed great, if such spores are functional. Numerous examples of such irregularities in microspore formation in *Populus* have been described (Peto, 1938; van Dillewijn, 1940).

A fairly wide variation is seen in the pollen sterility of the pure species studied. In general, these species which showed some univalent chromosomes were the most sterile, but the univalent frequency is hardly sufficient to account for the sterility encountered. Apparently genetic and environmental factors are also involved.

The triploid form of *P. alba,* with an unreduced chromosome number of fifty-seven, shows, as one would expect, a varying number of univalents, bivalents, and trivalents. It also shows quadrivalent formation to some extent (Table III), the significance of which has already been commented upon. It is surprising that the pollen sterility of this triploid is less than that of some of the diploid species studied.

Pollen fertility reported for various triploid forms has been summarized in Table V. Peto (1938) has commented upon this high fertility. It is his opinion that this is merely apparent, and he assumes that the genetically unbalanced pollen grains deteriorate rapidly following their

TABLE 5.

POLLEN STERILITIES IN TRIPLOID FORMS OF POPULUS SPECIES.

Triploid Species	Per cent Fertility	Authority
P. tremula	58–75	Johnsson, 1940
P. tremula	44	Muntzing, 1936
P. alba	63	Peto, 1938
P. alba var. aureo-intertexta	94	Peto, 1938
P. alba	67	Smith, 1942

formation. In the pollen slides which he examined, he observed numerous tiny specks which he interpreted to be degenerate pollen grains. It has been shown, however, that in the cross of a triploid $\times$ a diploid and a triploid $\times$ a triploid, *P. tremula,* progeny with intermediate chromosome numbers varying from thirty-eight to seventy-six can be obtained (Johnsson, 1940; Bergstrom, 1940). This fact seems to show that unbalanced pollen grains in at least one species of *Populus* can survive. It has been shown that the genus *Populus* is probably a derived polyploid (van Dillewijn, 1940, and the present study). If this is the case, then certain chromosomes and thus certain combinations of genes are duplicated within the basic set. This condition would be exaggerated in the case of a triploid form, where the basic set of nineteen chromosomes is present three times. In a situation of this sort, it might be expected that pollen sterility due to duplications and deficiencies of whole chromosomes would not be apparent, for it is conceivable that spores lacking certain duplicated chromosomes would still have a functional set of genes.

On the basis of the pairing relationships of the chromosomes at meiosis, it is apparent that the triploid forms of diploid species thus far reported are autotriploids (Muntzing, 1936), which probably arose through the union of a diploid with a haploid gamete.

Studies of the first and second meiotic divisions and the development of the immature microspores have been made by different writers. However, little work has been done on the further development of the male gametophyte. Chamberlain (1897), working with *P. monilifera* (probably *P. deltoides*), reports that the division of the microspore nucleus into the tube and generative nuclei takes place in the pollen grain relatively early, before the tapetal cells of the anther sac degenerate. He describes a rather unusual condition in that two divisions of this pollen grain nucleus occur. On the conclusion of the first division, the smaller of the daughter nuclei is cut off from the other by a cell wall and degenerates. The remaining nucleus then divides again to form the generative and tube nuclei. He concludes by stating, "Since spores already upon the stigmas showed no further differentiation, the division of the generative cell which presumably takes place, although I was not so fortunate as to observe it, must occur after the pollen tube begins to form."

If the condition described by Chamberlain, in which an extra prothallial cell is produced in the pollen grain, is correct, then it is unique, as far as is known in the Angiosperms, and thus of very special interest. Consequently an attempt was made to follow the microspore development up to the production of the gametes. In this part of the work the species *P. deltoides, P. acuminata,* and *P. adenopoda* were used. It was possible to demonstrate the first microspore division by aceto-carmine smears (*Fig. 3*). However, shortly after this division occurs, the pollen wall becomes so opaque that further observation by this method becomes impossible. Further study was made by embedding in paraffin, sectioning, and staining with haematoxylin. A second division within the pollen grain was not observed. The mature pollen grains examined contained two nuclei and there was no visible remnant of a disintegrating nucleus. However, occasional cases, both in *P. acuminata* and *P. adenopoda,* showed a third nucleus within the pollen grain. Since these species show some irregularity at metaphase I (Table III), it is possible that these irregularities might account for this third nucleus.

The development of the pollen tube in the species *P. deltoides, P. laurifolia, P. acuminata,* and *P. adenopoda* was investigated by placing freshly shed pollen from these species on slides coated with a mixture of agar-agar, gelatin, and sugar, as described in the section on technique. The pollen germinates almost immediately. As a rule the tube nucleus emerges first and the generative nucleus follows. The appearance of the generative nucleus after its emergence from the pollen grain is such that the chromosomes may be distinguished within it. In certain cases it would seem that the term generative cell should be used rather than generative nucleus. The division of the cell takes place from ten to fifteen hours after germination of the pollen grain. Different stages in the development of the pollen tube are shown in *Figs. 4–7*.

HYBRIDIZATION IN POPULUS

Natural hybrids are of frequent occurrence within the genus *Populus*. Johnson (1939) lists sixteen such interspecific hybrids. Rehder (1940) lists sixteen hybrids which have been given species or varietal names but does not include all those listed by Johnson. In all, about twenty-five natural interspecific hybrids have been reported in the genus.

Among the first interspecific hybrids to be described in this genus were many which occurred in botanic gardens when an introduced species was planted near a native species or when two introduced species were planted together. × *Populus berolinensis,* the hybrid *P. laurifolia* × *P. nigra* var. *italica,* which originated in the Botanic Garden of Berlin before 1870, is an example of this. × *Populus canadensis* and its varieties and × *P. robusta* are further examples. Peto (1938) reports similar hybrids in Canada between the European species *P. alba* and the native species *P. grandidentata* and *P. tremuloides.* It has been noted that female trees of species which have no male trees in the vicinity set viable seed. *P. Maximowiczii* is a good example of this fact, for in the Arnold Arboretum it sets seed, some of which produce hybrid seedlings, although there are no male trees of this species in North America.

At different times natural hybrids have been described from the field. This has been especially true in eastern Asia and North America, where the number of species of *Populus* is most abundant. From China the "species" *P. Simonii* is probably a natural hybrid, and × *P. Woobstii* is thought to be the cross *P. laurifolia* × *P. tristis*. In order to determine the actual extent of natural hybridization among the North American species, a survey was made of the geographic distribution of the principal species and their natural hybrids, based upon a study of the herbarium sheets of *Populus* in the herbarium of the Arnold Arboretum.

× *Populus Andrewsii* represents the cross *P. Sargentii* × *P. acuminata*. It has been collected from two stations in Colorado, Welsenberg and Montrose, both within the southern part of the overlap range of the parent species, which are also represented from these stations. × *Populus Parryi* has been collected from three localities in California, Canada de las Uvas, San Bernando, and Owens Lake. It is the result of the cross *P. Fremontii* × *P. trichocarpa*. × *Populus Jackii* (*P. Tacamahaca* × *P. deltoides*) has been collected from some twenty localities scattered over southern Quebec and Ontario, Vermont, and New York. This area represents but a small part of the overlap range. In many cases both parents have been collected from the same localities as the hybrid. The hybrid *P. grandidentata* × *P. tremuloides* is somewhat similar in both these respects. It has been collected at twelve stations from Quebec and New England west to Ohio. The probable hybrid *P. acuminata* × *P. Wislizeni* has been collected from one locality, Silver City, New Mexico. The cross *P. candicans* × *P. Tacamahaca* is represented by one collection made in the Arnold Arboretum. Four of these natural hybrids are the result of intersectional crosses, while two are crosses between species belonging to the same section, *P. grandidentata* × *P. tremuloides* and *P. candicans* × *P. Tacamahaca*.

Any conclusion drawn from this study of natural hybridization are necessarily limited by the fact that only those herbarium sheets contained in the Arnold Arboretum herbarium were examined. In no case does the distribution of the hybrid cover the entire range of overlap between the parent species. In two cases the hybrid is represented by but two collections. From the numerous artificial hybrids reported one might expect to find natural hybrids widespread. Their relative scarcity may be due to several reasons. 1. These hybrids are capable of reproducing themselves only through vegetative means. 2. Hybrids are scarce in those regions in which relatively little collecting has been done and abound in those regions where abundant collections have been made. 3. The most probable reason, however, is that while growing in the same general geographic region, the parent species may occupy different ecological habitats and overlap rather infrequently. An attempt will be made in a later part of this work to account for this lack of hybridization on the basis of

TABLE 6.

NATURAL AND ARTIFICIAL INTERSPECIFIC HYBRIDS WITHIN THE GENUS POPULUS ARRANGED TO SHOW CROSSING WITHIN AND BETWEEN SECTIONS.

Leuce × Leuce	Leuce × Tacamahaca	Leuce × Aegeiros	Tacamahaca × Tacamahaca	Tacamahaca × Aegeiros	Aegeiros × Aegeiros
14	2	4	7	28	28

edaphic isolation. However, it can be shown that, in spite of such isolation, most of the possible hybrids occur between species of the same geographic region.

Artificial interspecific hybrids in this genus have been produced in abundance by different workers. Smith and Nichols (1941) list eighty-one artificial interspecific hybrids which have been produced and described by Henry (1914), Heimburger (1936, 1940), von Wettstein (1933), Schreiner (1934), and others. Table VI shows how these hybrids, along with the known natural hybrids, are distributed between and within the sections of the genus. The significance of this distribution will be discussed in relation to speciation in a later part of this work.

Material for a cytological study of some of the artificial hybrids produced by Schreiner and his collaborators for the Oxford Pulp and Paper Company was obtained from Dr. E. J. Schreiner of the Northeastern Forest Experiment Station. The number of hybrids investigated was unfortunately limited to those which happened to come in flower over the period 1939–1941. Most of these were not the wide crosses which were desired for study. Those hybrids from which collections were made are described in Table VII, along with the natural hybrids investigated. The latter were obtained from the collections in the Arnold Arboretum.

In all, twenty-five metaphase I, anaphase I and, in some cases, anaphase II plates were analysed to determine the extent of chromosome pairing and to study the various abnormalities which follow asynapsis. In each case the pollen sterility was determined by a count of two thousand pollen grains. In this connection it might be noted that the sterility was variable, differing somewhat with different collections from the same tree taken at the same or different times. Where possible, prophase stages of meiosis were studied to obtain some idea of chromosome pairing at the earlier stages. Table VIII summarizes the data on chromosome pairing and pollen sterility obtained from both the natural and artificial hybrids studied.

CYTOLOGY OF HYBRIDS

In order that chromosomes may pair at meiotic metaphase, three general conditions must be realized: first, that genetically similar chromosomes are present; second, that asynaptic genes do not influence the pair-

TABLE 7.

A LIST OF THE NATURAL AND ARTIFICIAL HYBRIDS OF POPULUS INVESTIGATED, WITH DESCRIPTIONS OF THE CROSSES WHICH THEY REPRESENT.

Name or number*	Cross	Description of cross
1. ×P. Andrewsii	P. Sargentii × P. acuminata	Between sections Tacamahaca & Aegeiros; both parents native to North America.
2. ×P. berolinensis	P. laurifolia × P. nigra var. italica	Cross within the section Aegeiros between geographically isolated species.
3. ×P. canadensis 4. ×P. canadensis var. Eugenei 5. ×P. canadensis var. regenerata	P. deltoides × P. nigra	Cross within the section Aegeiros between geographically isolated species, P. deltoides from North America, P. nigra from Europe & western Asia.
6. ×P. Jackii	P. Tacamahaca × P. deltoides	Intersectional cross Tacamahaca × Aegeiros; parents native to North America.
7. P. nigra var. plantierensis	P. nigra var. italica × P. nigra var. betulifolia	Within the section Aegeiros; both parents varieties of the same European species.
8. ×P. robusta	P. angulata × P. nigra var. plantierensis	Within the section Aegeiros between geographically isolated species.
9. P. Simonii	Supposed true species; native to north China.	
10. ×P. Woobstii	P. laurifolia × P. tristis ?	Cross within the section Tacamahaca; parents native to western Asia.
OP–64 OP–74 OP–113	P. charkoviensis × P. plantierensis	Both parents probably hybrids; cross might be written thus: (deltoides × nigra) × (nigra var. italica × nigra var. betulifolia).
OP–96 OP–97 OP–98 OP–118	P. nigra × P. laurifolia	Cross between sections Tacamahaca and Aegeiros; between geographically isolated species.
OP–99	P. charkoviensis × P. clone robusta	Both parents probably hybrids within section Aegeiros; (deltoides × nigra) × (angulata × nigra var. plantierensis).

TABLE 7 (*continued*).

Name or number*	Cross	Description of cross
OP-102	P. nigra × P. berolinensis rossica	Parents within the section Aegeiros; male parent hybrid; deltoides × nigra var. italica.
OP-103	P. nigra × P. nigra	Control cross.
OP-104	P. nigra × P. trichocarpa	Intersectional cross between geographically isolated species.
OP-105 OP-106	P. nigra baatanicorum vitrum × P. volga P. nigra baatanicorum vitrum × P. plantierensis	Crosses between 2 closely related varieties of P. nigra.
OP-109 OP-110	P. Rasumowskyana × P. caudina P. Rasumowskyana × unidentified cotton-wood	Female parent probably the hybrid P. laurifolia × P. nigra; parents probably belong to section Aegeiros.
OP-111 OP-114	P. charkoviensis × P. incrassata	P. charkoviensis probably hybrid P. deltoides × P. nigra; male parent closely related to P. nigra; both belong to section Aegeiros.
OP-112	P. deltoides × P. deltoides	Control cross.
OP-116	P. charkoviensis × P. berolinensis	Both parents probably hybrids; (nigra × deltoides) × (laurifolia × nigra var. italica); both belong to section Aegeiros.
OP-117	P. charkoviensis × P. deltoides	(nigra × deltoides) × deltoides; cross within the section Aegeiros.
OP-119	P. charkoviensis × P. caudina	Female parent probably hybrid; both within section Aegeiros.

* Entries numbered 1-10 are natural hybrids. The remaining entries are artificial hybrids; clone numbers and parentages supplied by Dr. Schreiner.

ing; and third, that, after pairing, chiasmata form in the pachytene chromosomes.

In the present study, while it is recognized that the latter two conditions may play a part in the pairing behavior of the chromosomes at meiotic metaphase, no attempt has been made to study the chiasmata formation in the parental species and hybrids due to the extremely small size of the chromosomes. In general, it was noted that the univalents tend to be the smaller chromosomes of the complement. At this time not enough is known of the genetics of these hybrids to determine to

TABLE 8.

MEIOTIC CHROMOSOME PAIRING, CHROMOSOME NUMBER, INVERSION BRIDGE FORMATION, AND POLLEN STERILITY IN NATURAL AND ARTIFICIAL HYBRIDS OF POPULUS.

Name or Number	Chro. No.	Metaphase I Analysis I	II	III	Anaphase I Analysis L	B	M	Pollen Sterility Per cent
1.	19	0.72	18.64	0	0.72	0.14	1	20
2.	19	5.30	16.20	0.10	2.00	0.12	1	57
3.	19	1.84	18.08	0	0.60	0.12	2	17
4.	19	4.92	16.48	0.04	2.90	0.33	3	63
5.	19	3.92	17.04	0	3.69	0.04	1	56.5
6.	19	2.40	17.80	0				62
7.	19	0	19.	0				6
8.	19	6.00	16.	0	2.50	0.13	2	75
9.	19	1.76	18.12	0				31
10.	19	14.24	11.88	0				80
OP-64	19	0.28	18.86	0	0.16	0.23	1	5
OP-74	19	0.64	18.68	0	0.20	0.08	1	24
OP-113	19	1.14	18.43	0	0.16	0.23	1	22.4
OP-96	19	0.40	18.80	0				20
OP-97	19	1.00	18.50	0	0.40	0.20	1	16
OP-98	19	0.20	18.90	0				10
OP-118	19	0.80	18.60	0	0.40	0	0	25
OP-99	19	1.00	18.50	0				26
OP-102	19	1.20	18.40	0				20.4
OP-103	19	0.20	18.90	0				5
OP-104	19	0.80	18.60	0	0.66	0.33	2	23
OP-105	19	0.20	18.90	0	0.26	0.06	1	10
OP-106	19	0	19.	0	0.06	0	0	6
OP-109	19	0.60	18.70	0	0.86	0.53	3	12
OP-110	19	2.20	17.90	0	1.25	0.30	2	40.5
OP-111	19	0.20	18.90	0	0.40	0	0	
OP-114	19	0.40	18.80	0				
OP-112	19	0.20	18.90	0	0.46	0	0	6
OP-116	19	3.00	17.50	0				
OP-117	19	1.40	18.30	0	1.00	0.26	3	
OP-119	19	0.76	18.62	0	0.44	0.12	2	35

I, II, and III under metaphase analysis refer to the average number of univalents, bivalents, and trivalents per cell. L, B, and M under anaphase analysis refer to the average number of lagging chromosomes, average number of inversion bridges and maximum number of inversion bridges per cell.

what extent asynaptic genes influence pairing relationships. Environmental factors are also known to cause asynapsis.

Two classes of genetic dissimilarity of the chromosomes are recognized. The first, which is purely genic and presumably arises through gene mutation, is usually not assigned a large role in asynapsis. The second type of dissimilarity is structural and is brought about by rearrangements of genic material within the chromosome. It is usually assumed that this type of dissimilarity plays the major role in asynapsis.

Darlington (1937) discusses the classification of hybrids at some length, dividing them into seven classes: numerical, structural, undefined structural, complex, polyploid, numerical-structural, and Mendelian hybrids. Under this classification the interspecific hybrids in *Populus* considered here would be placed in the undefined structural hybrid class, these " . . . resulting from the union of gametes dissimilar as a result of changes which cannot be defined . . . simply because the structural differences between their chromosomes are too slight or too numerous to be detected."

The undefined structural hybrids are further broken down into those which show potentially complete pairing at metaphase I, those which show partial pairing, and those which have a potentially complete failure of pairing. Evidently the interspecific hybrids of *Populus* investigated thus far might be placed in the first two groups, although the larger number belongs to the second, for these hybrids show a partial and always variable pairing.

Numerous examples may be cited for each of the hybrid classes listed above. Among the undefined structural hybrids which show potentially complete pairing are *Salix viminalis* × *S. caprea* (Haakanson, 1929), *Platanus orientalis* × *P. occidentalis* (Sax, 1933), and *Catalpa bignonioides* × *C. ovata* (Smith, 1941). The hybrids *Viola arvensis* × *V. rothmagensis* (Clausen, 1931) and *Ribes nigrum* × *R. Grossularia* (Meurman, 1928) are examples of undefined structural hybrids which show partial pairing.

By the cytological examination of the interspecific hybrids from pachytene stage of prophase onward it is possible to demonstrate that a varying number of bivalents and univalents are present (*Figs. 1, 18, 21*). Within a single hybrid the number of univalents present per cell at metaphase I may vary from none to thirty-eight (*Figs. 18, 19, 21*). Considering the hybrids studied as a whole, the number of normal cells, normal in the sense that they contained nineteen bivalent chromosomes at metaphase I, varied from four to ninety-six per cent, with an average of fifty-three per cent.

Univalent chromosomes were present in varying numbers in all the hybrids examined. Usually these univalents lie on either side of the metaphase plate (*Fig. 18*), come onto the plate after the bivalent chromosomes have divided, and then divide (*Fig. 21*). There is some evidence that some univalent chromosomes do not divide at anaphase I but go to the poles without lagging or dividing. On the basis of an examination of five hundred each of metaphase I and anaphase I figures (twenty-five each of twenty hybrids), it was found that more univalents were present at metaphase I than appeared as lagging univalents at anaphase I. The average was 1.65 univalents at metaphase I as compared to 0.96 univalents at anaphase I. Since no univalent chromosomes were observed dividing at anaphase II it seems likely that those univalent chromosomes which did not divide at anaphase I behave in a normal manner at the following division.

After dividing, the lagging univalents may or may not reach the poles

TABLE 9.

A COMPARISON OF SUPERNUMERARY SPORES AND UNIVALENT CHROMOSOMES IN SPECIES AND HYBRIDS OF POPULUS.

Species or hybrid	Univalents per cell	Supernumerary spores per cell
P. deltoides	0	0
P. alba (diploid)	0	0
P. nigra	0	0
×P. Andrewsii	0.72	0.55
×P. berolinensis	5.30	0.32
×P. robusta	6.00	0.47
×P. canadensis	1.84	0.30

in time to be incorporated into the daughter nuclei. If they do not reach the poles they are lost in the cytoplasm (*Fig. 23*). If they are included in the dyad nuclei they are distributed at random to the poles at anaphase II or are lost in the cytoplasm. On the basis of one hundred anaphase II figures analyzed in two hybrids it was found that three times as many univalent chromosomes were lost at anaphase I as there were at anaphase II. The ultimate fate of these univalent chromosomes seems to depend upon the rapidity with which they progress to the poles at both anaphase I and II. In both cases if they reach the poles before the daughter nuclei are formed they are included in these nuclei, otherwise they are left behind in the cytoplasm, where they form either micronuclei or supernumerary spores. Just what determines their fate is not clear. It does not seem to depend upon the number of univalents available, for the nucleus of the supernumerary spore is as small as the micronucleus. The factor determining this may be the position of the univalents at the time of the cell wall formation, those near the microspore nuclei becoming micronuclei and those farther out becoming supernumerary spores.

That the presence of supernumerary spores is correlated with the presence of univalent chromosomes is shown by Table IX.

An anaphase analysis of these interspecific hybrids revealed in nearly every case a varying number of inversion bridges (Table VIII; *Figs. 24–31*). The condition in which a portion of a chromosome is present in the inverted state is one of the most frequently encountered meiotic aberrations. This condition can be detected in plants when a crossover occurs within the heterozygous inversion region, for as a result chromatin bridges are formed at anaphase I. A loop pairing at pachytene is also characteristic. The occurrence of inversions in both plants and animals has been reported by many writers, among them Muntzing (1934), Richardson (1936), and Stebbins (1938). Structural hybridity has not previously been reported in the genus *Populus*. Haakanson (1929) has reported a case of reciprocal translocation in *Salix*.

Following the occurrence of a crossover within the heterozygous inversion, a dicentric chromatid and an acentric fragment should be produced at anaphase I. The fragment usually lies in the cytoplasm in the vicinity of the bridge and varies in size with the length and position of the inverted region. Only five cases were encountered in these hybrids where the fragment could be seen associated with the bridge (*Figs. 25, 30*). This is not an unusual condition, for Swanson (1940) finds that in *Tradescantia* fifty per cent of the bridges studied lacked visible fragments. Sax (1937) and Darlington (1937) report a somewhat similar condition. These investigators account for the lack of fragments on the basis of the presence of small subterminal inversions, which result in fragments which are below the limit of visibility or are obscured by other chromosomes of the complement.

It is possible that the number of bridges observed was but a fraction of those which actually occurred, since the bridges formed in the smaller chromosomes would break in very early anaphase or stretch so thinly that they could not be seen. Usually the inversion bridge breaks and the two parts of the chromosome reach the poles, but occasionally the bridge fails to break and remains in the cytoplasm following the first division (*Fig. 31*).

No bridges were seen in material from control crosses or from the species of *Populus* examined.

It is of interest that van Dillewijn (1940) notes the presence of chromatin strings stretching between the two anaphase plates at late anaphase I in *P. robusta*. Meurman (1933) figures the heteromorphic sex-chromosome pair in *P. Simonii* (a probable hybrid) as lagging at anaphase I and resembling a chromosome bridge. It is possible that what in the past have been taken to be sex-chromosome pairs at anaphase are in reality inversion bridges. This seems especially likely since the members of the heteromorphic pair seem to differ but slightly in size. In the hybrids studied here, the possibility that what appears to be inversion bridges are in reality dividing sex-chromosomes seems to be ruled out in those cases where two or more bridges were seen in a single cell.

In general it may be said that pollen sterility is due to one or more of three possible factors: purely genetic, structural, and environmental. It is not possible to separate these three causes in the case of interspecific hybrids of *Populus*. From an examination of pure species within this genus it is apparent that pollen sterility varies from 2–7 per cent in those species showing complete chromosome pairing and from 19–45 per cent in those species showing a varying number of univalent chromosomes at metaphase I. Presumably the sterility in the first group was due largely to genetic causes, while that of the second group was due to both genetic and environmental causes. Presumably in the case of the interspecific hybrids all three factors contribute to sterility. At present it is impossible to determine to what extent each of these exerts its influence. There does seem to be a correlation between univalent formation and pollen sterility, as had already been noted in the case of the species studied. In general those hybrids with the higher number of univalents show the higher sterilities. The correlation is high, since r equals 0.88.

TABLE 10.

A COMPARISON OF CERTAIN NATURAL AND ARTIFICIAL INTERSPECIFIC HYBRIDS OF POPULUS IN REGARD TO DATE OF ORIGIN, UNIVALENT CHROMOSOME FORMATION, AND POLLEN STERILITY.

Name or number	Cross	Probable date of origin	Univalents per cell	Percentage of sterility
Natural Hybrids:				
×P. berolinensis	P. laurifolia × P. nigra var. italica	1870	5.30	57
×P. canadensis var. Eugenei	P. deltoides × P. nigra	1850	4.92	63
Artificial Hybrids:				
OP–67	P. nigra × P. laurifolia	1925	1.00	16
OP–114	P. nigra × P. trichocarpa	1925	0.80	23

The failure of chromosome pairing in these hybrids, followed by a loss of chromosomes or unequal distribution of chromosomes to the microspores, results in deficiencies and duplications of entire chromosomes. In the case of deficiencies, at least, this would lead to the sterility of those microspores deficient for one or more chromosomes. The loss of fragments of chromosomes through the formation of inversion bridges would also result in deficiencies for parts of chromosomes.

Peto (1938) notes that the pollen sterility in the hybrids within the section *Leuce* compares favorably with the sterility of the parent species. In the case of the hybrids considered here, it seems that the natural hybrids have an average sterility which is considerably higher than that of the parent species. The artificial hybrids, on the other hand, possess sterilities corresponding to those of the species, ranging from 5–40 per cent with an average of 19.7 per cent. The natural hybrids, however, range from 6–80 per cent with an average of 46.7 per cent pollen sterility.

It is known that the mutation rate increases with age (Cartledge and Blakeslee, 1934, and 1935). It might be expected that those physiological changes in the cell which condition this increased mutation rate might cause an increase in susceptibility to environmental influences, and, in addition, that structural changes occurring over a long period of time might accumulate to produce a greater pollen sterility. Certain natural and artificial interspecific hybrids of *Populus* are compared in Table X.

Some of the common meiotic abnormalities found in the interspecific hybrids of *Populus* have been mentioned. Among these were asynapsis, with subsequent lagging univalent chromosomes at anaphase I and II, and irregularities in cytokinesis within the pollen mother cell which result in dyads, triads, and number of microspores in excess of four. A pre-

TABLE 11.

A COMPARISON OF INTERSECTIONAL WITH INTRASECTIONAL CROSSES OF POPULUS, AND OF CROSSES BETWEEN NON-GEOGRAPHICALLY ISOLATED SPECIES WITH CROSSES BETWEEN GEOGRAPHICALLY ISOLATED SPECIES.

Class of hybrid	Number of hybrids	Average number univalents Metaphase I	Average number bridges Anaphase I	Average Per cent Sterility
Crosses within the section	13	3.22	0.19	37.9
Crosses between sections	7	0.90	0.17	25.0
Crosses between geographically isolated species	10	2.52	0.16	36.25
Crosses between non-geographically isolated species	3	5.78	0.14	54.0

cocious furrowing was a common abnormality of this sort. It was not uncommon to find that the furrowing process was well advanced before the completion of the second meiotic division. Muntzing (1936) and van Dillewijn (1940) describe cases of spindle fusion during the meiotic divisions in *Populus,* which result in microspores with the unreduced number of chromosomes. This is a possible cause for the occurrence of autotriploids within the genus. What appears to be a case of a third division in the pollen mother cell before microspore wall formation is shown in *Fig. 22.* Four spindles have formed and the thirty-eight chromosomes present have apparently been distributed to the poles at random.

DISCUSSION

Cytological and genetical studies of interspecific hybrids have been used by many investigators to establish probable interspecific relationships in plants and animals. The cytological study of species hybrids based upon chromosome configurations and sterility counts has been particularly useful, since it can be used as a basis for the determination of the manner in which speciation has taken place.

In the one varietal hybrid of *Populus* studied, *P. nigra* var. *plantierensis* (*P. nigra* var. *italica* $\times$ *P. nigra* var. *betulifolia*), the chromosome behavior and pollen sterility is comparable to that of a pure species.

Since *Populus* has been subdivided into four sections, and since the species within a section resemble one another more than they resemble those of other sections, it might be supposed that intrasectional hybrids would be more easily obtained and would show a lower percentage asynapsis and pollen sterility than intersectional hybrids. Table XI compares crosses between and within the sections *Tacamahaca* and *Aegeiros,* which are perhaps less distinctly set off from one another than from the other sections of the genus. From the table it is clear that there is no significant difference in regard to asynapsis and pollen sterility between crosses within and those between these sections.

A glance at Table VI will show that the majority of the crosses are inter- and intrasectional crosses involving species belonging to the two sections *Tacamahaca* and *Aegeiros*. This is to be expected, since these two sections contain more species than do the others. Further, the species producing the better timber trees of the genus are placed in these sections. No hybrids are known either within the section *Leucoides* or between species of this section and those of the other sections of the genus. Interspecific hybrids are known, however, within and between the sections *Leuce* and the sections *Tacamahaca* and *Aegeiros*. Table VI seems to indicate that crosses within the section are more easily obtained than are intersectional crosses (except *Tacamahaca* and *Aegeiros*). Heimburger (1940) sees a definite limitation to species hybridization based on genetic affinities which cause crossing to follow a series similar to the series aspens — silver poplars — cottonwoods — balsam poplars. However, Johnson (1939) states that there appears to be little limitation to species hybridization within the genus, as far as artificial hybridization is concerned.

A comparison of the cytological behavior of hybrids between geographically isolated species is of interest, inasmuch as it permits a study of the effects of isolation upon speciation over long periods of time. Table XI compares hybrids which result from crossing of geographically isolated species with hybrids resulting from the crossing of non-geographically isolated species, in regard to asynapsis, inversion bridge formation, and pollen sterility. It is apparent that there is no significant difference between the two groups. Species of *Populus* native to North America cross readily with European and Asiatic species to produce hybrids which are as fertile as those resulting from crosses between native North American species.

The term ecospecies, defined by Turesson (1922) as uniform types between which crossing is possible with a relatively high degree of fertility but which commonly are prevented from doing so by isolating barriers, either edaphic or geographical, would seem to apply to species of *Populus*. An examination of hybrids between certain species reveals a considerable amount of sterility; however, the F_2 and backcross generations which have been obtained show a segregation indicative of an exchange of genes between the two species.

Species as discrete units can exist as such only by means of some isolating mechanism. Various classifications of these mechanisms have been made (Sax, 1936; Dobzhansky, 1941). In general they may be divided into five classes: edaphic (adaptation to particular local habitats), geographic, physiological (probably genetic, but in this case referring to flowering time), chromosomal (either numerical or structural), and purely genetic.

TABLE 12.

HABITATS AND BLOOMING TIMES OF CERTAIN SPECIES OF POPULUS WHICH OCCUPY THE SAME GEOGRAPHIC REGION.

Species	Physiological blooming time in Arnold Arboretum	Edaphic ecological habitat
P. grandidentata	April 20/40	Moist sandy soil, gravelly hillsides
P. tremuloides	April 20/40	Rich moist soil, borders of streams and swamps
P. deltoides	May 5/40	Low, river-bottomlands
P. Tacamahaca	May 4/40	Low, often inundated river-bottomlands, swamp borders

Considering the three sections of the genus which have been studied, it is clear that artificial hybrids may be made in any direction. The F_1 hybrids have proved to be relatively fertile. However, at this time insufficient data are at hand to determine with certainty the viability of the second generation. It would seem that genetic isolation itself could not be the major factor in isolation of the species.

Autotriploid forms of a number of species within the section *Leuce* have been described. These, though relatively fertile, are unable to preserve their identity. No other polyploid forms are at present known in this genus. Polyploidy (numerical chromosomal isolation) is ruled out as a factor in speciation within this genus. Evidence has been advanced to show that *Populus* is a derived or secondary polyploid, so polyploidy may have played a part in the ancestral differentiation of the genus. The discovery of inversion bridges in the F_1 interspecific hybrids and the asynapsis present in most hybrids indicate considerable structural differentiation of the chromosomes of the different species. But, as in the case of genetic isolation, it does not appear to prevent the crossing of the species or the production of a relatively fertile F_1 generation.

A striking example of physiological isolation is found in this genus. The species included within the section *Leuce* are earlier in blooming time by two to three weeks than are those of the other species of the genus. They are thus definitely set off in nature. This isolation may be overcome artificially (Smith and Nichols, 1941). However, the major factor in isolation of the species of *Populus* seems to be isolation of a geographic and edaphic nature. Both types are essentially the same, geographic isolation being perhaps more complete and on a larger scale than edaphic isolation.

The species *P. grandidentata, P. tremuloides, P. deltoides,* and *P. Tacamahaca* occupy a somewhat similar area in northeastern United States and the adjoining region of Canada. Table XII summarizes their habitats and blooming times.

Populus grandidentata and *P. tremuloides* are set off from the remaining two species by their time of blooming. Presumably they are themselves isolated by edaphic factors, since their habitats differ somewhat. However, the hybrid *P. grandidentata* × *P. tremuloides* does occur. Similarly the hybrid × *P. Jackii* (*P. Tacamahaca* × *P. deltoides*) occurs rather frequently, although presumably the parental species are separated by edaphic isolation.

A consideration of evidence available would indicate that the first step in speciation in *Populus* may have been a physiological isolation of a group or groups of species from the general population, since the major geographic groups of *Populus* species all contain species belonging to the section *Leuce*. This physiological isolation was in turn followed by geographic and edaphic isolation. The structural-chromosomal differentiation which has taken place since that time has been insufficient to prevent interspecific hybridization and the production of reasonably fertile hybrids.

The slow accumulation of genetic differences through mutation has probably been the major factor in the differentiation of the species of *Populus*, but apparently these species can exist as discrete units only as a result of physiological isolation, in the case of the section *Leuce*, and geographic or edaphic isolation in the case of the individual species.

ACKNOWLEDGMENTS

The writer acknowledges with gratitude the many valuable suggestions and criticisms of Professor Karl Sax, under whose direction this investigation has been carried out. The guidance of Professor Alfred Rehder in the study of the distribution of species of *Populus* and the occurrence of natural hybrids, and the kindness of Dr. Ernst J. Schreiner, in supplying cytological material of the various artificial hybrids, are gratefully acknowledged.

SUMMARY

The chromosome numbers of thirty-eight species, varieties, and natural hybrids of *Populus* have been determined, twelve of which were in confirmation of previous work by other investigators. All species exist as diploids with an unreduced chromosome number of thirty-eight. In the case of three species, all within the section *Leuce*, triploid forms with an unreduced chromosome number of fifty-seven exist.

The chromosomes of the hybrid *P. nigra* × *P. trichocarpa* at the pachytene stage of the meiotic prophase vary in length from 30.6 to 8.5 μ in length. One group of three and two groups of two chromosomes are of exactly the same length. No heteromorphic chromosome pair which might be interpreted as a sex-chromosome pair has been seen consistently.

The occurrence of secondary association of chromosomes has been noted by other workers. Additional evidence for secondary polyploidy is found in the fact that morphological similarities exist among certain groups of chromosomes and that occasional trivalent associations of

chromosomes are found in hybrids and quadrivalent associations in the triploid form of *P. alba*.

The instigation and progress of the meiotic divisions within the catkin are consistent within the species and within the section of the genus. These divisions are regular as a rule, but in a few species a certain amount of asynapsis and abnormal pollen sterility is encountered. This is not interpreted as due to any genetic dissimilarity between the chromosomes.

One chromosome of the complement is invariably associated with the nucleolus at meiotic prophase. In the majority of cases the nucleolus possesses a knob which projects from the point of attachment of the associated chromosome.

The triploid form of *P. alba* shows a varying number of univalent, bivalent, trivalent, and quadrivalent chromosome configurations at metaphase I. The fact that the pollen sterility of the triploid forms is somewhat less than that to be expected on the basis of univalent formation is accredited to the fact that the basic set of chromosomes is triplicated and thus genetic unbalance, due to the loss of whole chromosomes, is less likely to occur.

Cytokinesis is of the type usually found in cases of simultaneous pollen cell formation. The process seems to be easily upset in the case of triploid forms and interspecific hybrids of *Populus*.

A study of the development of the male gametophyte from the first microspore division up to the time of fertilization shows this to be typical of the process as found in the Angiosperms.

The geographic distribution of the North American species of *Populus* has been investigated, especially as related to the occurrence of natural hybrids. The natural and artificial hybrids which have been reported are arranged in tabular form to show the extent of crossing within and between sections of the genus.

The study of chromosome behavior at meiosis in ten natural and twenty-one artificial interspecific hybrids shows them to be variable in regard to synapsis. They are probably structurally undefined hybrids under Darlington's classification. It has been demonstrated that the chromosomes of the different species have been differentiated structurally and that inversion bridges are of relatively frequent occurrence. Pollen sterility within the artificial hybrids is of the same order as that within the parental species, but that of the natural hybrids is somewhat higher. An attempt is made to explain this fact on the basis of an accumulation of structural changes within the chromosomes over the relatively longer period of time these natural hybrids have been in existence as clones. No significant difference in pollen sterility, univalent formation, or inversion bridge frequency is found when intersectional crosses are compared with intrasectional crosses. Similarly a comparison of crosses between geographically isolated species and non-geographically isolated species reveals no significant difference.

A review of the isolating mechanisms which may operate in this genus seems to indicate that geographic and edaphic isolation are those which separate the species, although one entire section is set off from the other sections of the genus by a physiological isolation. It seems from the evidence available that differentiation of the species of *Populus* has been brought about by a slow accumulation of genetic differences through mutation. These species can exist as discrete units, however, only through the operation of geographic, edaphic and, in a few cases, physiological isolation. Genetic and structural-chromosomal isolation plays a relatively minor part in species isolation.

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DESCRIPTION OF PLATES

All drawings are at a magnification of × 2090.

PLATE I

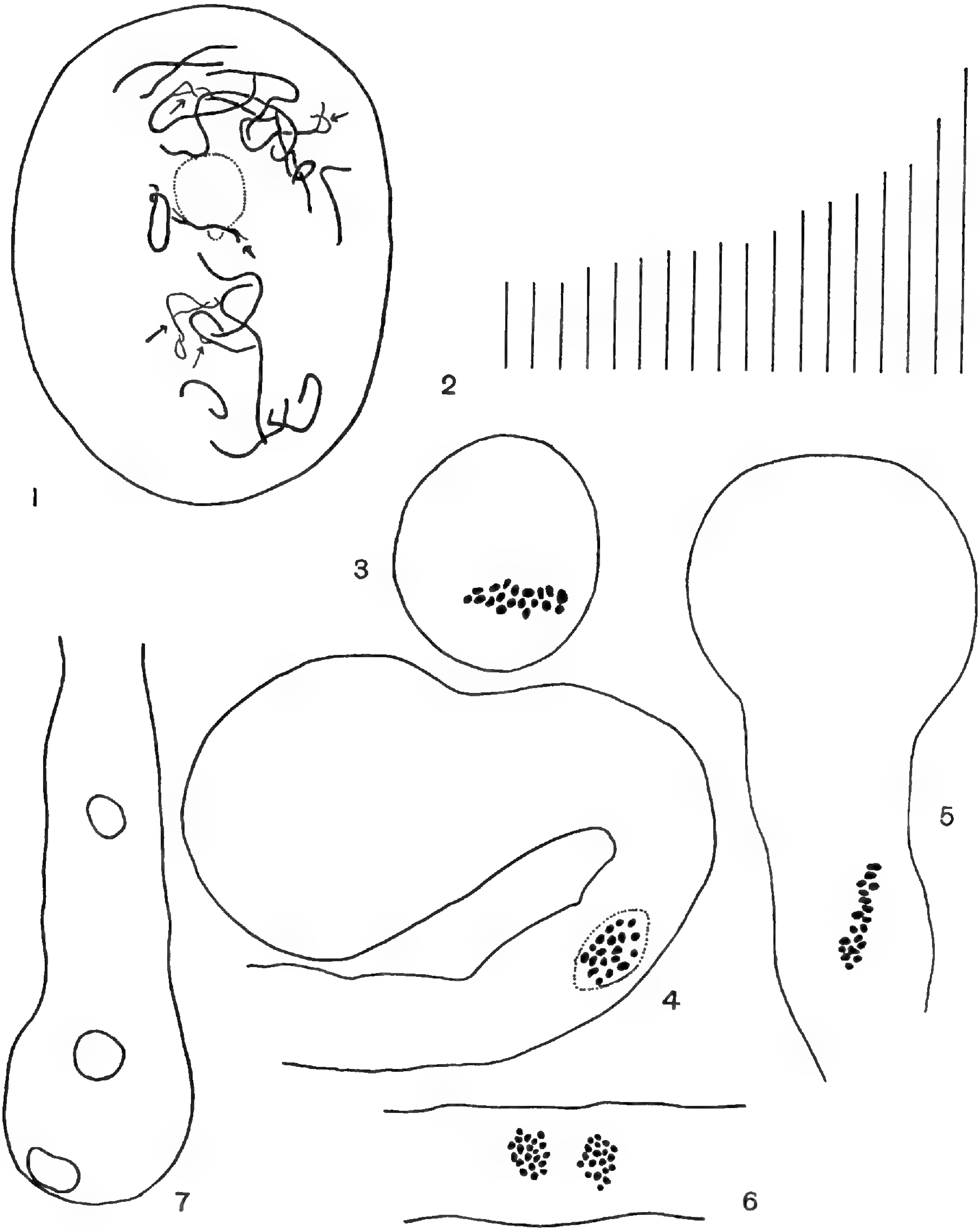
FIG. 1. Pachytene stage of meiosis of the hybrid *P. nigra* × *P. trichocarpa*. One chromosome is associated with the nucleolus at the junction of the knob and the nucleolus proper. Failure of synapsis is indicated by arrows. Camera lucida drawing. FIG. 2. Idiogram of pachytene chromosomes shown in figure 1. One group of three chromosomes and two groups of two chromosomes are of exactly the same length. FIG. 3. Metaphase of the first microspore division in *P. acuminata*. FIG. 4. Generative nucleus in the pollen tube of *P. laurifolia* twelve hours after germination. FIG. 5. Metaphase of the division of the generative nucleus in the pollen tube of *P. laurifolia*. FIG. 6. Anaphase of the division of the generative nucleus in the pollen tube of *P. laurifolia*. FIG. 7. Pollen tube showing tube nucleus (at lower end of tube) and two gametes of *P. deltoides*.

PLATE II

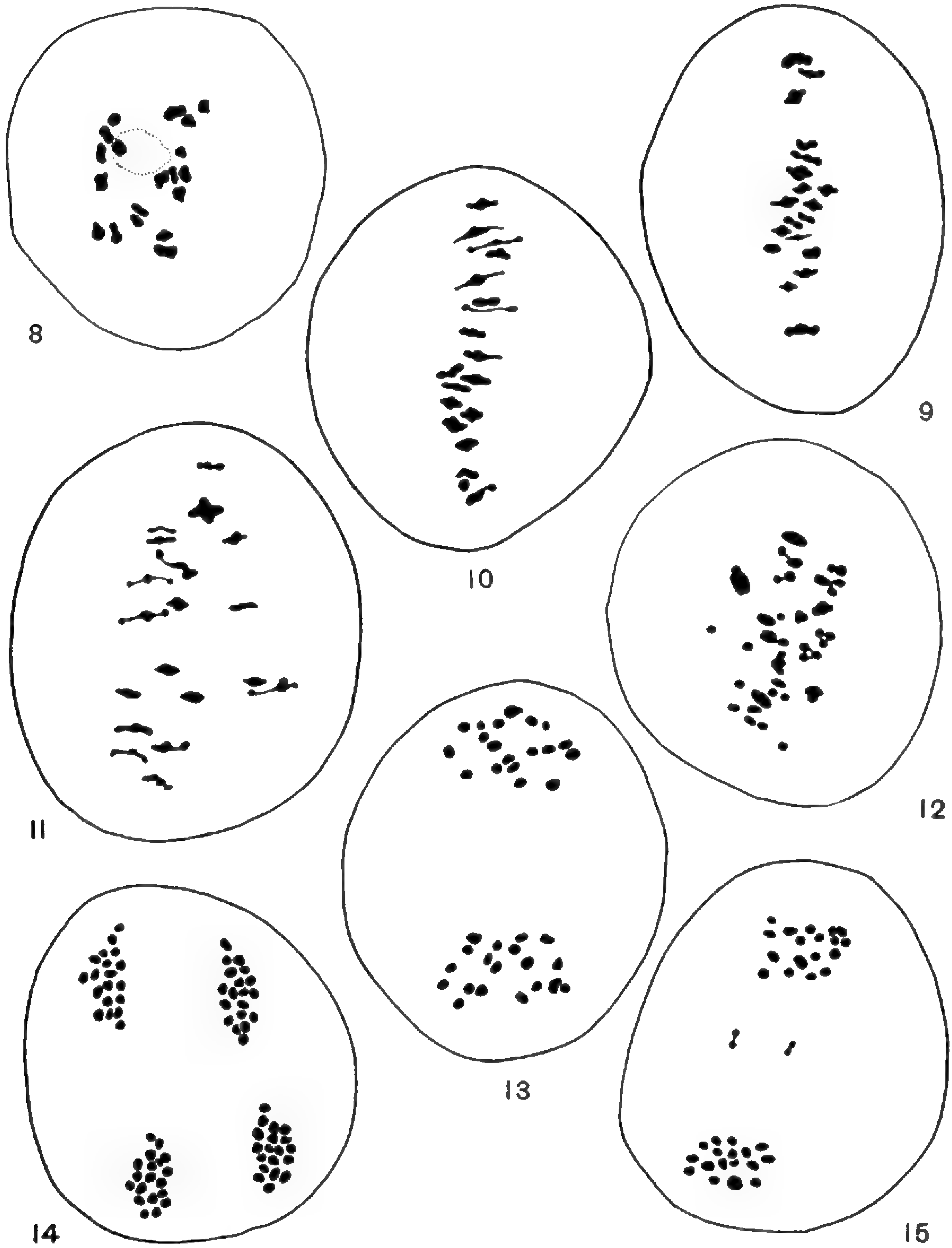
FIG. 8. Late diakinesis in *P. Sargentii*. Nineteen bivalent chromosomes present, one of which is associated with the nucleolus. FIG. 9. Metaphase I in *P. acuminata,* showing nineteen bivalent chromosomes. FIG. 10. Metaphase I in *P. adenopoda,* with "heteromorphic chromosome pair" at lower side of cell. FIG. 11. Metaphase I in *P. alba* (diploid), with nineteen bivalent chromosomes. FIG. 12. Metaphase I in *P. alba* (triploid). Nine univalent, seven bivalent, ten trivalent, and one quadrivalent chromosomes are present. FIG. 13. Anaphase I in *P. laurifolia,* showing nineteen chromosomes at each pole. FIG. 14. Anaphase II in *P. alba* (diploid). FIG. 15. Anaphase I in *P. acuminata*. Two lagging univalent chromosomes are shown in division.

PLATE III

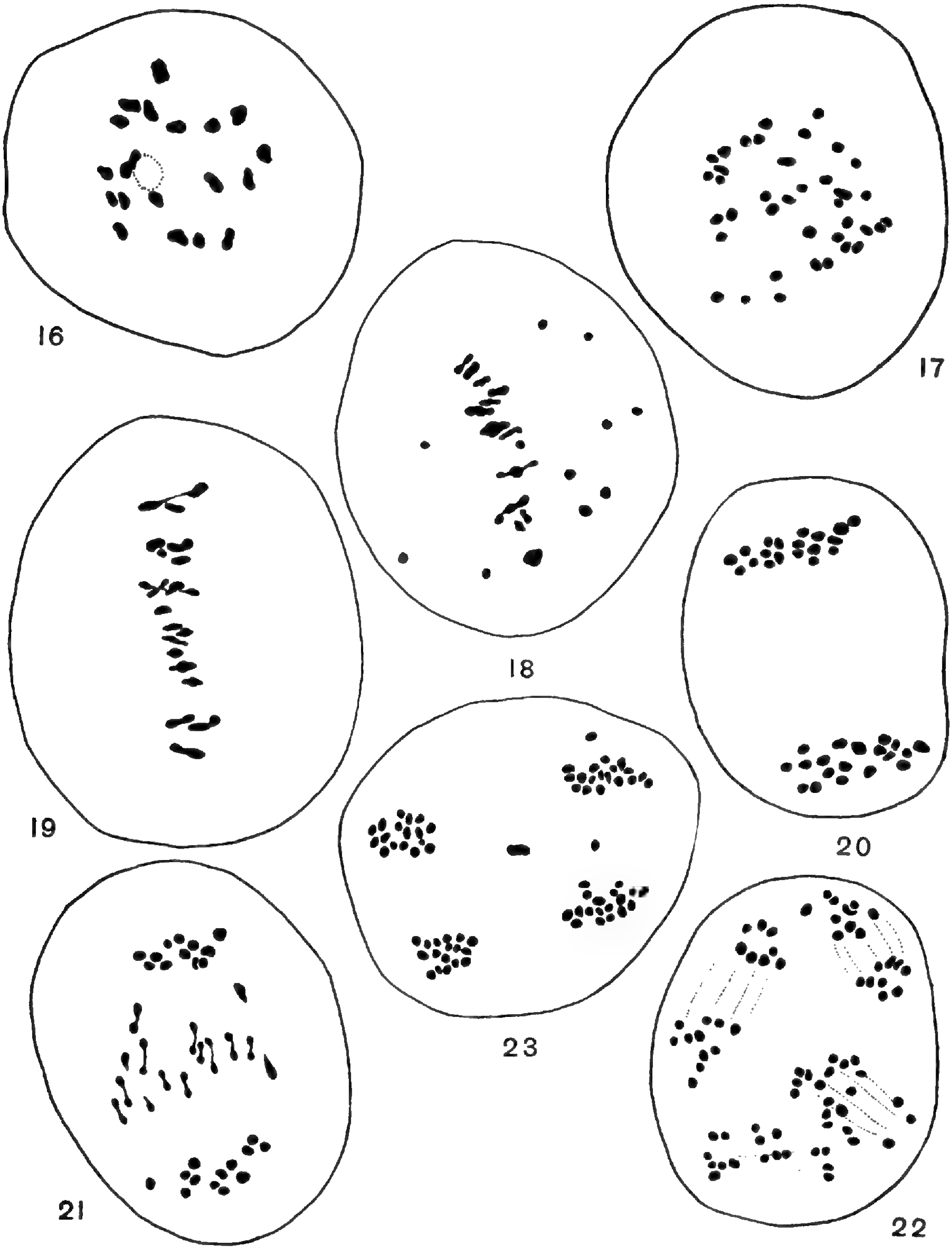
FIG. 16. Late diakinesis in the hybrid × *P. Rasumowskyana* × *P. caudina,* with nineteen bivalent chromosomes present. FIG. 17. Metaphase I in ×*P. Woobstii* showing thirty-eight univalent chromosomes. FIG. 18. Metaphase I in *P. nigra* × *P. laurifolia,* showing fourteen bivalent chromosomes on the plate and ten univalent chromosomes scattered at the sides. FIG. 19. Metaphase I in *P. nigra* × *P. laurifolia,* showing nineteen bivalent chromosomes on the plate. FIG. 20. Regular anaphase in *P. nigra* × *P. laurifolia,* with nineteen chromosomes at each pole. FIG. 21. Irregular anaphase I in *P. nigra* × *P. laurifolia;* thirteen univalent chromosomes dividing on the plate; irregular distribution of chromosomes to the poles. FIG. 22. A third division within the pollen mother cell in ×*P. charkoviensis* × *P. deltoides,* with a random distribution of the chromosomes to the poles. FIG. 23. Anaphase II in ×*P. Rasumowskyana* × *P. caudina*. Apparently two lagging chromosomes have been lost at the first division and one is lagging at the second division.



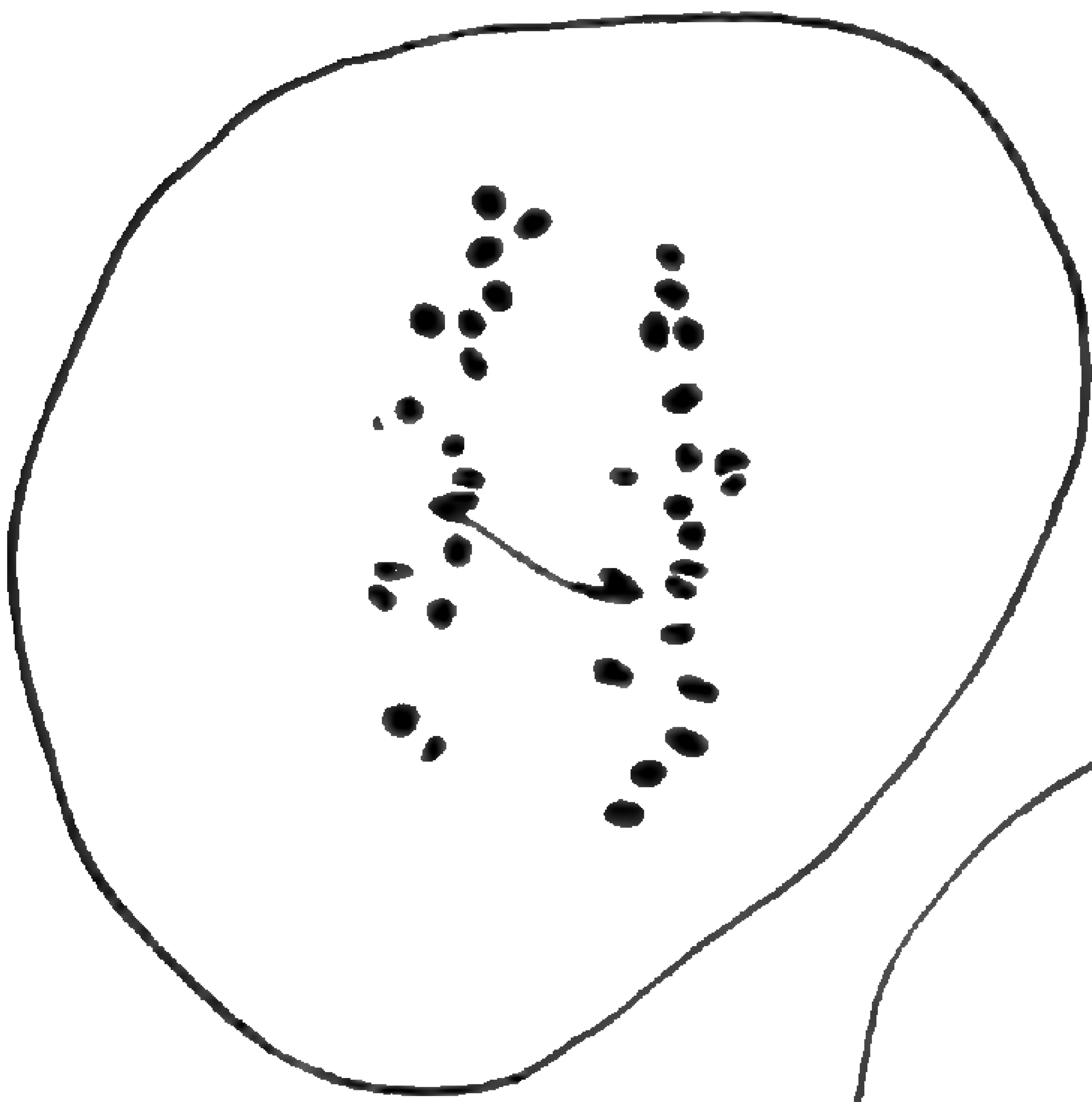
CYTOLOGY AND SPECIATION IN POPULUS



Cytology and Speciation in Populus



CYTOLOGY AND SPECIATION IN POPULUS



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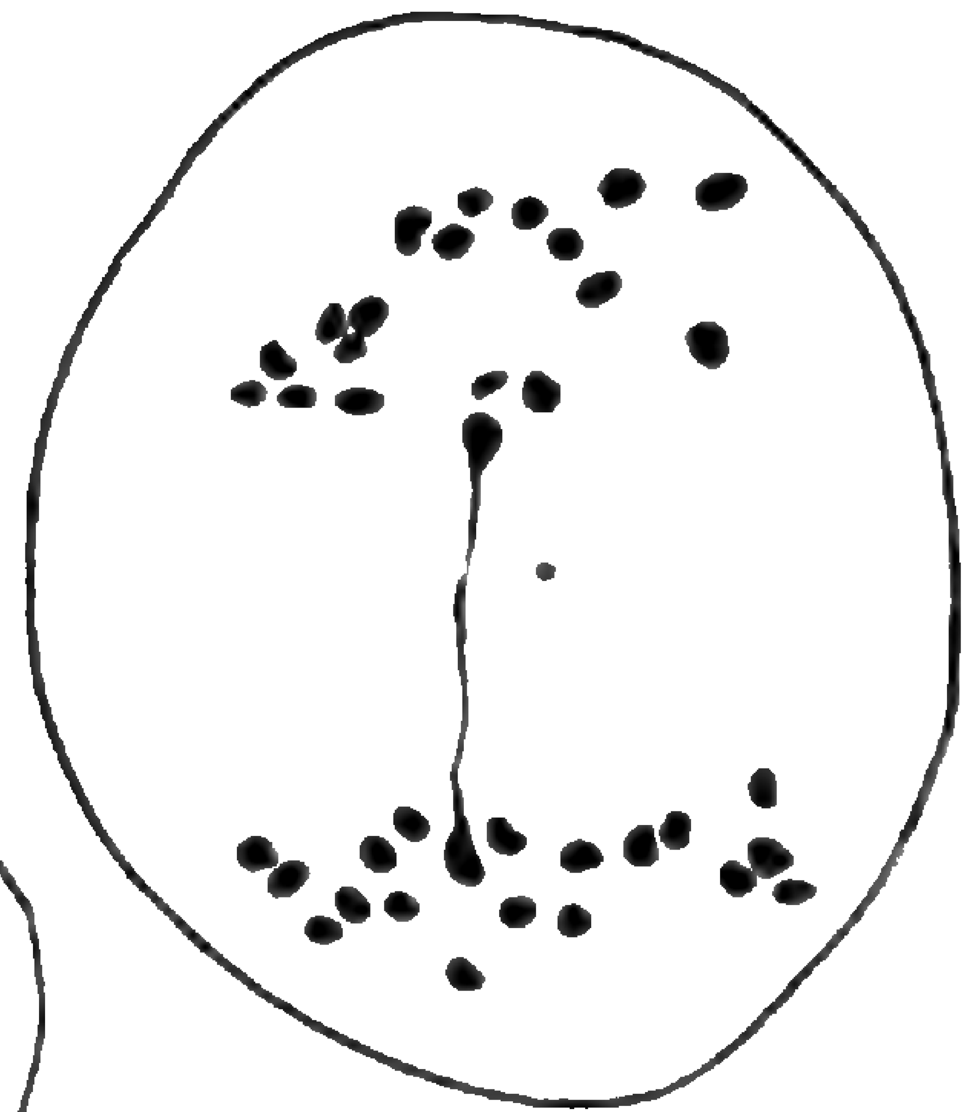

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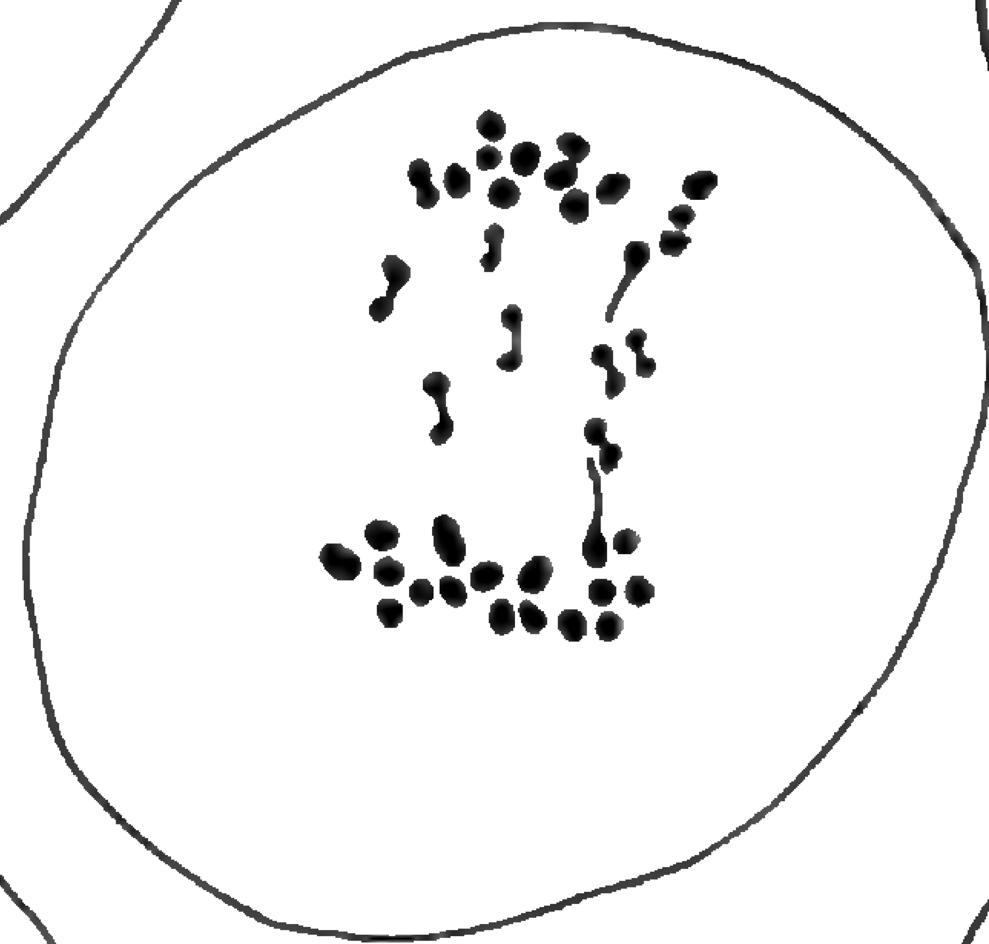

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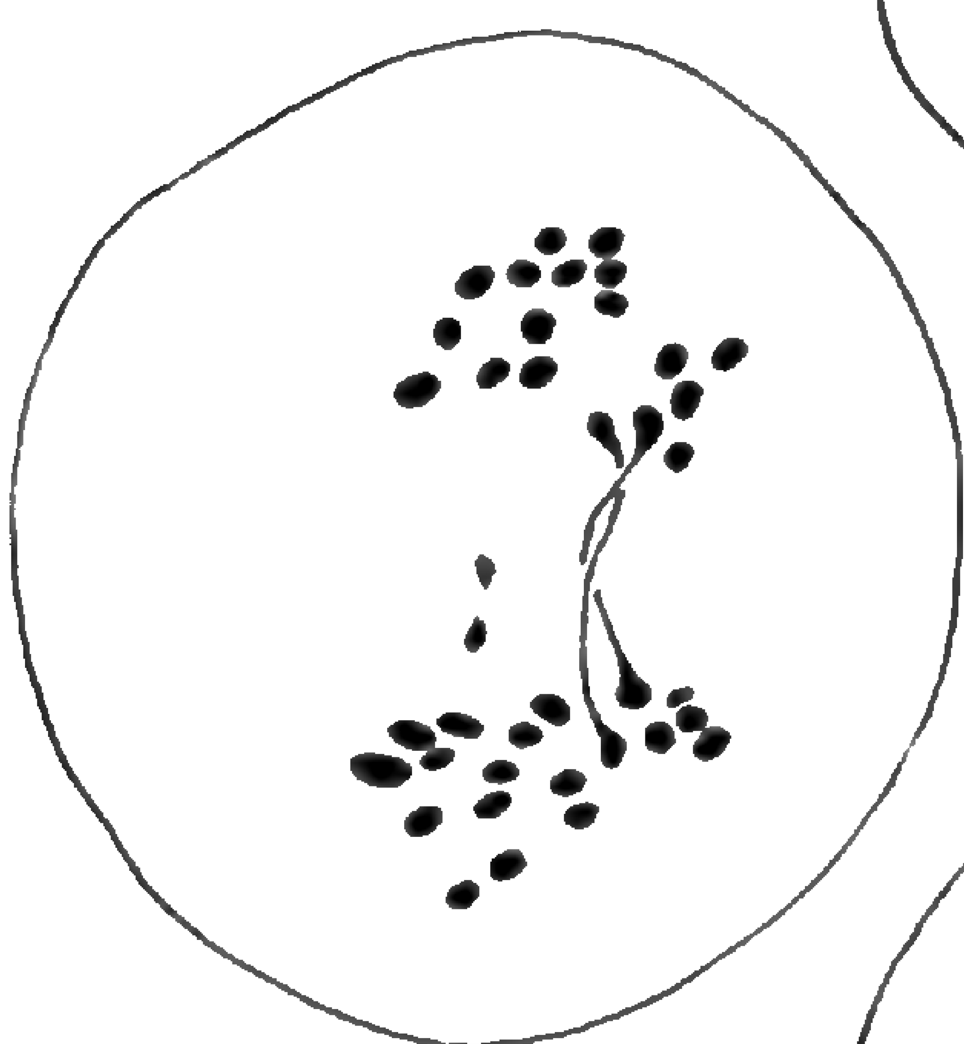

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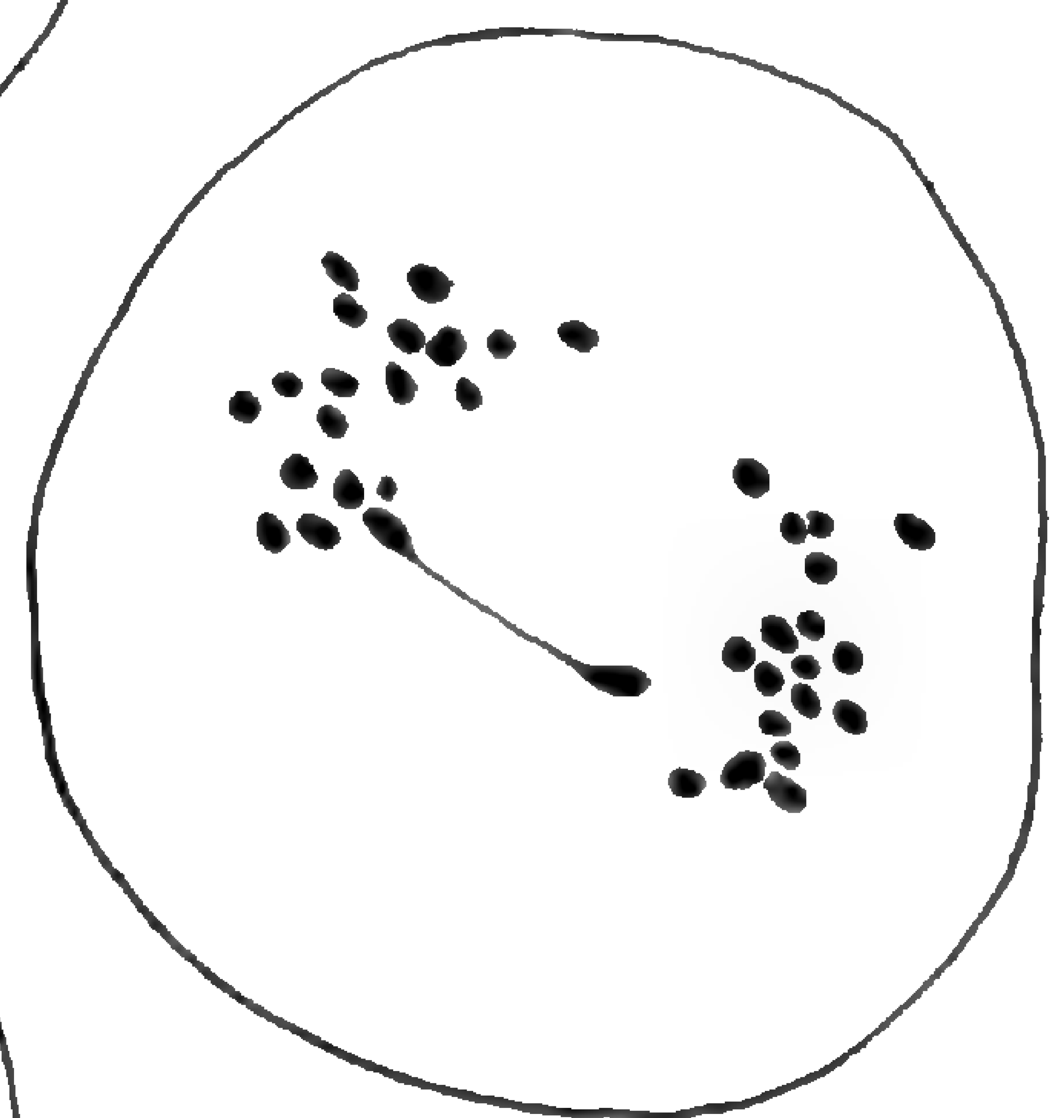

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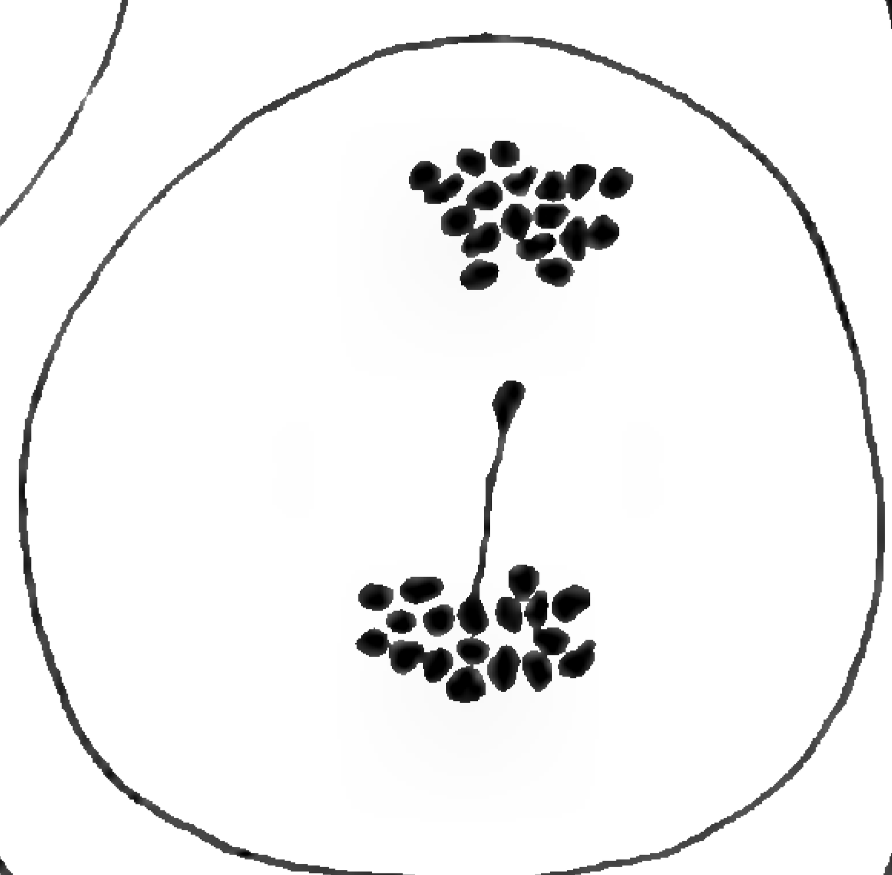

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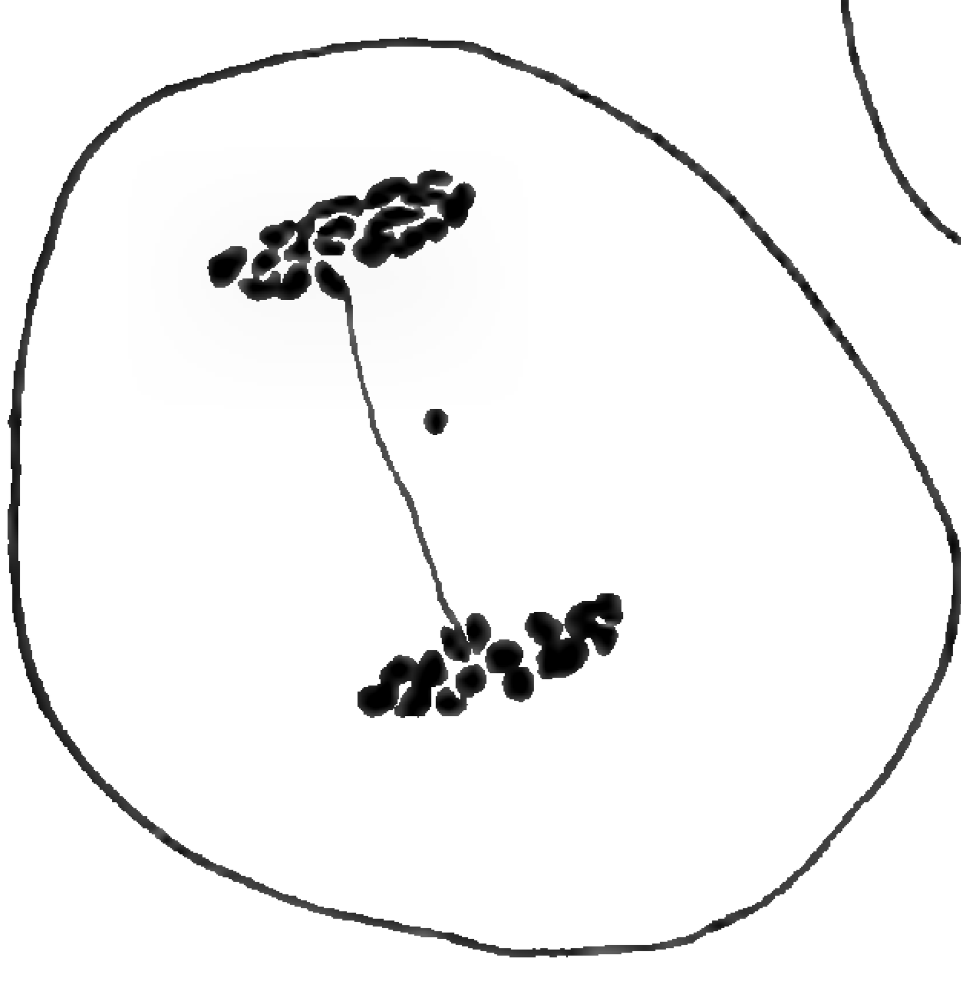

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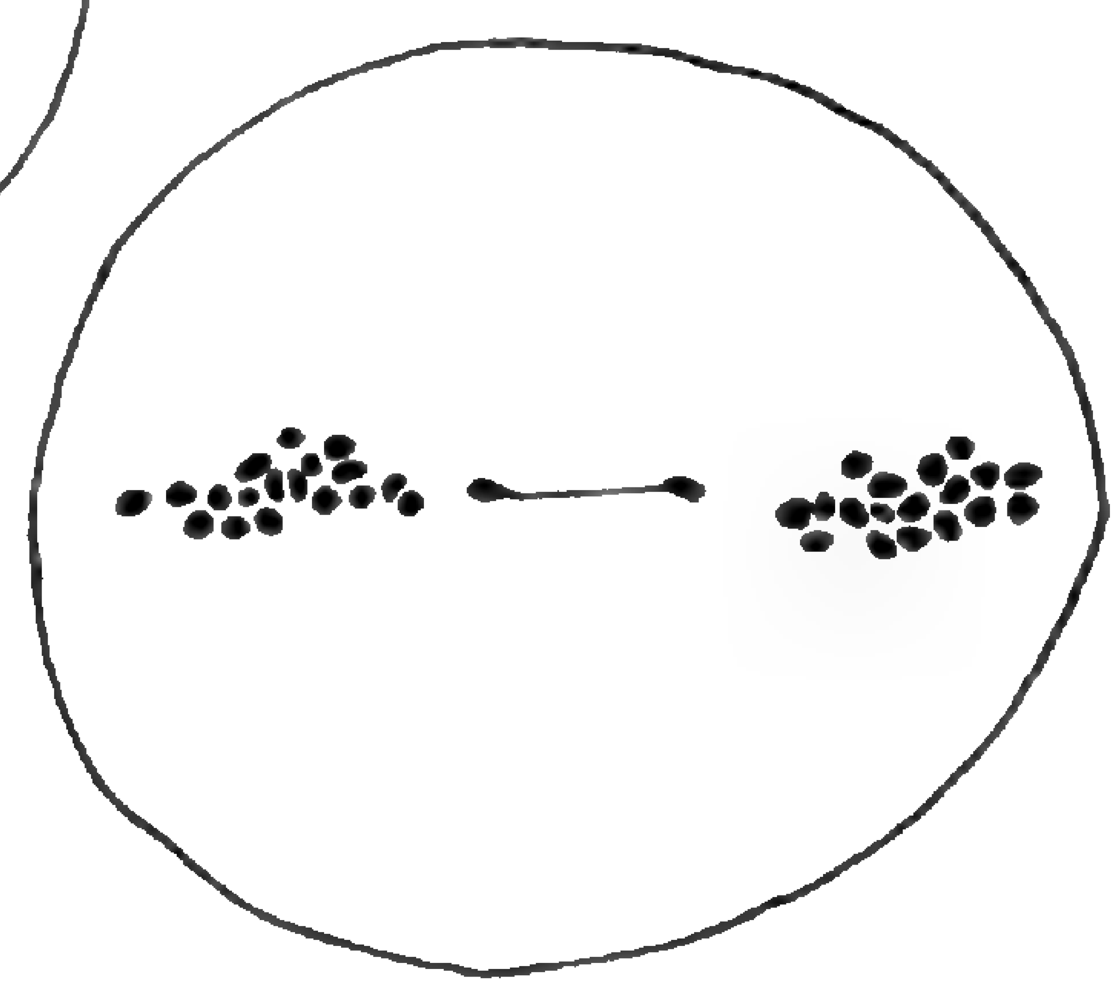

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CYTOLOGY AND SPECIATION IN POPULUS

PLATE IV

FIG. 24. Early anaphase I in ×*P. charkoviensis* × ×*P. berolinensis*, showing an inversion bridge without a visible fragment. FIG. 25. Anaphase I in ×*P. charkoviensis* × ×*P. berolinensis*, with an inversion bridge and fragment. FIG. 26. Anaphase I in ×*P. charkoviensis* × ×*P. robusta*. Remnant of an inversion bridge. FIG. 27. Anaphase I in ×*P. Rasumowskyana* × *P. caudina*, showing two inversion bridges and one dividing fragment. FIG. 28. Anaphase I in ×*P. Rasumowskyana* × unidentified cottonwood. Bridge, no fragment visible. FIG. 29. Anaphase I in *P. nigra* × *P. laurifolia*. Inversion bridge, no fragment. FIG. 30. Late anaphase I in ×*P. charkoviensis* × ×*P. berolinensis*. Bridge and fragment. FIG. 31. Unbroken inversion bridge left out in cytoplasm at the first meiotic division in ×*P. Andrewsii*.

BIOLOGICAL LABORATORIES,
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PLANTS OF COAHUILA, EASTERN CHIHUAHUA, AND ADJOINING ZACATECAS AND DURANGO, I

IVAN M. JOHNSTON

IN this, the first of a projected series of papers, I begin an enumeration and analysis of the vascular flora found on the great arid plateau lying between the Eastern and Western Sierra Madre of northern Mexico. Predominantly a region of Cretaceous calcareous rocks, it contains many broad silty valleys, most of them bolsons, with extensive areas of desert scrub dominated by *Larrea* and *Flourensia,* and many scattered limestone mountain ranges, some of which support oak-chaparral on the higher ridges and in their upper canyons, and a few of which are lofty enough for the development of small coniferous forests. Igneous rocks, scattered and local in the eastern half of the plateau, increase in abundance and frequency toward the base of the predominantly igneous Western Sierra Madre and prevail in large areas in eastern Chihuahua, where grasslands and grassy hills with liveoaks are the characteristic types of vegetation.

The western limit of the region studied extends, roughly, from the area about Lake Guzman, in northwestern Chihuahua, southeast to near Chihuahua City and then southward in an irregular line west of Camargo and Jimenez to include the northern and eastern parts of the State of Chihuahua. Continuing southward, the limit passes west of Mapimi and Torreon to include the northeastern portions of the State of Durango. As the eastern limits of the area, I have followed the eastern boundary of the State of Coahuila. This includes parts of extreme eastern and northeastern Coahuila which are not parts of the plateau. Since, however, the few collections available from these districts represent a flora which, in large part, has extended up onto the plateau in the east-central parts of Coahuila, it has seemed practical and interesting to include in the catalogue, at least, records of all the collections available from the entire State of Coahuila.

The southern boundary is indefinite; in practice it roughly follows the latitude of the southeastern portion of the State of Coahuila. This includes in our area the northern portions of the State of Zacatecas. The northern limit follows the international boundary. Although the eastern and western limits of the areas studied are roughly natural, the northern and southern limits are not so. The plateau flora treated continues northward from our area into southern New Mexico and into trans-Pecos Texas, with many of its characteristic species reaching southeastern Arizona and the Edwards Plateau and its escarpments in Texas. The Rio Grande is not a floristic boundary. Floristically the Big Bend area of Texas and the mountains along the Rio Grande to the northwest of it have the closest of relations with the area south of the river. Because of the paucity of collections made about our southern limits, little can be said regarding the details of species-distribution in that region. It is clear, however, that a great many species of our area extend south into the extensive desert tracts of northern San Luis Potosi. A goodly number reach their southern limits in the dry valleys of northwestern Hidalgo and some even on the arid plateau of central Mexico, in western Vera Cruz and adjacent Hidalgo and Puebla.

In publishing the present enumeration of species I am under no illusion that it approaches a nearly complete listing of all the species actually growing in the area. I shall, in fact, be surprised if it includes seventy-five percent of the total vascular flora. However, it will be vastly more complete and very much more detailed than Watson's enumeration of Edward Palmer's collections, Proc. Am. Acad. **17:** 316–361 (1882) and **18:** 96–191 (1883), published sixty years ago, the only listing of the flora to date. The present catalogue is based almost exclusively upon collections available at the Arnold Arboretum and the Gray Herbarium, particularly the latter. These include such classical collections as those of Berlandier, Gregg, Palmer, Pringle, and Purpus, and the less widely distributed recent collections from the area by L. H. Harvey, Harde LeSueur, E. G. Marsh Jr., C. H. Muller, Forrest Shreve, Stephen S. White, F. L. Wynd, F. L. Wynd & C. H. Mueller, and L. R. Stanford, K. L. Retherford & R. D. Northcraft. Reported upon also are the extensive collections made since 1941 by Mr. Robert Stewart in Coahuila and Chihuahua and those made in Coahuila and Chihuahua by Dr. C. H. Muller and me in 1940, and by me alone in 1941. Collections available from the area probably total well over 15,000 specimens. They do not represent, however, a satisfactory sampling of the flora of the whole area. There are available few if any collections from the Laguna District, the valleys of the Rio Florida, Rio Conchos, and Rio Grande, or from that very promising but unexplored large tract of desert country west of Ojinaga and east of the El Paso-Chihuahua City highway. The majority of the species missing from this catalogue will be discovered in these districts. It is recognized that the present catalogue can be only an incomplete preliminary one. I believe, however, that it will be adequate as a basis for a general discussion of the composition and origins of the flora. These general subjects, as well as matters regarding the geography and geology of the terrain, floristic areas, major plant-associations, collectors' itineraries, etc. will be covered in the concluding numbers of this series of papers.

My work on the flora of the intermontane plateau of northern Mexico has been carried on in close cooperation with Dr. Forrest Shreve, of the Desert Laboratory of the Carnegie Institution. One of the objectives of the present catalogue is to supply taxonomic and phytogeographical data for the detailed ecological survey of the intermontane plateau deserts of northern Mexico and adjacent United States being prepared by Dr. Shreve. In furtherance of the work I have had three seasons of field work in the area, in 1938, 1940, and 1941, financed by the Carnegie Institution and the Arnold Arboretum and by a grant from the William F. Milton Fund.

POLYPODIACEAE

by C. A. WEATHERBY

Woodsia mexicana Fée, Mém. Fam. Foug. **7**: 66. *t. 26, f. 3* (1857).

COAHUILA: Sierra del Pino, crevices of limestone cliffs just below crest of high ridge west of La Noria, *Johnston & Muller 612;* Sierra Cruces, Cañon Tinaja Blanca, shaded cliff of igneous rock, open canyon, *Johnston & Muller 284.* CHIHUAHUA: Sierra Rica, Cañon Madera, scarce in shady rock-crevices in canyon, *Stewart 2462.* ZACATECAS: Concepcion del Oro, in earth in shade of rocks and bushes in elevated canyon, Aug. 1904, *Palmer 257.*

Western Texas to Arizona and south to San Luis Potosi and Vera Cruz. The two Coahuilan collections have the fronds glandular-pubescent beneath. They belong, accordingly, to the phase of the species described as *W. pusilla* Fourn. Bull. Soc. Bot. France **27**: 329 (1880), which outside our area has been collected in San Luis Potosi and in southern Arizona. In its glandularity this phase suggests *W. Plummerae.* It has, however, the deeply laciniate indusia characteristic of *W. mexicana.*

Woodsia Plummerae Lemmon, Bot. Gaz. **7**: 6 (1882).

CHIHUAHUA: Wet ledges in the hills northwest of Chihuahua, *Pringle 455* and *834.*

Ranging from trans-Pecos Texas (Davis Mts.) to Arizona and south into northern Mexico.

Cystopteris fragilis (L.) Bernh. in Schrad. Neu Jour. Bot. **1**^{2}: 26. *t. 2, f. 9* (1806).

COAHUILA: Sierra del Carmen, Cañon Sentenela, *Wynd & Mueller 521.*

The collection cited is young and poorly developed, but it appears to belong with the Arizona phase of this cosmopolitan species described as subsp. *tenuifolia* Clute.

Dryopteris augescens (Link) C. Chr. var. **Lindheimeri** (C. Chr.) Broun, Ind. N. Am. Ferns 62 (1938).

D. normalis C. Chr. var. *Lindheimeri* C. Chr. Dansk. Vidensk. Selsk. Skr. Naturv. Afd. **10**: 182 (1913).

COAHUILA: Sierra Hechiceros, Cañon Indio Felipe, along creek in shady canyon, becoming 16 dm. tall, *Stewart 73* and *113, Johnston & Muller 1376;* Cañon del Agua Grande west of Las Delicias, by water, scarce, becoming 1 m. tall, *Stewart 2797;* El Tordillo, western margin of Valle de Delicias, frequent in shade near water, *Stewart 2870.*

The largest and most luxuriant fern in our area. It is known from southern Texas (as far east as Houston), Coahuila, Tamaulipas, and San Luis Potosi.

Phanerophlebia umbonata Underw. Bull. Torr. Bot. Cl. **26**: 211 (1899).

COAHUILA: Rancho Agua Dulce, wooded canyon on east slope of Sierra San Manuel, *Wynd & Mueller 349;* Sierra Gloria, *Marsh 1871;* Sierra Guajes, Cañon Milagro, shaded places in canyon, *Stewart 1532* and *1533;* Sierra Hechiceros, Cañon Indio Felipe, shade at base of cliffs in deep canyon, *Stewart 523, Johnston & Muller 1362.*

Mountains of Nuevo Leon, Tamaulipas, and Coahuila, and Chisos Mts., Texas.

Phanerophlebia auriculata Underw. Bull. Torr. Bot. Cl. **26**: 212 (1899).

COAHUILA: Sierra Mojada, Cañon Calabasa, fairly common in shade in deep canyon about 100 m. below crest, *Stewart 2198.* CHIHUAHUA: Canyon in Mapula Mts., southwest of Mapula Station, Oct. 1886, *Pringle 831* (ISOTYPE).

Ranging from our area northward in western Chihuahua into Arizona and New Mexico.

Asplenium Palmeri Maxon, Contr. U. S. Nat. Herb. **13:** 39 (1909).

COAHUILA: Mountains 6 mi. east of Saltillo, 1880, *Palmer 1435;* San Antonio de los Alamos, under rocks in shaded gulch at base of high north-facing tuff cliffs, fronds prostrate, rooting at tip, *Johnston 8272.* CHIHUAHUA: Canyons in hills northwest of Chihuahua, Oct. 23, 1885, *Pringle 444.*

Ranging from central Texas to Arizona and south to Central America.

Asplenium resiliens Kunze, Linnaea **18:** 331 (1844).

COAHUILA: Rancho Agua Dulce, Sierra San Manuel, *Wynd & Mueller 351;* Sierra Gloria, *Marsh 1927;* mountains 6 mi. east of Saltillo, 1880, *Palmer 1435;* hills near Saltillo, shaded clay bank in deep arroyo, 1898, *Palmer 365;* hill near Saltillo, base of shaded rocks near summit, Aug. 10, 1905, *Palmer 755;* slope of mountain 24 km. northwest of Fraile, *Stanford et al. 408;* Sierra Guajes, Cañon Milagro, cliff-faces, *Stewart 1715;* mesa 15 km. northwest of Buena Vista, shade of cliff, *Stewart 1443;* escarpment on west side of Potrero de la Mula, about rocks on steep slope under oaks, *Johnston 9220;* Sierra Madera, Cañon del Agua, rock-crevices in moist dense wooded canyon, *Muller 3250;* Sierra Hechiceros, Cañon Indio Felipe, under rocks on bottom of deep shaded canyon, *Johnston & Muller 1360;* Sierra del Pino, crevices of north-facing limestone cliffs just below crest of high ridge west of La Noria, frequent, *Johnston & Muller 613;* western extremity of Sierra Madera, deep narrow canyon 2 km. southeast of Puertecito, shade of rocks on canyon bottom, *Johnston 9316;* Sierra Mojada, Cañon Hidalgo, shade in canyon below crest, *Stewart 1061;* Sierra Negras, 9 km. south of Parras, *Stanford et al. 193.* CHIHUAHUA: Sierra Rica, Cañon Madera, rock-crevices in shaded canyon, *Stewart 2474.*

Ranging from Pennsylvania, Kansas, and Arizona south along the Andean chain to Argentina (including *A. Lealii* Alston).

Asplenium exiguum Bedd. Ferns So. India *t. 146* (1863).

COAHUILA: Sierra Madera, Cañon del Agua, sparse in rock-crevices in moist densely wooded canyon, *Muller 3251.* CHIHUAHUA: Deep shaded damp glen at head of canyon next south of the large central canyon in the Mapula Mts., southwest of Mapula station, Nov. 4, 1886, *Pringle 833.*

A rare fern known only from scattered stations in Arizona, Sonora, Chihuahua, Coahuila, and Federal District, and from southern India and northern China.

Gymnopteris hispida (Mett.) Underw. Our Native Ferns ed. 6. 84 (1900).

Gymnogramma hispida Mett. ex Kuhn, Linnaea **36:** 72 (1869).

Bommeria hispida Underw. Bull. Torr. Bot. Cl. **29:** 633 (1902).

COAHUILA: Sierra Cruces, Cañon Tinaja Blanca, shelter of ledge in open canyon, *Johnston & Muller 281.* CHIHUAHUA: Sierra Rica, Cañon Madera, common in shaded places in canyon, *Stewart 2466;* Pirámide, base of rock-masses, *Johnston 8146;* 8 mi. northwest of Cruces, base of tuff cliff, *Johnston 7977;* Sierra Encinillas, 7 km. north of Fierro, among rocks on hillside, *Stewart 795;* near Chihuahua, *Pringle 465.*

This species ranges from western Texas to Arizona and south into Durango. In our area, at least, the species appears to be confined to areas of igneous rocks.

Pellaea cardiomorpha Weatherby, nom. nov.

Pteris cordata Cav. Descr. 267 (1802).

Pellaea cordata (Cav.) J. Sm. Cat. Kew Ferns 4 (1856), non Fée (1850–52).

COAHUILA: Sierra del Carmen, Cañon Sentenela, *Wynd & Mueller 590.* CHIHUAHUA: Sierra Rica, Cañon Madera, scarce in shady rock-crevices in canyon, *Stewart 2525;* hills about 8 mi. northeast of Chihuahua, Oct. 17, 1885, *Pringle 448.* ZACATECAS: Pico de Teira, southwest of Cedros, Sept. 1908, *Lloyd 247* (US).

The new name for this species, *P. cardiomorpha,* is put forward with some diffidence. *Pellaea cordata* (Cav.) J. Sm. is definitely illegitimate, but, following Hooker, most authors have regarded *P. sagittata* (Cav.) Link as synonymous with it. If this be correct, the name *P. sagittata,* which is quite clear under *Pellaea,* should be taken up. But the material at hand indicates that the two species proposed by Cavanilles really differ in several characters, most of which, as Hooker long ago pointed out in regard to some of them, are not as constant as one could wish, but which, taken together, seem to give adequate grounds for separation. I have accordingly preferred to coin a new name in place of *P. cordata,* which has no indubitable synonym. The two species may be distinguished as follows:

Rhizome-scales bright brown in mass (contrasting with those of bud and stipe), linear or linear-lanceolate, sparsely pectinate with long, often retrorse teeth; blades not dimorphic, rachis and rachillae always glabrous, pinnules very broadly cordate, usually as broad as long, the margins usually not strongly revolute; spores globose or obtusely triangular in outline, especially so as seen from the commisural face, averaging about 50 μ in diameter........................*Pellaea cardiomorpha.*

Rhizome-scales pale brown, not contrasting with those of bud and stipe, mostly rather broadly lanceolate and serrulate with short teeth; fronds somewhat dimorphic, the sterile smaller and with broad plane pinnules, rachis and rachillae often with short and thick glandular hairs on upper surface, pinnules of the fertile fronds from deltoid-ovate to deltoid-lanceolate, the margins often strongly revolute; spores globose or the larger broadly ellipsoid, varying considerably in size, 65–80 μ, commonly about 75 μ....................................*Pellaea sagittata.*

In addition to the above enumerated characters, the pinnae of *P. cardiomorpha* tend to stand at a broad angle to the rachis, those of the fertile fronds of *P. sagittata* to be more or less strongly ascending. In both, the lower leaf-surface may be either glabrous or pubescent with white hairs. In mature and well developed material the spore-characters hold consistently.

As here defined, *P. cardiomorpha* becomes a species mainly of northern and central Mexico, extending north to the Davis Mts., Texas, and south in eastern Mexico to Hidalgo, Michoacan, and Oaxaca. *Pellaea sagittata* ranges from San Luis Potosi and Zacatecas south to Guatemala and southward along the Andes to Bolivia.

Pellaea intermedia Mett. ex Kuhn, Linnaea **36:** 84 (1869).

COAHUILA: Sierra del Pino, Cañon Ybarra, arroyo banks, *Stewart 1821;* Sierra del Pino, La Noria, crevices in limestone along narrow shaded arroyo, *Johnston & Muller 642;* Picacho de San José, crevices of cliffs, *Stewart 1115;* San Antonio de los Alamos, about shaded tuff cliffs, *Johnston & Muller 859* and *900;* Lerios, 1880, *Palmer 1426;* Carneros Pass area, 1880, *Palmer 1427;* 4 km. east of Fraile, *Stanford et al. 354;* Sierra Negras, 9 km. south of Parras, *Stanford et al. 161.* CHIHUAHUA: Sierra Santa Eulalia, limestone ledges, *Pringle 461.* ZACATECAS: Mountain 18 km. west of Concepcion del Oro, *Stanford et al. 576;* Cedros, ravines, *Lloyd & Kirkwood 135.*

Ranging from trans-Pecos Texas to Arizona and south into our area and eastward into the mountains of Nuevo Leon. The type of *P. intermedia* is the rare glabrous phase of the species. Our plants belong to the common forma *pubescens* (Mett. ex Kuhn) Broun.

Pellaea ovata (Desv.) Weatherby, Contr. Gray Herb. **114:** 34 (1936).
Pellaea flexuosa (Kaulf. ex C. & S.) Link, Fil. Sp. 60 (1841).

COAHUILA: Sierra San Manuel, Rancho Agua Dulce, *Wynd & Mueller 318;* western base of Sierra Guajes 8 km. east of Buena Vista, igneous hillside, not common, *Stewart 1467.*

From central and southern Texas south through eastern Coahuila and the eastern Sierra Madre to Central and South America.

Pellaea atropurpurea (L.) Link, Fil. Sp. 59 (1841).

COAHUILA: Sierra San Manuel, Rancho Agua Dulce, *Wynd & Mueller 358;* western base of Sierra del Carmen 8 km. east of Hac. Encantada, shade in canyon, *Stewart 1698;* Sierra Guajes, Cañon Milagro, hillside, *Stewart 1725;* Sierra Madera, Cañon Charretera, stream-gravel in oak thicket, *Johnston 9040;* Sierra Gloria, *Marsh 1888;* Sierra Hechiceros, Cañon Indio Felipe, foot of talus slope, *Stewart 171* and *172;* Sierra del Pino, Cañon Ybarra, shade in caynon, *Stewart 1813;* Sierra del Pino, La Noria, shaded bushy arroyo-bank, *Johnston & Muller 476;* Picacho de San José, cliff-crevices, *Stewart 1111;* Sierra Mojada, Cañon Hidalgo, in shaded canyon below crest, *Stewart 1065.* CHIHUAHUA: Sierra Rica, Cañon Madera, rock-crevices in shaded canyon, *Stewart 2475.*

Ranging from Vermont and western South Dakota south to Guatemala.

Pellaea Wrightiana Hook. Sp. Fil. **2:** 142 (1858).

COAHUILA: Sierra Hechiceros, Rancho El Tule, about rocks on sunny hillside, *Johnston & Muller 1309.* CHIHUAHUA: Sierra Virulento, one plant on steep rocky east slope 3 mi. east of Rancho Virulento, *Johnston 8090.*

Ranging from central Texas to Baja California. Apparently a plant of igneous rocks.

Pellaea ternifolia (Cav.) Link, Fil. Sp. 59 (1841).

CHIHUAHUA: Grassy summits of the Sierra Santa Eulalia, southeast of Santa Eulalia, Nov. 5, 1885, *Pringle 446;* cool rocky slopes of mountains near Chihuahua, Oct. 1886, *Pringle 920.*

From southeastern Arizona south along the western Sierra Madre, extending to Peru, Argentina, and northern Chile. Apparently a plant of igneous rocks.

Pellaea microphylla Mett. ex Kuhn, Linnaea **36:** 86 (1869).

COAHUILA: Sierra San Manuel, Rancho Agua Dulce, *Wynd & Mueller 320;* Hillcoat Mesa, west of Encantada Ranch, *Marsh 1454;* high mesa 14 km. northwest of Buena Vista, common on open hillside, *Stewart 1435;* Sierra Madera, Cañon Charretera, rocky bed of arroyo, abundant, *Johnston 8930;* Sierra Gavia, under rocks on canyon floor, *Johnston 7206;* Puerto San Lazaro, scattered on open talus slope, *Muller 3079;* mountains 6 mi. east of Saltillo, 1880, *Palmer 1423;* San Lorenzo Canyon, 6 mi. southeast of Saltillo, rather common in rather exposed parts of canyon, Sept. 1904, *Palmer 404;* Lerios, July 1880, *Palmer 1424;* mountain 24 km. northwest of Fraile, *Stanford et al. 416;* Sierra del Pino, Cañon Ybarra, rocky hillside, common, *Stewart 1884;* Sierra del Pino, summit of great western escarpment about 10 mi. north of La Noria, under rocks, *Johnston & Muller 552;* Sierra del Pino, crest of eastern ridge about 4 mi. northeast of La Noria, under rocks, *Johnston & Muller 654;* western base of Picacho del Fuste, limestone ledges on north slope, *Johnston 8389;* top of Cuesta Zozaya, about rocks on dry open slope, *Johnston 9291;* western extremity of Sierra Madera, deep narrow canyon 2 mi. southeast of Puertecito, among rocks of canyon-floor and in rock-crevices on canyon-walls, *Johnston 9318;* Santa Elena, eastern foothills of Sierra Cruces, ledges and rocky slopes, *Johnston & Muller 207, Stewart 271* and *346;* Sierra Mojada, Cañon Hidalgo, shade in canyon below crest, *Stewart 1066;* east side of Valle Acatita, crevices in limestone 2 km. northeast of Parritas, *Stewart 2767;* margin of

Valle Delicias, 1 km. northwest of mouth of Cañon Blanco, frequent in arroyos, *Stewart 2912*. CHIHUAHUA: Sierra San Carlos, base of cliff near mouth of canyon, *Johnston & Muller 44;* Sierra Almagre, dry sunny floor of arroyos, *Johnston & Muller 1136;* high northwestern end of Sierra Diablo, rocky hillside, *Stewart 986;* Sierra Santa Eulalia, limestone hillside, *Pringle 440* and *458;* pass 19 mi. east of Jimenez, limestone hillside, *Johnston 7854*. ZACATECAS: valley 15 km. west of Concepcion del Oro, *Stanford et al. 47*.

Centering in our area and extending eastward into the Sierra Madre of Nuevo Leon, and northward to the south escarpment of the Edwards Plateau and trans-Pecos Texas. Confined to limestone.

Notholaena delicatula Maxon & Weatherby, Contr. Gray Herb. **127**: 7 (1939).

COAHUILA: Sierra Madera, Charretera Cañon, steep north slope in conifer forest, on rocks, about 8500 ft. alt., *Johnston 9046;* Lerios, July 1880, *Palmer 1387* (TYPE); Carneros Pass area, March 1880, *Palmer 1385*.

Endemic to the mountains of southeastern Coahuila and northern Nuevo Leon. The record from Jalisco, Maxon & Weatherby, l. c., was caused by an error on one of Pringle's labels. Though indicated to be from Jalisco, the collection actually came from near Monterey, Nuevo Leon.

Notholaena limitanea Maxon, var. **mexicana** (Maxon) Broun, Ind. No. Am. Ferns 119 (1938).

Notholaena limitanea subsp. *mexicana* Maxon, Amer. Fern Jour. **9**: 72 (1919).

COAHUILA: Sierra Madera, Cañon Charretera, on rocks on steep north slope in coniferous forests, about 8500 ft. alt., *Johnston 9046a;* base of mountains southeast of Saltillo, road to Diamante Pass, limestone ledge, *Johnston 7269;* Carneros Pass, *Pringle 3031* (Field Mus.); Sierra del Pino, high western ridge 10 mi. north of La Noria, under limestone rocks along ridge-crest, *Johnston & Muller 551;* Sierras Negras, 9 km. south of Parras, *Stanford et al. 201* in pt.; Picacho de Jimulco, summit, *Stanford et al. 107*. CHIHUAHUA: Sierra Santa Eulalia, limestone ledges, Sept. 13, 1885, *Pringle 451* (ISOTYPE). ZACATECAS: mountain 18 km. west of Concepcion del Oro, *Stanford et al. 574;* Cedros, canyons, *Kirkwood 140*.

Ranging from our area into Durango and possibly Tamaulipas. Among the cited collections, *Johnston 7269* is exceptionally stout and strict for this variety. It is, however, approached by some individuals of the type collection, and in all technical details, especially the strongly reticulate-rugose spores, it entirely agrees with them.

Notholaena aurea (Poir.) Desv. Mém. Soc. Linn. Paris **6**: 219 (1827).

VERNACULAR NAMES: Canaguala; Canawala.

COAHUILA: Sierra del Carmen, Cañon Sentenela, *Wynd & Mueller 511;* Mesa Grande, high mesa 40 km. northwest of Hac. Encantada, open hillside, not common, *Stewart 1644;* Soledad, Sept. 1880, *Palmer 1399;* Saltillo, purchased in market, Sept. 1898, *Palmer 369;* mountain borders near Saltillo, July 6, 1848, *Gregg 219;* Sierra Hechiceros, Cañon Indio Felipe, common at base of cliffs and on talus, *Stewart 89* and *135;* Sierra Hechiceros, Rancho El Tule, about rocks on arid hillside, *Johnston & Muller 1310;* San Antonio de los Alamos, local, shaded places under tuff cliffs, *Johnston & Muller 899;* Sierra Jimulco, 11 km. northeast of Jimulco, *Stanford et al. 84*. CHIHUAHUA: Sierra Rica, Cañon Madera, common on open sunny slopes, *Stewart 2467;* Pirámide, one colony at base of large rock-masses, *Johnston 8144;* Sierra Virulento, rocky east slope, *Johnston 8083;* 8 mi. northwest of Cruces, base of sandstone cliff, *Johnston 7980;* 11 mi. northeast of Camargo, lava cliff, *Johnston 7896;* rocky hills near Chihuahua, Oct. 1885, *Pringle 462*.

Ranging from Texas and Arizona south to Argentina. Palmer reports that this fern is sold in the market at Saltillo, a decoction of the plant being taken internally for "pain in the stomach and for coughs."

Notholaena sinuata (Lag.) Kaulf. Enum. Fil. 135 (1824).

VERNACULAR NAMES: Nacahuela; Lengua de Cervo.

COAHUILA: Sierra del Carmen, Cañon Sentenela, *Wynd & Mueller 510;* Sierra Encantada, Cañon San Enrique, west of Buena Vista, bank of dry arroyo, *Stewart 1407;* Sierra Azul, Buena Vista Ranch, July 8, 1938, *Marsh 1220;* Saltillo, crevices of sandstone at summit of a mountain, 1898, *Palmer 183;* Lerios, 1880, *Palmer 1400;* 3 km. southwest of Fraile, in arroyo, *Stanford et al. 336;* Sierra del Pino, Cañon Ybarra, arroyo banks, *Stewart 1821a;* Sierra Madera, Cañon Charretera, moist ledges, *Johnston 9097;* Cañon de Jara, east of Socorro, *Schroeder 10;* Sierra Cruces, near Santa Elena, shady arroyo, *Stewart 292;* Picacho de San José, crevices of cliffs, *Stewart 1110;* Sierras Negras, 9 km. south of Parras, *Stanford et al. 203;* Picacho de Jimulco, summit, *Stanford et al. 105.* CHIHUAHUA: 11 miles northeast of Camargo, lava cliff, *Johnston 7923.* ZACATECAS: Cedros, canyons, *Lloyd & Kirkwood 138* in pt.

South-central Texas to Arizona and southward in the Andean region to northern Argentina.

Notholaena sinuata var. **integerrima** Hook. Sp. Fil. **5:** 108 (1864).

COAHUILA: Rancho Agua Dulce, Sierra San Manuel, *Wynd & Mueller 321;* Sierra Azul, Buena Vista Ranch, July 8, 1938, *Marsh 1250;* Soledad, 1880, *Palmer 1402;* Saltillo, 1880, *Palmer 1401;* Buena Vista, 1848, *Gregg 297* in pt.; San Antonio de los Alanzanes, 1848, *Gregg 365;* Lerios, 1880, *Palmer 1406;* mountain valley 24 km. northwest of Fraile, *Stanford et al. 429a;* Sierra del Pino, Cañon Ybarra, arroyo banks, *Stewart 1843;* about 10 miles north of Cuatro Cienegas, *Wynd 745a;* El Coyote, east side Valle Acatita, *Stewart 2731* and *2751;* Puerto Ventanillas, south of Las Delicias, on slopes, *Stewart 2963;* mouth of Cañon Blanco, north end of Valle Delicias, *Stewart 2904;* San Lorenzo de Laguna, 1880, *Palmer 1409.* CHIHUAHUA: Chihuahua, *Pringle 464* in pt. ZACATECAS: Mountain 18 km. west of Concepcion del Oro, *Stanford et al. 575;* Cedros, canyons, *Lloyd & Kirkwood 136* in pt. and *137.*

Southern Oklahoma (Arbuckle Mts.) and central Texas to southeastern Arizona and southward, mostly along the eastern Sierra Madre, to Vera Cruz.

Hooker's name, *N. sinuata* var. *integerrima,* has very generally been applied to the plant here classified as *N. sinuata* var. *cochisensis.* That application can no longer be maintained. When he proposed var. *integerrima,* Hooker cited three collections in the Kew Herbarium, of Liebmann, Gregg [*297*] and Seemann [*1928*]. Of these, only the Liebmann specimen is labelled as belonging to the variety. It is a single small frond with oblong, quite entire pinnae, the scales of the lower surface like those of typical *N. sinuata,* but those of the upper relatively broad-bladed and persistent as in var. *cochisensis.* The Seemann material is similar, though much more ample, the sheet containing four complete individuals. The pinnae are small, the smallest approaching the dimensions of var. *cochisensis,* and there is also some approach to that variety in the scales of the lower surface. The Gregg collection, as represented in Hooker's herbarium, consists of a detached frond similar to the Liebmann specimen and an entire plant of var. *cochisensis.* Had Hooker cited this last Gregg specimen particularly or accounted for it in his description, it might have been designated as type and the usual application of his name maintained.

But one can hardly reconcile his statement "pinnae entire or nearly so" with var. *cochisensis,* in which the pinnae, though tiny, show at least one conspicuous lobe. In view of this and of Hooker's having labelled only the Liebmann specimen, it must be taken as type and the epithet *integerrima* applied accordingly.

Field observation and a restudy of material in the Gray Herbarium indicate that rather numerous specimens with shallowly lobed pinnae, which have hitherto either been associated with var. *cochisensis* or regarded as dwarfed individuals of typical *N. sinuata,* actually belong with var. *integerrima,* as represented by the Liebmann and Seemann collections. They are like these collections in their combination of scale-characters, in their small size, and, except for the lobing of the pinnae, in habit. They are accordingly here placed in var. *integerrima.* So understood, that group becomes a reasonably consistent, if not altogether happily named, variety, intermediate in characters between typical *N. sinuata* and var. *cochisensis,* grading into both, and with the mainly Texan and northeast-Mexican range above indicated.

In central Mexico, typical *N. sinuata* also produces a phase with entire pinnae (*N. laevis* of authors, not Mart. & Gal.; *N. crassifolia* Moore & Houlst.; *N. pruinosa* Fée).

Notholaena sinuata var. **cochisensis** (Goodding) Weatherby, comb. nov.

Notholaena cochisensis Goodding, Muhlenbergia **8:** 93 (1912).

Notholaena sinuata var. *crenata* Lemmon, Ferns Pacific Slope 7 (1882), nomen nudum.

VERNACULAR NAMES: Canelilla; Doradillo.

COAHUILA: Between Rancho Santo Domingo and Hac. Piedra Blanca, *Wynd & Mueller 659* (US); Sierra Azul, Buena Vista Ranch, July 8, 1938, *Marsh 1239;* Sierra San Vicente, Cañon Espantosa, *Schroeder 61;* 6 mi. north of Hipolito, *Johnston 7235;* mountains 6 mi. east of Saltillo, 1880, *Palmer 1401;* Buena Vista, 1848, *Gregg 297* in pt.; Chojo Grande, 27 mi. southeast of Saltillo, 1904, *Palmer 359;* Lerios, 1880, *Palmer 1405;* Carneros Pass area, 1880, *Palmer 1407* in pt.; 4 km. east of Fraile, *Stanford et al. 355;* Sierra del Pino, ridge-crest 4 mi. northeast of La Noria, *Johnston & Muller 652;* Sierra Madera, Cañon Charretera, ledges, *Johnston 9096;* 10 mi. north of Cuatro Cienegas, *Wynd 745;* Cañon de Jara, east of Socorro, *Schroeder 16;* Sierra Cruces, near Santa Elena, slopes, *Johnston & Muller 235;* Cañon del Agua Chica, west of Las Delicias, gypsum, *Stewart 2827;* near mouth of Cañon Blanco, Sierra Margaritas, limestone crevices, *Stewart 2905;* San Lorenzo de la Laguna, 1880, *Palmer 1410;* Sierras Negras, 9 km. south of Parras, *Stanford et al. 194;* Sierra Jimulco, 11 km. northeast of Jimulco, *Stanford et al. 42.* CHIHUAHUA: Sierra Rica, Dec. 1882, *Newberry;* Chihuahua, 1908, *Palmer 357;* pass 19 mi. east of Jimenez, limestone, *Johnston 7853;* 6 mi. west of Piloncillo, lava hillside, *Johnston 7880a.* DURANGO: 23 mi. north of Zaragoza, under sandstone rocks, *Johnston 7792.* ZACATECAS: Valley 15 km. west of Concepcion del Oro, *Stanford et al. 548;* Cedros, canyons, *Lloyd & Kirkwood 138* in pt.

This is the plant which has long been called *N. sinuata* var. *integerrima.* The three recognizable variants of *N. sinuata* may be distinguished as follows:

Pinnae 1 cm. or more long, ovate, commonly subacute and cut ⅓–½ to the midrib into 4–6 pairs of oblong lobes; scales of the upper surface of the lamina with narrow central portion or reduced to stellate processes, usually soon deciduous, those of the lower surface lanceolate, up to 1.5 mm. long; rhizome-scales pectinate-ciliate or -serrulate...*N. sinuata* (typical).

Pinnae mostly less than 1 cm. long, very obtuse, with 1–3 pairs of broadly ovate lobes or entire; scales of the upper surface with relatively broad central portion, usually persistent till full maturity of the frond.

Pinnae oblong, entire or with about 3 pairs of shallow lobes; scales of lower surface and rhizome as in the typical variety........................var. *integerrima*.

Pinnae subquadrate, nearly or quite as broad as long, with 1 or 2 (rarely 3) pairs of lobes; scales of the lower surface ovate, 0.5 mm. long; rhizome-scales entire or nearly so..var. *cochisensis*.

A good many field observers are of the opinion that var. *cochisensis* should be treated as a distinct species, and their contention has been strengthened by the recent discovery that the variety is poisonous to stock, the typical form not. Nevertheless, judged by the usual taxonomic evidence, var. *cochisensis* is so connected with the typical variety, through var. *integerrima*, that the traditional treatment of it as a variety only is not unreasonably conservative.

Notholaena Aschenborniana Klotzsch, Linnaea **20:** 417 (1847).

COAHUILA: Sierra San Manuel, *Wynd & Mueller 337* (US); Sierra Gavia, 5 mi. north of Saucillo, under rocks, terrace on canyon-floor, *Johnston 7209;* mountains 8 mi. west of Saltillo, hillside, *Johnston 7660;* San Lorenzo Canyon, 6 mi. southeast of Saltillo, sunny arroyo-banks at canyon-mouth, 1904, *Palmer 402;* Sierra del Pino, La Noria, crevices of limestone in narrow shaded arroyo, *Johnston & Muller 643;* western base of Picacho del Fuste, north-facing slope about limestone ledges, *Johnston 8384;* Sierra Madera, Cañon Charretera, ledges and rocky arroyo-bed, *Johnston 8928, 8931a, 9094;* gorge just east of Socorro, on cliffs, *Johnston 8850a;* Sierra Mojada, *Jones 531* (US); western edge of Valle Acatita, 2 km. northeast of Parritas, shaded crevices in limestone, *Stewart 2768;* Cañon Blanco, Sierra Margaritas, shade of cliffs, *Stewart 2915;* Sierra Negras, 9 km. south of Parras, *Stanford et al. 204.* CHIHUAHUA: Sierra Santa Eulalia, limestone ledges, *Pringle 466* and *469.*

Western Texas to Arizona and south to central Mexico.

Notholaena Schaffneri (Fourn.) Underw. var. **Nealleyi** (Seaton) Weatherby, comb. nov.

Notholaena Nealleyi Seaton ex Coulter, Contr. U. S. Nat. Herb. **1:** 61 (1890).

COAHUILA: Mountains 4 mi. west of Cuatro Cienegas, shaded rock-crevices in small canyon, *Johnston 7167;* Sierra Cruces, sheltered on north-facing limestone ledges at Santa Elena, *Johnston & Muller 205.*

The type of *N. Nealleyi* came from Limpia Canyon, Jeff Davis Co., Texas (*Nealley 560*). These, at least, are the data accompanying the specimen designated as type in the U. S. Nat. Herb. The collector's number has been changed from *894* to *560*. As published, the type was said to come from the Chinati Mts. and to be numbered *894*. Other collections of this fern have been made at Goodenough Springs, Val Verde Co., Texas (*Nealley 123*), and from Barranco de Santa Maria, Zacuapan, Vera Cruz (*Purpus 6199*). They may be distinguished from typical *N. Schaffneri* as follows:

Rhizome-scales narrowly linear-attenuate, densely and conspicuously pectinate-ciliate; median pinnae with 4–6 pairs of free pinnules............*N. Schaffneri* (typical).

Rhizome scales linear-subulate, sparsely and inconspicuously pectinate-ciliate; median pinnae usually with 1–3 pairs of free pinnules.........*N. Schaffneri* var. *Nealleyi*.

The Nealley and Purpus specimens, mentioned above, are small and have passed as immature individuals. The two collections from Coahuila, however, have fronds up to 22 cm. long and freely soriferous, and are obviously full grown. The characters of the variety are retained even in this mature state. Davenport, Bot. Gaz. **16:** 54 (1891), observed that two plants were involved in this species-aggregate, but unfortunately he supposed Fournier's rather small type material to be the same as Nealley's specimens and gave a new name (*N. Schaffneri* var. *mexicana*) to the typical variety of *N. Schaffneri.*

Notholaena Grayi Davenp. Bull. Torr. Bot. Cl. **7:** 50 (1880).

COAHUILA: Soledad, Sept. 1880, *Palmer 1388;* San Antonio de los Alamos, under rocks, dry basalt in upper canyon, *Johnston & Muller 926.* CHIHUAHUA: Sierra Encinillas, rocky hillside 6 km. north of Fierro, common in crevices, igneous rocks, *Stewart 790;* cliffs of volcanic tuff, 8 mi. northwest of Cruces, *Johnston 7984;* 11 mi. northeast of Camargo, lava cliff, *Johnston 7902;* 6 mi. west of Piloncillo, lava hillside, *Johnston 7880;* rocky hills near Chihuahua, *Pringle* 463 in pt.

Ranging from Texas and Arizona south through Chihuahua and Sonora to Jalisco.

Notholaena aliena Maxon, Contr. U. S. Nat. Herb. **17:** 605 (1916).

COAHUILA: Soledad, Sept. 1880, *Palmer 1389* (ISOTYPE). CHIHUAHUA: Rocky hills near Chihuahua, Oct. 1885, *Palmer 463* in pt.

Known from Tamaulipas, Coahuila, Chihuahua, and Arizona.

Notholaena candida (Mart. & Gal.) Hook. Sp. Fil. **5:** 110 (1864).

COAHUILA: Villa Juarez, Sept. 1880, *Palmer;* Muzquiz, *Marsh 351* (US); mountains northeast of Monclova, Sept. 1880, *Palmer 1380;* Sierra Gavia, 5 mi. north of Saucillo, under rocks on terrace in canyon, *Johnston 7205;* gorge just east of Socorro, on cliffs, *Johnston 8849;* western extremity of Sierra Madera, deep narrow canyon 2 km. northeast of Puertecito, ledges on canyon-wall, *Johnston 9319.*

Ranging from Texas and New Mexico south to Guatemala.

Notholaena neglecta Maxon, Contr. U. S. Nat. Herb. **17:** 602 (1916).

COAHUILA: San Lorenzo Canyon, 6 mi. southeast of Saltillo, a few plants in narrow seams in the rock near the ground, dry but somewhat shaded, 1904, *Palmer 424;* Saltillo, crevices on dry sloping side of canyon, 1902, *Palmer 324* (ISOTYPE); high western ridge of Sierra Fragua, north of Puerto Colorado, under rocks on pinyon-clad steep east-slope, scarce, *Johnston 8775;* western extremity of Sierra Madera, deep narrow canyon 2 km. southeast of Puertecito, ledges on canyon-wall, one colony, *Johnston 9319a;* Sierra Cruces, canyon 5 mi. southwest of Santa Elena, crevices of shales on shaded canyon-wall, local, *Johnston & Muller 822;* La Botica, Sierra Margaritas, limestone cliffs, scarce, *Stewart 2894;* Sierra Mojada, Apr. 19, 1892, *Jones 520* (US). CHIHUAHUA: Sierra Santa Eulalia, limestone cliffs, Sept. 9, 1885, *Pringle 452.*

Ranging from southeastern Arizona south into Chihuahua and into eastern Coahuila. The collection from the Sierra de la Fragua is an unusually narrow-bladed form with relatively small basal pinnae.

Notholaena Standleyi Maxon, Amer. Fern Jour. **5:** 1 (1915).

COAHUILA: Near Santo Domingo, igneous hill, *Wynd & Mueller 467;* Saltillo, summit of mountain, shaded crevices of sandstone, May 1898, *Palmer 184;* Saltillo, 1905, *Palmer 754;* Carricito, north-facing ledge of lava, *Johnston & Muller 163;* eastern foothills of Sierra Cruces, vicinity of Santa Elena, shaded rock-crevices, *Stewart 347;* Sierra Cruces, Cañon Tinaja Blanca, hillsides and along arroyo, *Stewart 330* and *624, Johnston & Muller 296;* base of tuff cliffs 3 mi. northwest of San Antonio de los Alamos, *Johnston & Muller 857;* La Botica, base of Sierra Margaritas, limestone cliffs, *Stewart 2893;* canyon-mouth, Cañon Blanco, Sierra Margaritas, crevices on slope, *Stewart 2907;* canyon 6 mi. west of Viesca, *Johnston 7744;* Picacho de Jimulco, about summit, *Stanford et al. 89;* San Lorenzo de la Laguna, 1880, *Palmer 1379.* CHIHUAHUA: Sierra Rica, Dec. 1882, *Newberry;* Sierra San Carlos, road to mines, base of limestone cliff at canyon-mouth, *Johnston & Muller 37;* Sierra Encinillas, 7 mi. north of Fierro, among rocks on hillside, *Stewart 794;* 8 mi. northwest of Cruces, base of tuff cliff, *Johnston 7979;* hills west of Chihuahua, *Pringle 467;* Meoqui, *LeSueur 1138;* 11 mi. northeast of Camargo, lava cliff, *Johnston 7895;* Cañon La Renga, 15 km. northwest of Santa Fe, crevices of limestone, common, *Stewart 2618.*

Ranging from Texas and western Oklahoma to Nevada and Arizona and south through western Mexico to central Mexico.

Notholaena Greggii (Mett. ex Kuhn) Maxon, Contr. U. S. Nat. Herb. **17:** 606 (1916).

Pellaea Greggii Mett. ex Kuhn, Linnaea **36:** 86 (1869).

Allosorus Greggii (Mett. ex Kuhn) Kuntze, Rev. Gen. **2:** 806 (1891).

Notholaena Pringlei Davenp. Bull. Torr. Bot. Cl. **13:** 132. *t. 58* (1886).

Cheilanthes Davenportii Domin, Bibl. Bot. **20**[Heft 85]: 133 (1915).

COAHUILA: Monclova, Aug. 1880, *Palmer 1383;* 10 mi. north of Cuatro Cienegas, *Wynd 747;* Lomas del Aparejo, eastern side of Llano de Guaje, dry limestone ledges on sunny hillside, *Johnston & Muller 774;* Tanque La Luz, south end of Cañada Oscuro, limestone ledges between gypsum on escarpment, *Johnston 8503;* Sierra Cruces, limestone ledges near Santa Elena, *Johnston & Muller 206;* south base of Picacho de San José, in arroyo, confined to gypsum, *Johnston & Muller 817;* San José, under basaltic rocks on rocky hillside, *Johnston & Muller 994;* Sierra Planchada, 6 mi. northeast of Esmeralda, limestone ledges on hillside, *Johnston & Muller 833;* Sierra Mojada, *Jones 519* (US); Cerro Zapatero, July 1910, *Purpus 4633;* El Coyote, eastern margin of Valle Acatita, crevices on slope, *Stewart 2743;* Rancho Las Uvas, east side Valle Acatita, gypsum, *Stewart 2693;* Cañon del Agua Chica, west of Las Delicias, shade on gypsum cliffs, *Stewart 2831;* mouth of Cañon Blanco, Sierra Margaritas, limestone crevices, *Stewart 2906;* San Lorenzo de la Laguna, May 1880, *Palmer 1382* and *1383.* CHIHUAHUA: Sierra Rica, Dec. 1882, *Newberry;* Sierra Santa Eulalia, dry calcareous ledges and bluffs, April 23, 1885, *Pringle 441* (type of *N. Pringlei*); Sierra Santa Eulalia, calcareous bluffs, Nov. 15, 1888, *Pringle 857;* Cañon del Coyote, 20 km. northwest of Santa Fe, crevices of limestone, common, *Stewart 2614.* DURANGO: Rocky hill northwest of Mapimi, April 17, 1847, *Gregg 467* (ISOTYPE of *N. Greggii*); Lerdo, Cerro el Raymundo, *Chaffey 58* in pt. (US); 7 mi. southwest of Chocolate, shaded slope, *Shreve 9113.*

This species is practically confined to our area. Outside, it has been found on the northern side of the Rio Grande at the mouth of Boquillas Canyon in Texas. While evidently not confined to it, the species is frequently found on or near gypsum. The type of *Notholaena Greggii,* judging from the date on the type-specimen, was collected near the Durango-Chihuahua state-line northwest of Mapimi, between Jaralito and Arroyo de Cerro Gordo.

Notholaena bryopoda Maxon, Proc. Biol. Soc. Wash. **18:** 205 (1905).

COAHUILA: Western base of Picacho del Fuste, north-facing mountain-side, common on all gypsum beds and confined to them, *Johnston 8354;* south end of Cañada Oscuro near Tanque La Luz, common on the gypsum beds on the escarpment, confined to gypsum, *Johnston 8488;* eastern foothills of Sierra Cruces near Santa Elena, forming large clumps on gypsum beds, confined to gypsum, *Stewart 839, Johnston & Muller 243;* Rancho del Coyote, eastern margin of Valle Acatita, crevices on gypsum, common, *Stewart 2732.*

Outside of our area this fern is known only from the type-collection, made by Pringle in the mountains of southern Nuevo Leon, 15–20 miles south of Doctor Arroyo. The plant appears to be a marked gypsophile. In the Sierra Cruces, near El Fuste, and in Cañada Oscuro, the plant was abundant and luxuriating on gypsum and confined to that substratum. It forms dense clumps which may become as much as a meter in diameter.

Cheilanthes alabamensis (Buckl.) Kunze, Linnaea **20:** 4 (1847).

COAHUILA: Rancho Agua Dulce, wooded canyon on east slope of Sierra San Manuel, *Wynd & Mueller 377;* ravine near Puerto Santa Anna, Hac. Mariposa, *Wynd & Mueller 219;* Sierra Guajes, Cañon Milagro, faces of cliffs, *Stewart 1714;* Caracol Mts., 1880, *Palmer 1419;* Soledad, Sept. 1880, *Palmer 1420;* Saltillo, shaded clay bank in deep arroyo, 1898, *Palmer 366* in pt.; Saltillo, Sierra del Pueblo, moist rock crevices near ground, 1904, *Palmer 433* in pt.; San Lorenzo Canyon, 6 mi. southeast of Saltillo, Sept. 1904, *Palmer 405* in pt.; San Lorenzo Canyon, shaded rocky canyon wall, Sept. 1904, *Palmer 403;* Cañon del Chojo Grande, 27 mi. southeast of Saltillo, earth at base of shady rock, Aug. 1904, *Palmer 377;* General Cepeda, high bluff, 1904, *Palmer 326* in pt.; Sierra del Pino, La Noria, shaded arroyo banks, *Johnston & Muller 495* and *644;* western extremity of Sierra Madera, deep narrow canyon 2 km. southeast of Puertecito, under rocks on shaded canyon-floor, *Johnston 9314;* Sierra Parras, March 1905, *Purpus 1100;* Sierra Hechiceros, Cañon Indio Felipe, under rocks in deep shaded canyon, *Johnston 1361;* Sierra Cruces, Cañon Tinaja Blanca, shrubby banks and shaded cliffs, *Stewart 331, Johnston & Muller 282;* San Antonio de los Alamos, moist shaded places about tuff cliffs, *Johnston & Muller 894.* CHIHUAHUA: Sierra Almagre, about rocks in deep shaded canyon, *Johnston & Muller 1193;* Sierra Santa Eulalia, shaded places, Nov. 2, 1885, *Pringle 449.*

This fern ranges from Virginia to Florida, west to Missouri and Arizona, and south into Nuevo Leon, Coahuila, and Chihuahua.

Cheilanthes notholaenoides (Desv.) Maxon ex Weatherby, Contr. Gray Herb. **114:** 34 (1936).

VERNACULAR NAME: Sanguinaria.

COAHUILA: Saltillo, shaded clay bank in deep arroyo, 1898, *Palmer 366* in pt.; Saltillo, under rock ledge on exposed hillside, June 1898, *Palmer 238;* Saltillo, purchased in market under name "Sanguinaria," Sept. 1898, *Palmer 368;* mountains 6 mi. east of Saltillo, 1880, *Palmer 1418;* base of mountains southeast of Saltillo, road to Diamante Pass, *Johnston 7268;* San Lorenzo Canyon, 6 mi. southeast of Saltillo, Sept. 1904, *Palmer 405* in pt.; Carneros Pass area, March 1880, *Palmer 1417;* mountains 24 km. northwest of Fraile, in arroyo, *Stanford et al. 385;* Sierra Madera, Cañon Charretera, in shade on rocky bed of arroyo, *Johnston 8929;* Sierra Mojada, Cañon Hidalgo, shade in canyon below crest, common, *Stewart 1067;* Sierra Negras, 9 km. south of Parras, *Stanford et al. 209.* CHIHUAHUA: Sierra Almagre, under rocks on shaded canyon-floor, *Johnston & Muller 1152;* Sierra Santa Eulalia, shaded places, Nov. 2, 1885, *Pringle 449.* ZACATECAS: Mountain 18 km. west of Concepcion del Oro, *Stanford et al. 573;* Cedros, *Lloyd 125.*

Entering our area from the south and southeast, extending north from Guatemala through eastern Mexico and reaching its northern limit in Coahuila and Chihuahua, where it grows with the related *C. alabamensis* and, at times, is separated with difficulty from that more northerly ranging species. Palmer reports that small bunches of this fern are sold in the market at Saltillo under the name "Sanguinaria," a decoction of the plant being drunk "to purify the blood."

Cheilanthes aemula Maxon, Contr. U. S. Nat. Herb. **10:** 495 (1908).

COAHUILA: Sierra Guajes, Cañon Milagro, on cliffs, not common, *Stewart 1710;*

Mt. Caracol, 1880, *Palmer 1412;* Sierra Hechiceros, Cañon Indio Felipe, base of talus-slope, not common, *Stewart 155.*

Ranging from Texas (escarpment of Edwards Plateau) south through eastern Coahuila and the Sierra Madre of Nuevo Leon and Tamaulipas to eastern San Luis Potosi.

Cheilanthes horridula Maxon, Amer. Fern. Jour. **8:** 94 (1918).

Cheilanthes aspera Hook. Sp. Fil. **2:** 111. *t. 108a* (1852), non Kaulf. (1831).

COAHUILA: Mountains 24 mi. northeast of Monclova, 1880, *Palmer 1422;* hillside 2 mi. west of Sacramento, road to Cuatro Cienegas, *Johnston 7092;* Sierra Gavia, 5 mi. north of Saucillo, under rocks on slope, *Johnston 7207;* Saltillo, Sierra del Pueblo, crevices, 1904, *Palmer 433* in pt.; General Cepeda, high bluff, *Palmer 326* in pt.; Picachos Colorados, under rocks below cliffs, *Johnston & Muller 112;* near Santa Elena, Sierra Cruces, limestone ledges, *Johnston & Muller 204;* south base of Picacho de San José, dry arroyo bank near gypsum exposures, *Johnston & Muller 816;* open limestone canyon, 6 mi. west of Viesca, *Johnston 7743;* Las Uvas, east side Valle Acatita, frequent, *Stewart 2697.* CHIHUAHUA: Bachimba Canyon, rocky hills, Oct. 31, 1885, *Pringle 447;* 11 mi. northeast of Camargo, lava cliff, *Johnston 7903a.* DURANGO: 23 mi. north of Zaragoza, under sandstone rocks on slope, *Johnston 7793;* Raymundo Hill, Lerdo, alt. 1650 m., Nov. 25, 1911, *Chaffey 58* in pt.

A local and rather rare species, ranging from central Texas to southwestern New Mexico and Durango.

Cheilanthes moncloviensis Baker, Ann. Bot. **5:** 210 (1891).

COAHUILA: Soledad, Sept. 1880, *Palmer 1378* (ISOTYPE).

Known also from Puebla.

Cheilanthes Wrightii Hook. Sp. Fil. **2:** 87. *t. 110a* (1852).

COAHUILA: Near Santo Domingo, igneous hill, *Wynd & Mueller 472;* Sierra Cruces, Cañon Tinaja Blanca, common among grass on sunny open gravelly terrace in upper canyon, *Johnston & Muller 288;* Sierra Cruces, crest north of Puerto Bajito at head of Cañon Tinaja Blanca, common on grassy sunny rocky slope, *Stewart 1949.* CHIHUAHUA: Sierra Virulento, about rocks on crest of ridge, *Johnston 8073;* 8 mi. northwest of Cruces, sandstone cliff, *Johnston 7985;* Sierra Encinillas, 6 mi. north of Fierro, among rocks on hillside, fairly common, *Stewart 794;* rocky hills northwest of Chihuahua, Oct. 7, 1885, *Pringle 445;* 11 mi. northeast of Camargo, about lava cliff, *Johnston 7903.*

Arizona to Texas and south to Durango. In our area the species is confined to areas with igneous rocks and frequently grows with short grass on sunny gravelly terraces and slopes.

Cheilanthes meifolia D. C. Eaton, Proc. Am. Acad. **18:** 185 (1883).

COAHUILA: Rancho Agua Dulce, wooded canyon on eastern slope of Sierra San Manuel, *Wynd & Mueller 350.*

Known also from Nuevo Leon, Tamaulipas, and San Luis Potosi.

Cheilanthes Feei Moore, Ind. Fil. p. xxxviii (1857).

COAHUILA: Cañon Chojo Grande, 27 mi. southeast of Saltillo, growing out of small hole in an exposed rock at base of canyon, 1904, *Palmer 374;* Saltillo, exposed rocks, 1904, *Palmer 432;* Puerto Colorado, faces of sandstone cliffs, *Johnston 8693;* San José, crevices of north-facing basalt crags on slope, fronds flat against rock, *Johnston & Muller 981.* CHIHUAHUA: Sierra Almagre, near Ojo del Almagre, crevices on dry cliff of volcanic rock, fronds closely appressed against rock, *Johnston & Muller 1205.*

Widely distributed in western United States and extending south into adjacent Mexico.

Cheilanthes tomentosa Link, Hort Berol. **2:** 42 (1833).

COAHUILA: Sierra Hechiceros, Cañon Indio Felipe, about rocks in deep wooded canyon, *Stewart 130* and *137, Johnston & Muller 1363;* Rancho Agua Dulce, Sierra San Manuel, dry arroyos, *Wynd & Mueller 337.* CHIHUAHUA: Chihuahua, northwestern hills, Oct. 23, 1885, *Pringle.*

Ranging from Virginia and Georgia west to Arkansas and Arizona, and south into northern Mexico.

Cheilanthes castanea Maxon, Proc. Biol. Soc. Wash. **32:** 111 (1919).

COAHUILA: Sierra Guajes, Cañon Milagro, on cliffs, not common, *Stewart 1711;* Soledad, 1880, *Palmer 1390* in pt.; Caracol Mt., 1880, *Palmer 1391* in pt.; Saltillo, Apr. 1880, *Palmer 1391;* mountains 6 mi. east of Saltillo, July 1880, *Palmer 1398;* Carneros Pass, ledges, *Pringle 2777;* Carneros Pass area, 1880, *Palmer 1390* (ISOTYPE); Sierra del Pino, La Noria, shady bushy arroyo-bank, *Johnston & Muller 477;* Sierra del Pino, high western ridge about 10 mi. north of La Noria, under rocks on crest, *Johnston & Muller 553;* Sierra Madera, Cañon del Agua, rock crevices in moist densely wooded canyon, *Muller 3252b;* Sierra Madera, Cañon Charretera, moist bushy ledges and shaded arroyos, *Johnston 8931* and *9095;* Sierra Cruces, Cañon Tinaja Blanca, shaded banks in open canyon, *Johnston & Muller 283;* Sierra Mojada, Cañon Hidalgo, slopes of canyon below crest, *Stewart 1057;* Sierra Jimulco, 10 km. northeast of Jimulco, *Stanford et al. 43.* ZACATECAS: Concepcion del Oro, high up in canyon in shady moist places, 1904, *Palmer 260* in pt.; Concepcion del Oro, 1902, *Palmer 388;* mountain 18 km. west of Concepcion del Oro, *Stanford et al. 577.*

Ranging from Texas to Arizona and south to Zacatecas and Hidalgo.

Cheilanthes Eatoni Baker, Syn. Fil. 140 (1867).

COAHUILA: Soledad, 1880, *Palmer 1394, 1395, 1396;* east of La Rosa, *Wynd & Mueller 43;* hills near Saltillo, shaded clay bank in deep arroyo, 1898, *Palmer 367;* base of mountains southeast of Saltillo, road to Diamante Pass, limestone ledge, *Johnston 7270;* Carneros Pass area, 1880, *Palmer 1397;* 3 km. southwest of Fraile, in arroyo, *Stanford et al. 341;* Sierra Hechiceros, about rocks on sunny hillside at El Tule, *Johnston & Muller 1308;* Sierra Hechiceros, Cañon Indio Felipe, base of cliffs, not common, *Stewart 131;* south of Carricito, north-facing basalt ledges, *Johnston & Muller 162;* Sierra del Pino, Cañon Ybarra, dry hillside, *Stewart 1875;* Sierra del Pino, under rocks on ridge-crest 4 mi. northeast of La Noria, *Johnston & Muller 653;* Sierra Cruces, Cañon Tinaja Blanca, under rocks in lower canyon, *Johnston & Muller 252;* Sierra Cruces, lava crags at head of Cañon Tinaja Blanca, *Johnston & Muller 306;* Picacho de San José, crevices of cliffs, *Stewart 1112;* San José, about basalt crags on hillside, *Johnston & Muller 980;* San Antonio de los Alamos, under large lava rocks in open upper canyon, *Johnston & Muller 903;* Sierra Negras, 9 km. south of Parras, *Stanford et al. 202* in pt.; Sierra de Parras, July 1910, *Purpus 4609.* CHIHUAHUA: Sierra Santa Eulalia, Oct. 27, 1885, *Pringle;* rocky hills near Chihuahua, Oct. 1885, *Pringle 455* in pt.; Meoqui, *LeSueur 1147.* ZACATECAS: Cedros, canyons, *Lloyd & Kirkwood 139.*

Ranging from Oklahoma and Texas west to Arizona and south to Durango and San Luis Potosi.

Cheilanthes jamaicensis Maxon, Contr. U. S. Nat. Herb. **24:** 51 (1922).

COAHUILA: Sierra de la Gloria, March 4, 1939, *Marsh 1964;* Sierra Madera, Cañon del Agua, abundant in rock-crevices in moist densely wooded canyon, *Muller 3252;* mountains 6 mi. east of Saltillo, 1880, *Palmer 1418* in pt.

Here first reported from Mexico; previously known only from Jamaica and from Santo Domingo (var. *domingensis* C. Chr.). The geographical distribution of the species is unusual; one would not, off hand, expect a local West Indian species to appear, apparently just as locally, in the mountains of northeastern Mexico. However, this is not unprecedented; *C. notholaenoides,* though much more common than *C. jamaicensis* in the Mexican highlands, similarly occurs in Jamaica and Hispaniola. Since its nearest relatives are Cordilleran, *C. jamaicensis,* in spite of its rarity on the mainland, may reasonably be classed with those continental species which have outlying stations in the West Indies.

Cheilanthes myriophylla Desv. Berl. Mag. **5:** *328* (1811).

CHIHUAHUA: Hills northwest of Chihuahua, cool cliffs, Oct. 16, 1886, *Pringle 829*. ZACATECAS: Concepcion del Oro, shaded moist places among rocks and bushes high in canyon, Aug. 1904, *Palmer 260* in pt. and *258*.

Ranging from our area to Durango and San Luis Potosi and along the Andes to Chile and Argentina. Differing from *C. villosa* in having the upper surface of the fronds glabrous (rather than bearing coarse hairs) and scales of the lower surface fibrillose.

Cheilanthes villosa Davenp. Cat. Davenport Herb. Suppl. 45 (1883).

COAHUILA: Sierra Guajes, Cañon Milagro, on cliffs, not common, *Stewart 1709;* gorge just east of Socorro, on cliffs, *Johnston 8850;* Sierra San Vicente, Cañon Espantosa, *Schroeder 97;* top of grade at Cuesta Zozaya, about rocks on dry open slopes, *Johnston 9292;* western extremity of Sierra Madera, deep canyon 2 km. southeast of Puertecito, ledges on canyon-wall, *Johnston 9320;* Sierra Cruces, basalt crags at head of Cañon Tinaja Blanca, *Johnston & Muller 306;* San José, about crags on basalt hill, *Johnston & Muller 979;* San Antonio de los Alamos, under basalt rocks in open canyon, *Johnston & Muller 904;* La Botica, limestone cliffs, scarce, *Stewart 2895;* Sierras Negras, 9 km. south of Parras, *Stanford et al. 202* in pt.; Picacho de Jimulco, summit, *Stanford et al. 106* in pt.; Jimulco, April 28, 1885, *Pringle*. CHIHUAHUA: Sierra Rica, Dec. 1882, *Newberry;* 8 mi. northwest of Cruces, about tuff cliff, *Johnston 7978;* Sierra Santa Eulalia, April 6, 1885, *Pringle;* Sierra Santa Eulalia, Nov. 2, 1885, *Pringle 459;* hills west of Chihuahua, about head of aqueduct, May 8, 1885, *Pringle*.

Ranging from trans-Pecos Texas (Davis Mts.) to southern Arizona, and south into our area.

Cheilanthes Lindheimeri Hook. Sp. Fil. **2:** 101. *t. 107a* (1858).

CHIHUAHUA: 1 mi. west of Poza de Villa, under rocks on small igneous hill, *Johnston & Muller 1386;* 3 mi. south of Pirámide, terrace along rocky arroyo, under rocks, *Johnston 8113;* 11 mi. northeast of Camargo, lava cliff, *Johnston 7924;* Chihuahua, rock-crevices, shady riverbank, 1908, *Palmer 358*.

Texas to Arizona and south to Sonora, Durango, and San Luis Potosi. In our region found only in areas of igneous rock.

Cheilanthes lendigera (Cav.) Sw. Syn. Fil. 128, *328* (1806).

CHIHUAHUA: Mapula Mts., southwest of Mapula station, central canyon on shaded ledges and cool cliffs, Oct. 21, 1886, *Pringle 828* and *835*.

Texas (Chisos Mts.); Arizona south along the western Sierra Madre, reaching northwestern South America.

Cheilanthes mexicana Davenp. Bull. Torr. Bot. Cl. **15:** *227* (1888).

CHIHUAHUA: Portrero Peak, Sierra Santa Eulalia, northeast of Mapula station, verge of a high cliff near the summit, Oct. 12, 1886, *Pringle 827* (TYPE).

Only the type collection seen. Although, in describing the species, Davenport compared it with *C. viscida* and *C. Parishii,* it is much more closely related to *C. lendigera* and *C. Schaffneri* Moore (*Myriopteris rufa* Fée, non *C. rufa* Don; *C. cinnamomea* D. C. Eaton). From the former it differs in its compact habit, smaller pinnules, and nearly rudimentary indusium. There seem to be no very satisfactory characters whereby to separate it from the latter as represented by *Schaffner 911* and *914,* from San Luis Potosi, referred to *C. cinnamomea* by Eaton; more material may show that *C. mexicana* should be reduced to synonymy under *C. Schaffneri.*

Cheilanthes pyramidalis Fée, Mém. Foug. **7:** 38. *t. 25, f. 3* (1857).

CHIHUAHUA: Mapula Mts., large central canyon southwest of Mapula station, cool rocky slopes, Oct. 1886, *Pringle 832*.

Previous students of ferns have usually treated *C. pyramidalis* as a synonym of *C. marginata;* even Fournier treated it as only varietally distinct. It is not a very strong species. True *C. marginata* of South America, however, has a broadly deltoid lamina, ovate to short-linear ultimate segments, and strongly ciliate indusia which are usually decurrent on the rachillae. *Cheilanthes pyramidalis* of Mexico is distinguishable by its narrowly deltoid to deltoid-lanceolate lamina and its strong tendency to develop elongate-linear ultimate segments. There is much variation in the degree of ciliation and decurrence of the indusium (in Fée's type, as he figures it, it is strongly ciliate but not at all decurrent), but it is always somewhat ciliate. The species has been collected in the western states of Mexico and in Vera Cruz and Guatemala, and apparently it reappears in Venezuela (*Fendler 90*). The geographic relationship between *C. pyramidalis* and *C. marginata* is not unlike that between *Notholaena nivea* and *N. incana.* At its extreme northern limit, *C. pyramidalis* passes into var. *arizonica* (Maxon) Broun, characterized by its slender habit, deltoid-ovate lamina, elliptical to oblanceolate ultimate segments, and merely papillate-denticulate, non-decurrent indusia.

Pringle's collection (*832*) from the Mapula Mts. does not have the elongate segments of typical *C. pyramidalis,* but it does possess relatively narrow fronds and ciliate, more or less decurrent indusia, and therefore it is referred to the typical variety rather than to var. *arizonica.* Maxon, Amer. Fern Jour. **8:** 117 (1918), cites *Pringle 1442* as intermediate in characters. There are two sheets of this collection in the Gray Herbarium, containing three individuals, two of which are very good *C. pyramidalis.* The third, though suggesting the variety, has the relatively narrow frond of the typical form, and the indusia, though only weakly decurrent, are definitely ciliate.

Cheilanthes Kaulfussii Kunze, Linnaea **13:** 145 (1839).

CHIHUAHUA: Rocky hills northwest of Chihuahua, at base of cliffs in shade, *Pringle 457* and *826*.

Ranging from Central America north to Nuevo Leon, Durango, and Chihuahua; trans-Pecos Texas (Davis and Chisos Mts.).

Cheilanthes leucopoda Link, Fil. Sp. 66 (1841).

COAHUILA: Sierra Jimulco, 11 km. northeast of Jimulco, *Stanford et al. 82;* steep open north canyon, 6 mi. west of Viesca, *Johnston 7745*. CHIHUAHUA: Sierra Santa

Eulalia, in soil about ledges, 1885, *Pringle 442*. DURANGO: 7 mi. southwest of Chocolate, shaded slope, *Shreve 9112*.

From our area ranging south in Durango, reaching San Luis Potosi. It extends north to the southern escarpment of the Edwards Plateau in Texas.

Adiantum Capillus-Veneris L. Sp. Pl. 1096 (1753).

VERNACULAR NAMES: Culantrillo; Silantrillo.

COAHUILA: Muzquiz, *Marsh 1138;* Sierra Madera, Cañon del Agua, along edge of water in upper canyon, *Muller 3249;* Cuatro Cienegas, *Marsh 2021;* Saltillo, 1880, *Palmer 1430;* Saltillo, shady narrow arroyo, abundant on wet rocks, 1898, *Palmer 71;* Chojo Grande, 27 mi. southeast of Saltillo, common on wet canyon-wall and about waterfall, 1904, *Palmer 360;* Sierra Hechiceros, Cañon Indio Felipe, along creek and about waterfall, *Stewart 72* and *129;* Sierra Mojada, Cañon Hidalgo, shade in canyon below crest, *Stewart 1062;* El Coyote, eastern margin of Valle Acatita, frequent about spring, *Stewart 2737;* Cañon del Agua Grande west of Las Delicias, common on gypsum bank by water, *Stewart 2801;* San Lorenzo de la Laguna, 1880, *Palmer 1431*. CHIHUAHUA: Sierra Almagre, Ojo del Almagre, locally common about spring, *Johnston & Muller 1210;* Chihuahua, moist crevices on shaded river bank, 1908, *Palmer 331*. ZACATECAS: Cedros, *Lloyd & Kirkwood 114*.

Widely distributed in the warmer parts of both hemispheres. Palmer reported that this fern was sold in the market at Saltillo under the name "Silantrillo" and notes that it was "used to assist menstruations in females."

Adiantum tricholepis Fée, Mém. Foug. **8:** 72 (1857).

COAHUILA: Hac. La Rosita, *Wynd & Mueller 296;* La Mariposa, *Wynd 691*. CHIHUAHUA: Sierra Santa Eulalia, April 1885, *Pringle;* rocky ledges in the hills northeast of Chihuahua, Oct. 10, 1885, *Pringle 456*.

Known from Texas (south escarpment of the Edwards Plateau), Tamaulipas, Coahuila, Nuevo Leon, Vera Cruz, Yucatan, Morelos, Guerrero, Jalisco, Sinaloa, and Chihuahua.

Polypodium peltatum Cav. Descr. 244 (1802).

Polypodium polylepis Roem. ex Kunze, Linnaea **13:** 131 (1839).

COAHUILA: Mountain 24 km. northwest of Fraile, on a log, *Stanford et al. 413*.

Ranging northward along the eastern Sierra Madre from central and southern Mexico.

Polypodium erythrolepis Weatherby, Contr. Gray Herb. **65:** 11 (1922).

COAHUILA: Cañon Sentenela, Sierra del Carmen, *Wynd & Mueller 599* and *610;* Sierra del Carmen, Aug. 26, 1936, *Marsh 626* (US). CHIHUAHUA: Portrero Peak, northeast of Mapula station, cold cliffs, Sept. 10, 1886, *Pringle 825* (TYPE).

Otherwise known from western Chihuahua, adjacent Sonora, and Durango. The above-cited collections from Coahuila, together with one from western Chihuahua (*LeSueur 1128*), go very far to break down the differences between *P. erythrolepis* and *P. peltatum*. In them, the abundant, ovate, deeply lacerate-margined scales of the former, which seemed so distinctive when it was proposed, nearly disappear and are replaced by suborbicular ones. The surviving distinctions are: *P. erythrolepis,* stipe nearly as long as the blade, costa green on the lower surface; *P. peltatum,* stipe conspicuously shorter than the blade, costa black on lower surface.

In addition, *P. erythrolepis* tends to have narrower rhizome-scales with narrower, more definitely erose-serrulate hyaline margins; but this is only a tendency. Furthermore, the collection here cited under *P. peltatum* (*Stanford et al. 413*) is also transitional in that the costa, though somewhat darker than the leaf-tissue, is green beneath and the orbicular scales of the under surface of the lamina are more or less erose-serrulate. In all probability, *P. erythrolepis* would best be treated as a variety of *P. peltatum*.

Polypodium guttatum Maxon, Contr. U. S. Nat. Herb. **17**: 575 (1916).

VERNACULAR NAME: Canahuala.

COAHUILA: Sierra del Carmen, Cañon Sentenela, *Wynd & Mueller 553;* Sierra Madera, Cañon Charretera, on rocks in moist shaded canyon under oaks at lower edge of pine-belt, *Johnston 8985;* shady canyon near Saltillo, abundant, 1898, *Palmer 65* (ISOTYPE); medicinal herb bought in Saltillo market, 1898, *Palmer 65½;* Carneros Pass area, 1880, *Palmer 1373;* mountain 25 km. northwest of Fraile, *Stanford et al. 371.*

Ranging from Hidalgo and Guanajuato northward along the eastern Sierra Madre into eastern Coahuila; Oaxaca; Baja California. Palmer reports this plant as sold in the market at Saltillo. Infusions are drunk as tea and used externally as a remedy for pain in the joints and particularly those of the shoulder.

Polypodium plesiosorum Kunze var. **Bakeri** Davenp. Garden and Forest **4**: 556 (1891).

COAHUILA: Sierra de la Gloria, *Marsh 1926.*

Known from Michoacan, Jalisco, and Nuevo Leon.

Polypodium polypodioides (L.) Watt, var. **Michauxianum** Weatherby, Contr. Gray Herb. **124**: 31 (1939).

COAHUILA: Sierra San Manuel, Rancho Agua Dulce, *Wynd & Mueller 368;* Caracol Mts., 1880, *Palmer 1376;* Saltillo, Sierra del Puebla, shaded crevices of detached rocks about summit, Nov. 3, 1904, *Palmer 447.*

Ranging from Maryland, Illinois, and Missouri southward and through eastern Mexico to Guatemala.

Polypodium thyssanolepis A. Br. ex Klotzsch, Linnaea **20**: 392 (1847).

CHIHUAHUA: Cold cliffs in rocky hills northeast of Chihuahua, Oct. 26, 1885, *Pringle 443.*

Ranging from southern Arizona to western Texas (Chisos Mts.) and southward to Costa Rica and Andean South America.

SCHIZEACEAE

by C. A. WEATHERBY

Anemia mexicana Klotzsch, Linnaea **18**: 526 (1844).

COAHUILA: Rancho Agua Dulce, Sierra San Manuel, *Wynd & Mueller 319;* Hac. Mariposa ravine near Puerto Santa Anna, *Wynd & Mueller 229;* Caracol Mt., 1880, *Palmer 1438.*

Ranging from central Texas south to Hidalgo and Morelos.

MARSILIACEAE

by C. A. WEATHERBY

Marsilea Fournieri C. Chr. Ind. Fil. 418 (1906).

Marsilea minuta Fourn. Bull. Soc. Bot. France **27**: 329 (1880), non L. (1771).

COAHUILA: Cerro de Cypriano, July 1910, *Purpus 4525*. CHIHUAHUA: Wet places near Chihuahua, *Pringle 1121*.

The species is also known from San Luis Potosi and Jalisco. The Mexican material of *Marsilea* at hand is scanty and often without fruit or otherwise unsatisfactory; determinations in the genus are therefore tentative and subject to correction.

Marsilea mucronata A. Br. Am. Jour. Sci. II. **3:** 55. *f. 2* (1847).

COAHUILA: Torreon, 1898, *Palmer 467*.

As Braun has suggested, *M. mucronata* may be no more than a variety of *M. vestita*. Baker so treated it, but without making the proper nomenclatural combination. The two are geographically separated, *M. vestita* on the Pacific Slope, *M. mucronata* in the high plains and eastern Rockies with outlying stations in the Great Basin. Within these areas the characters of pubescence given by Braun, the relatively abundant, long, slender and somewhat spreading hairs of *M. vestita*, the sparse, short, broad and appressed hairs of *M. mucronata*, hold so consistently that it seems much more natural to give *M. mucronata* some recognition than to reduce it outright to *M. vestita*, as has commonly been done in recent years.

The species ranges from southern Saskatchewan and Alberta south to Texas, New Mexico, and Arizona. Wright (*2112*) collected the species in low ground near San Elizario, Texas. It is to be expected elsewhere in the low ground along the Rio Grande at our northern boundary.

Marsilea sp.

CHIHUAHUA: Pond just east of Organos, growing in water up to a foot deep, blades floating on surface of pond, common, *Stewart & Johnston 2048;* Rio Conchos near Camargo, *White 2244*.

The two above-cited specimens are sterile. They suggest both *M. uncinata* and *M. mexicana* but are not definitely determinable.

PSILOTACEAE

by C. A. WEATHERBY

Psilotum nudum (L.) Griseb. Abh. Ges. Wiss. Göttingen **7:** 278 (repr. 130) (1857).

CHIHUAHUA: Hills about 8 mi. northeast of Chihuahua, growing from seams of rock in canyon, Oct. 1885, *Pringle 450*.

EQUISETACEAE

by C. A. WEATHERBY

Equisetum laevigatum A. Br. Am. Jour. Sci. **46:** 87 (1844).

COAHUILA: Muzquiz, *Marsh 229* and *473;* Sierra Hechiceros, Cañon del Indio Felipe, sand at edge of creek, scarce, *Stewart 36*.

Widely ranging in the United States and extending south through Mexico to Guatemala.

SELAGINELLACEAE

by C. A. WEATHERBY

Selaginella rupincola Underw. Bull. Torr. Bot. Cl. **25:** 129 (1898).

COAHUILA: Sierra Cruces, Cañon de Tinaja Blanca, ledges of igneous rock, stems ascending, *Johnston & Muller 307*. CHIHUAHUA: 20 km. north of Chihuahua, volcanic hills, rocky talus at base of cliff, more or less erect, *Stewart & Johnston 2122;* Chihuahua, 1908, *Palmer 38* in pt.; Sierra Azul, southwest of Mapula, crevices of igneous rock, *Pennell 18646* (US); Meoqui, 1936, *LeSueur 1146*.

Arizona and western New Mexico south along the western Sierra Madre to Durango and Guanajuato. A species apparently confined to igneous rocks. Its stems are assurgent to nearly erect and are ascendingly branched. The shoots are symmetrical and equally clothed on all sides by appressed leaves. The leaves are terminated by elongate white setae which form a conspicuous tuft at the end of sterile shoots.

Selaginella viridissima Weatherby, sp. nov.

Caules graciles, foliis inclusis circa 1 mm. diametro, elongati (ad 15 cm. longi), prostrati tegetem magnam intricatam laxam formantes, parce radicantes, bi- vel tripinnatim ramosi (spatiis inter ramos 1 cm. vel minus), ramulis plerumque brevibus (1 cm. vel minus longis). Folia uniformia, arcte adpressa, saturate viridia, plana vel leviter convexa, oblongo-linearia, acuta vel obtusiuscula, plerumque 1.6–2 mm. longa, 0.3–0.4 mm. lata, dorso anguste sulcata, utroque margine ciliis brevissimis 0.1 mm. vel minus longis folii apicem versus ad denticulos reductis praedita. Seta terminalis nulla. Spicae apice caulis ramorumque gestae usque ad 1 cm. longae. Sporophylla ovato-deltoidea, acuminata, e basi leviter dilatata subsagittata subabrupte in acuminem longam contracta, convexa, utroque margine crebre minuteque serrulato-ciliolata, 1.8–2 mm. longa, 0.3–0.4 mm. lata, sulcae medianae utroque latere vitta pallida ornata, sine seta terminali. Macrosporangia microsporangia intermixta. Macrospori 0.4–0.45 mm. diametro, flavi, dense leviterque reticulato-rugosi. Microspori aurantiaci, circa 40 μ diametro.

COAHUILA: Tinajas de los Osos, west end of Sierra Fragua, 2–3 km. north of Puerto Colorado, forming mats in shaded canyon, Sept. 1, 1941, *Johnston 8683;* Sierra Mojada, Cañon Calabasa, fairly common on shaded cliffs 100 m. below the crest, hanging in mats 1 m. in diameter, Oct. 27, 1941, *Stewart 2204* (TYPE, Gray Herb.).

A plant with slender elongate much branched trailing stems forming loose mats. The minute dark green leaves are acute, devoid of setae, and closely appressed to the rather wiry elongate stems. It grows on limestone at the two stations where it has been collected. A pretty species, related to *S. extensa* and *S. Sartorii,* from both of which it may be distinguished by its muticous leaves. From *S. mutica* and its immediate allies, *S. viridissima* differs in its much longer, relatively narrower, and plane leaves.

Selaginella macrathera Weatherby, sp. nov.

Caules repentes, ad 8 cm. longi, usque ad apicem parce radicantes, foliis inclusis circa 1.5 mm. diametro, bipinnatim crebreque ramosi (spatiis inter ramos ca. 5 mm.). Folia uniformia, laxe adpressa, subpallide viridia, oblongo-linearia, seta exclusa plerumque 1.8–2.2 mm. longa, 0.3–0.4 mm. lata, acuta, ventro plana, dorso leviter convexa conspicue angusteque sulcata, basi fasciculum pilorum brevium ciliis marginalibus similium margine utroque 10–12 ciliis brevissimis 0.1 mm. vel minus longis apicem folii versus ad denticulos hyalinos reductis praedita, apice in setam gracilem 1–1.4 mm. longam scabriusculam desinentia. Spicae ad 1 cm. longae apice caulis ramorumque superiorum gestae. Sporophylla anguste deltoidea, 1.8–2 mm. longa, basi leviter sagittata 0.6–0.8 mm. lata, valde convexa vix carinata, dorso leviter sulcata, marginibus breviter crebreque serrulato-ciliolata, seta ut in foliis praedita. Megasporangia absentia vel pauca, unicum visum apicem versus spicae gestum. Megaspori visi immaturi vel male evoluti aurantiaci, circa 0.3 mm. diametro, latere commisurali leviter, latere altero valde crasseque reticulato-rugosi. Microsporangia multa; microspori aurantiaci, ca. 40 μ diametro, irregulariter tuberculati.

CHIHUAHUA: Sierra del Virulento, 2–3 mi. east of Rancho Virulento, ledges on north-facing lava cliffs, common and forming mats, Aug. 11, 1941, *Johnston 8067* (TYPE, Gray Herb.).

A plant with creeping stems. The shoots are symmetrical and equally clothed on all sides with appressed leaves bearing a very long white terminal seta. In spite of its repent habit, the species apparently belongs to the group of *S. rupincola,* from all members of which it is distinguished by its combination of very short cilia and very long terminal seta.

Selaginella Wrightii Hieron. Hedwigia **39:** 298 (1900).

COAHUILA: El Berrendo, July 13, 1939, *Harvey 1173* (US); Sierra Gavia, 5 mi. north of Saucillo, rocky ledge, *Johnston 7208;* Sierra San Vicente, Cañon Espantosa, *Schroeder 72;* Saltillo, *Nil 10644* (US); Sierra del Pino, 4 mi. northeast of La Noria, about limestone rocks along crest of ridge, *Johnston & Muller 651;* western extremity of Sierra Madera east of Laguna de Leche, mats about limestone ledges in abrupt open canyon, *Johnston 8607;* Sierra Madera, Cañon Charretera, carpeting limestone ledges by tinaja, *Johnston 9106;* Cañon de Jara, just east of Socorro, mats about base of limestone cliffs, *Johnston 8854;* Sierra Mojada, April 19, 1892, *Jones 485* (US); 5 km. south of Sierra Mojada, *Harvey 1265a.* CHIHUAHUA: Sierra Almagre, moist limestone ledges in shaded canyon, *Johnston & Muller 1192;* east slopes of Sierra Santa Eulalia 2 km. north of San Antonio, *Harvey 1507.* ZACATECAS: Cedros, stony hills, *Lloyd & Kirkwood 142; Lloyd 20* (US).

Ranging from the Edwards Plateau and its escarpments, in Texas, west to southeastern New Mexico, and south through our area and the mountains of northeastern Mexico to San Luis Potosi, and possibly to Puebla. The type specimen, *Wright 829,* was collected June 25, 1849, "on hills near Turkey Creek, on flat rocks slightly covered with earth." This locality is near the present town of Cline, in western Uvalde County, Texas. The species appears to grow only on limestone. It is a creeping plant carpeting the ground under sheltering rocks or on ledges on north-facing cliffs. The erect fruiting spikes, 1–3 cm. long, are commonly produced in great abundance. The rather firm leaves have a short slightly tawny terminal seta. The leaves tend to be laterally arranged and the shoot is hence somewhat dorsi-ventral.

Selaginella Sheldoni Maxon, Proc. Biol. Soc. Wash. **31:** 171 (1918).

COAHUILA: Picacho de Jimulco, summit, 13 km. east of Jimulco, *Stanford et al. 118.* CHIHUAHUA: Chihuahua, 1908, *Palmer 38* in pt.

Southwestern Oklahoma, central and western Texas, and New Mexico. A creeping species with somewhat dorsi-ventral shoots. The leaves tend to be laterally spreading, and are terminated by a slender elongate white seta. Most of the known stations for the species are in areas of igneous rock.

Selaginella Parishii Underw. Bull. Torr. Bot. Cl. **33:** 202 (1906).

COAHUILA: Saltillo, *Nil 105* (US); Cerro Vega, west of Saltillo, crevices of sandstone, *Pennell 17272* (US); mountains near Saltillo, June 1909, *Nil* (US). ZACATECAS: Near Concepcion del Oro, sheltered rocky ledges, plant very dark green, 1904, *Palmer 306* (ISOTYPE); Tarey Canyon, near Cedros, clefts of slate rock, Feb. 7, 1911, *Chaffey 58* (US).

An endemic species with relatives in southern Mexico and southwestern United States (cf. Maxon, Smithsonian Misc. Coll. **72:** no. 5, p. 4. 1920). A prostrate repent plant with strongly dorsi-ventral shoots. The rather broad and thin acute leaves, without setae, are laterally widely spreading under favorable conditions but curve upward and become more or less connivent when dry.

The specimens here associated with the type collection of *S. Parishii* differ from it somewhat in gross appearance, and at one time they were annotated by Dr. Maxon as constituting a possible new species. In details, however, they are very close to the Palmer isotype; the more conservative course is to leave them in *S. Parishii* pending a thorough revision of the Mexican species of this group.

Selaginella lepidophylla (Hook. & Grev.) Spring, Monog. Lycopod. **2:** 72 (1849).

VERNACULAR NAMES: Flor de la Peña; Siempre Viva.

COAHUILA: Muzquiz-La Mariposa, Dec. 5, 1936, *Marsh 1041;* Sierra Encantada west of Buena Vista, July 14, 1938, *Marsh 1414;* 6 mi. north of Hipolito, limestone outcrop on slope, *Johnston 7236;* La Rosa, dry mountain slope, *Wynd & Mueller 45;* General Cepeda, common under overhanging ledges, 1904, *Palmer 327;* Cuatro Cienegas, *Marsh 2056;* Cañon de Jara east of Socorro, *Schroeder 17;* western base of Picacho del Fuste, north-facing bank of cemented gravels, common, *Johnston 8442;* south end of Cañada Oscuro near Tanque La Luz, steep slopes of escarpment, common on and off gypsum beds, *Johnston 8494;* west end of Sierra Fragua, Aguaje del Pajarito, north-facing limestone slopes, *Johnston 8806;* Cañon Blanco, Sierra Margaritas, open slopes, common, *Stewart 2914.* CHIHUAHUA: Sierra San Carlos, road to mine, on cliff near canyon mouth, *Johnston & Muller 41.* ZACATECAS: Cedros, rocky hills, *Kirkwood 134.*

Western Texas and New Mexico south to southern Mexico. A common plant on north-facing dry rocky slopes and ledges in limestone areas. The plant avoids the direct sun but grows in open situations in which it can only have water available during and for a short time after desert showers. Because it avoids direct sunlight and commonly occurs in abundance only on north-facing situations, it serves as a handy and rather reliable indicator of direction to a traveller in the desert mountains where it flourishes. During most of the year the plant is an inconspicuous brownish ball of brittle inrolled leaves as big as one's fist. Only after a rain, when the fronds unroll and reveal their green upper surfaces, forming flat bright green rosettes and magically bringing unexpected verdure to gray cliffs and banks, does one realize how common and abundant it is in a region. The plant is a slow growing perennial and probably grows for a good many years. Some old plants have their rosettes lifted as much as 5 cm. above the substratum by the accumulation of half decayed fronds of seasons past. A surprising amount of dirt and gravel collects within the rosette about the base of the old fronds.

Selaginella pilifera A. Br. Ind. Sem. Hort. Berol. App. 20 (1857).

Selaginella Pringlei Baker, Handb. Fern Allies 88 (1887).

Selaginella pilifera var. *Pringlei* (Baker) Morton, Amer. Fern Jour. **29**: 15 (1939).

COAHUILA: Yerda Spring, near Muzquiz, *Marsh 270;* Muzquiz-Mariposa, *Marsh 1042;* Saltillo, *Arsène 10677* and *Palmer 321* (US, fide Morton); western end of Sierra Fragua, high crest north of Puerto Colorado, common on shaded ledges, *Johnston 8748.* CHIHUAHUA: Sierra Santa Eulalia, March 30, 1885, *Pringle 211* (isotype of *S. Pringlei*); Sierra Almagre, moist shaded limestone cliffs in deep canyon, *Johnston & Muller 1140.*

Western Texas and adjacent southeastern New Mexico south to northern Sonora, San Luis Potosi, Nuevo Leon, and northern Tamaulipas. Apparently confined to limestones. A plant with habit similar to *S. lepidophylla,* but with more slender, less rigid stems and paler green, bristle-tipped leaves. In western Coahuila and adjacent Chihuahua it is uncommon and found on sheltered moderately moist cliffs in the oak-belt, and not with *Yucca, Dasylirion, Hechtia, Euphorbia antisyphilitica, Notholaena sinuata,* etc., the associates of *Selaginalla lepidophylla,* on the lower and open slopes of the mountains.

The type of *S. pilifera* is given as based on "Specimina Texana in montosis ad fluvium Rio Grande infra El Paso uno cum S. lepidophylla a cl. Wright anno 1849 collecta comm. Dr. G. Engelmann." In the Gray Herbarium there is only a single collection of *S. lepidophylla* made by Charles Wright during 1849. This is his no. *827,* collected from "high rocky bluffs of Devils River, July 22, 1849" in southern Val Verde County, Texas. His field-notes for 1849 have no entry which can be identified as pertaining to another collection of this species. It is possible, therefore, that the type of *S. pilifera* actually was collected in Val Verde County, Texas, rather than near the Rio Grande (presumably in the Quitman Mts.) below El Paso, as originally stated.

Morton has discussed the relationship of *S. pilifera* and *S. Pringlei* and has concluded that these two species differ only in trivial details, the former having entire, the latter having minutely serrulate margins on the lateral leaves. Except for the type, all the material he cites as belonging to typical *S. pilifera* comes from eastern Coahuila, Tamaulipas, and Nuevo Leon. The material from trans-Pecos Texas, New Mexico, Chihuahua, and San Luis Potosi he places in the var. *Pringlei.* Recently, however, Stephen White (*522*) has collected material in the valley of the Rio Bavispe, in northeastern Sonora, which has distinctly serrulate leaves. Since the characters of leaf-margin are weak at best and are not geographically correlated, it seems best to permit *S. Pringlei* to subside into synonymy.

PINACEAE

Pinus cembroides Zucc. Abh. Akad. Wiss. München **1**: 392 (1832).

Pinus osteosperma Engelm. in Wislizenus, Mem. Tour Mex. 89 (1848).

VERNACULAR NAME: Piñon.

COAHUILA: Sierra Encantada, *Stewart 1434, Marsh 1358;* Sierra Madera, Cañon del Agua, *Muller 3229;* Sierra del Pino, *Johnston & Muller 523, Stewart 1243;* Sierra Gavia, *Wynd & Mueller 165, Muller 3064;* Sierra San Vicente, Cañon Espantosa, *Schroeder 95;* 6 mi. east of Saltillo, 1880, *Palmer;* Chojo Grande near Saltillo, 1905, *Palmer 768;* Buena Vista, *Gregg;* Carneros Pass, *Pringle 2659* and *4018, Palmer;* near

General Cepeda, on mesa, *Pringle 13664;* summit of Picacho de Jimulco, *Stanford et al. 110.* CHIHUAHUA: Sierra Rica, *Stewart 2506;* Sierra Diablo, *Stewart 933.*

From Arizona, New Mexico, and trans-Pecos Texas south to Hidalgo. A small tree, usually 5–10 m. tall, commonly growing along arroyo-banks, on ridges, and on steep open slopes, usually associated with *Juniperus*. In western Coahuila and eastern Chihuahua the tree is seldom abundant in any locality.

Pinus Pinceana Gordon, Pinetum 204 (1858); Shaw, Gard. Chron. III. **38**: 122. *fig.* (1905), Pines of Mexico 7. *tab. 2* (1909).

Pinus latisquama Engelm. Gard. Chron. II. **18**: 712. *fig.* (1882).

COAHUILA: West end of Sierra Fragua just north of Puerto Colorado, abundant, *Johnston 8735;* Sierras Negras, 9 km. south of Parras, *Stanford et al. 148;* General Cepeda, *Nelson 6140;* Carneros Pass, *Palmer 1299* in 1880 (type of *P. latisquama*), *Pringle 2293* and *13207A, Shaw.* ZACATECAS: Pico de Teira, southwest of Cedros, 1908, *Lloyd 30.*

This very well marked pinyon-pine is known only from scattered stations in our area, and from Hidalgo and the peak of Orizaba in east-central Mexico. In our region it was first collected in March 1880, in the Carneros Pass area by Palmer. His material became the type of *Pinus latisquama* Engelm. The trees, which rarely become more than 7 m. tall, have a broad rounded crown whose silhouette from a distance is more suggestive of an oak tree than a pine. The ellipsoidal cones, russet when fully ripe, are borne on stalks and at the ends of the long supple brittle pendulous branchlets. The trunk becomes 2–6 dm. thick and commonly branches less than 2 m. above the ground. The bark is grayish, somewhat furrowed on the trunk and smooth on the branches. Where it has been found, the pine grows with scrub oaks and is confined to sheltered slopes and canyons.

Pinus Ayacahuite Ehrenb. ex Schlechtend. Linnaea **12**: 492 (1838).

VERNACULAR NAMES: Acanita; Pinaveta.

COAHUILA: Sierra del Carmen, Cañon Sentenela, *Wynd & Mueller 630;* Sierra del Carmen, Sept. 12, 1936, *Marsh 821;* Sierra Madera, *Muller 3210, Johnston 8998;* Carneros area, March 1880, *Palmer;* sierra 26 km. northwest of Fraile, *Stanford et al. 456;* General Cepeda, *Nelson 6136.*

I have seen cones for only one of the cited collections, *Johnston 8998*. This has seeds with the wing at least 10 mm. long. The form of the species growing in the western Sierra Madre, from Arizona to Durango, has the wing on the seeds only a few millimeters in length and has been distinguished from the typical plants under the name var. *brachyptera* Shaw (= *P. strobiformis* Engelm.). Some plants from the Sierra Madre of Nuevo Leon (*Muller 1244, 2283*) also have seeds with very short wings. The variety is probably also represented in Coahuila.

The species, with its varieties, ranges from Central America northward along the eastern Sierra Madre into Coahuila and along the western Sierra Madre into Arizona. It commonly attains a height of 15 m. and in favorable situations may approach 30 m. In Coahuila it associates with *Pseudotsuga* to form the forests on cool shaded north-slopes in the higher mountains. Along canyons and on open slopes its lower altitudinal limit is several hundred meters above that of *Pinus arizonica* and about 100 m. below that of *Pseudotsuga*.

Shaw, Pines of Mexico 12 (1909), reports *Pinus flexilis* from the mountains south of General Cepeda upon the basis of *Nelson 6136*. That specimen, in my judgment, appears referable to *P. Ayacahuite*. It has seeds with a broad wing about 8 mm. long, according to Shaw's manuscript notes.

Pinus Greggii Engelm. ex Parlatore in DC. Prodr. **16**[2]: 396 (1868); Shaw in Sargent, Trees and Shrubs **2**: 53. *tab. 124* (1907); Shaw, Pines of Mexico 28. *tab. 21* (1909).

COAHUILA: San Antonio de los Alanzanes, abundant, 30–50 ft., Aug. 31, 1848, *Gregg 402* (ISOTYPE); Cañon de las Iglesias, near Saltillo, *Shaw, Pringle 10142*.

A species known only from the Sierra Madre of Nuevo Leon and adjacent Coahuila, and perhaps Hidalgo. It is a 3-needle pine with sessile reflexed long-persistent tardily opening cones 6–12 cm. long. The cones are light colored (usually café au lait) and lustrous. The needles are very slender and 7–10 cm. long.

Pinus arizonica Engelm. in Wheeler, Rep. U. S. Geol. Surv. W. of 100th Merid. **6**: 260 (1878).

VERNACULAR NAMES: Pino; Pino Real.

COAHUILA: Sierra del Carmen, Cañon Sentenela, *Wynd & Mueller 650;* Sierra del Carmen, Sept. 12, 1936, *Marsh 830;* west of Buena Vista [?Sierra Encantada], *Marsh 2290;* Sierra del Pino, *Johnston & Muller 446;* Sierra Madera, *Muller 3208, Johnston 8935;* Sierra Gloria, *Marsh 1931;* Sierra Caracol, 1880, *Palmer;* Chojo Grande near Saltillo, 1905, *Palmer 769;* Carneros area, *Palmer, Pringle 2826;* mountains south of General Cepeda, *Shaw, Pringle 10139*.

Widely distributed and frequently the dominant pine in the eastern Sierra Madre of Nuevo Leon and Tamaulipas, south at least to Miquihuana and Doctor Arroyo. Also in the Chisos Mts. of Texas, southern New Mexico and Arizona, and northeastern Sonora. In northeastern parts of Mexico this pine has passed mostly as *P. Montezumae, P. pseudostrobus,* and *P. ponderosa*. Watson, Proc. Am. Acad. **18**: 158 (1883), reported it from Coahuila as *P. Montezumae* and *P. teocote*. I am unable to separate the pine of Coahuila and the eastern Sierra Madre from typical *P. arizonica* of Arizona. Sudworth, Pine Trees of the Rocky Mts. Region, U. S. Dept. Agr. Bull. **460**: *tab. 16, 17* (1917), gives an excellent illustration of the Arizonan plant. It agrees perfectly with Coahuilan material. In general appearance the Coahuilan plant much resembles forms of *Pinus ponderosa* growing in the Rocky Mountains. Its bark is the same. It differs from *Pinus ponderosa* in its somber brownish (rather than russet), more or less asymmetric, frequently stalked cones, weak, non-pungent umbo on the cone-scales, 3–5 needles, usually glaucescent branchlets, and more southern distribution. From *P. Montezumae* our tree differs in its smaller and proportionately broader cones, usually glaucescent branchlets, and northern range. From *P. pseudostrobus* it differs in its coarser more rigid non-pendulous foliage, more rigid and woody short-stalked or sessile cones, and northern distribution. In northeastern Mexico *P. arizonica* is to be confused only with *P. Hartwegii,* a tree of high altitudes in the Sierra Madre, which has very coarse loose needle-sheathes, conspicuous long-persistent bud-scales, non-glaucescent branchlets, somewhat thinner less rigid cone-scales, and cones averaging slightly smaller.

In Coahuila *P. arizonica* is probably the most common pine, forming open forests in the open valleys and on the drier slopes and ridges in the higher mountains. From its selections of habitats it appears to be intolerant of shade. It commonly grows 10–20 m. tall, with a clear trunk 4–10 dm. thick for a quarter or third of its total height.

Pseudotsuga taxifolia (Lam.) Britt. Trans. N. Y. Acad. Sci. **8**: 74 (1889).

VERNACULAR NAMES: Guayamé; Hallarín.

COAHUILA: Sierra del Carmen, Cañon Sentenela, *Wynd & Mueller 632;* Sierra del Carmen, Sept. 12, 1936, *Marsh 822;* Sierra Madera, *Muller 3221, Johnston 8995;* Sierra Gloria, *Marsh 1885;* Carneros area, March 1880, *Palmer;* mountains 26 km. northwest of Fraile, *Stanford et al. 451.*

Growing on slopes and along canyons in cool shaded places in the higher mountains, forming trees 10–30 m. tall. From Hidalgo extending north in the eastern Sierra Madre into our area, and north into the Chisos Mts. of Texas. Widely distributed in western United States.

Abies sp.

VERNACULAR NAME: Huallame.

COAHUILA: Vicinity of Carneros Pass, tree 40 ft. tall, 18 inches diameter, "Huallame," March 1880, *Palmer;* 26 km. northwest of Fraile, top of mountain with *Pinus* and *Pseudotsuga,* tree 30–40 ft. tall, trunk 18 inches thick, July 1941, *Stanford et al. 457.*

The two collections are unaccompanied by cones. They appear to be identical, however, with a very distinct *Abies* collected, in 1938, by Prof. Maximino Martínez in the Sierra Madre near Santa Catarina, between Monterey and Saltillo. The new species involved will soon be published in Mexico City. The foliage of the present species is not distichous. Its numerous crowded short rigid leaves ascend from all sides of the coarse branchlets in a manner more suggestive of a *Picea* than an *Abies.* Its short leaves bear numerous stomates on the flattened or broadly convex upper surface, and their vascular bundles, though clearly juxtaposed, remain distinct for most of their length. The hypoderm seems unusually well thickened under the middle third of the lower leaf-surface. These are all characters which permit the species to be quickly distinguished from *A. religiosa,* of central Mexico, and from the other, unnamed, Coahuilan species of the genus, the only Mexican plants to be confused with it. Among the species found in the United States, the present fir most suggests *A. lasiocarpa.* That northern high altitude species, however, has more pointed less regularly arranged leaves, whose resin-canals are large and distant from the lateral margins of the leaf. I doubt if it has any close relationship with the present Coahuilan species. It may be noted that Palmer's collection from "the Sierra Madre 40 miles south of Saltillo," cited as *Abies religiosa* by Watson, Proc. Am. Acad. **18**: 158 (1883), and by Rehder, Jour. Arnold Arb. **20**: 283 (1939), is identical with the Palmer collection which I have cited with more explicit geographical data above.

Abies coahuilensis sp. nov.

Arbor ad 30 m. alta habitum *Pseudotsugae taxifoliae* simulans; trunco ad 9 dm. crasso in parte inferiore cortice fusco rugoso crasso praedito, in parte superiore pallido sublevi; ramulis brunneis hirtellis eos *A. religiosae* simulantibus; foliis subdistichis e ramulis sub angulo 60–90° abeuntibus linearibus, 15–25 (saepe ca. 20) mm. longis, 1–1.7 mm. latis, supra basim coriaceis et saepe subtortis et curvatis, apice rotundis vel acutiusculis, supra viridibus plus minusve nitidis sulcatis sparsissime vel haud stomatosis, subtus conspicue bisulcatis costa prominente margine recurvo seriebus stomatum 4–5 congestis, intus canalibus resiniferis solitariis subepidermalibus ad utrumque marginem faciei inferioris donatis, fascias fibrovasculares conjunctas gerentibus, hypodermate sub facie superiore folii interrupta solum sub epidermate partium marginum et partis mediae faciei inferioris continua donatis; strobilis subsessilibus subcylindricis ca. 10 cm. longis supra basim ca. 4 cm. diametro; squamis 24–28 mm. latis 14–19 mm. longis, margine exteriore hirtellis sursum curvatis, alis minute eroso-denticulatis, margine interiore fere recto utrisque lateribus basi unguis 4–6 mm. longi et sinibus rotundis 1–2 mm. profundis 2–3 mm. latis donatis; bractea squamae haud vel vix exserta quam squama 2/5–4/5 longa, apicem versus 6–7 mm. lata deinde basim versus gradatim attenuata, apice truncata erosa mucronata; seminibus 7–8 mm. longis, alis 12–13 mm. latis ca. 1 cm. longis.

Coahuila: Corte Branco fork of Charretera Canyon, Sierra Madera, frequent above 7500 ft. alt., Sept. 14, 1941, *Johnston 9050;* head of La Pipa fork of Charretera Canyon, Sierra Madera, dense cool shady conifer forest on steep north slope, Sept. 13, 1941, *Johnston 9010* (type, Arn. Arb.)

This fir is frequent in the dense conifer forests on the northern slopes of the main ridge of the Sierra Madera in the drainage of Charretera Canyon. The tree grows mixed with *Pinus Ayacahuite, Cupressus,* and *Pseudotsuga,* but it is very much less common than these other trees. In appearance it simulates the *Pseudotsuga* so closely that I was unable to distinguish them at any distance and was able to make positive identification in the field only after examining the terminal buds on the branchlets, observing cones or cone-axes on the trees, or discovering cones or cone-scales beneath the trees. Timber has been cut and dragged out of the forests of the Sierra Madera for many years. Questioning men who know the forests and have cut timber there, I could find no evidence that this *Abies* had ever been distinguished by the local people from the more common and very similar appearing *Pseudotsuga,* well known to them as "Guayamé."

This species, and the *Abies* previously listed, were recognized as unnamed species and were described before I learned that Prof. Maximino Martínez was at work on a monograph of the Mexican species of the genus. Material of the two species of *Abies* was sent Prof. Martínez, and from the notes, specimens, and photographs he so obligingly sent in return I was readily able to identify the species I report from the Carneros Pass area and from northwest of Fraile with his material from Santa Catarina which he will soon publish as a new species. With this identification Prof. Martínez agrees. We are in disagreement, however, regarding the identification of the *Abies* of the Sierra Madera. Prof. Martínez identifies it with material collected by J. H. Faull near El Salto, in southwestern Durango, which will be described as a new species in the near future.

Through the courtesy of Prof. Faull I have been able to make a detailed study of his collections from El Salto which Prof. Martínez identifies with the present plant of the Sierra Madera. The Durango collections obviously represent a good undescribed species. Its vegetative characters suggest a relationship with *A. religiosa*. It differs from that species, however, in proportionately broader cone-scales and very short non-exserted bracts. In shape and size of the scales, bracts, and seeds, the Durango plant is very much like that from Coahuila. The vegetative characters, however, differ in a number of striking details. The Coahuilan plant has twigs which are dusky and duller brown in color, and which are not glabrous but evidently hispidulous. The leaves have a much thicker epidermis, are heavier and firmer in texture, and are green. They are not glaucous when young. Their petiolular base, better developed than in the Durango tree, is conspicuously erect, appressed to the stem below the middle, and above departing from the stem in an abrupt curve. The leaves of the Durango species are usually straight or nearly so and spread from their point of attachment. The Coahuilan tree has the lower surface of the leaf with very prominently thickened midrib and margins, and accordingly very deeply and narrowly bisulcate. The lower surface of the leaf of the Durango tree has a very much less thickened and prominent midrib and margins, and the intervening grooves are shallow and broad, bearing 4–10 rows of stomates. The upper leaf-surface in the Coahuilan plant bears few if any stomates, whereas that from Durango has several rows of them down the middle.

In gross appearance the plants also differ. Specimens of the Durango plant are suggestive of *A. religiosa*. Those of the Coahuilan tree suggest *Pseudotsuga* or some the *Abies* of the United States. The habit of the trees appear to differ also. Professor Faull tells me that the tree at El Salto has a distinctive local name, is well known and distinguished by the local people, and has the characteristic habit permitting it to be instantly recognized as an *Abies*. The Coahuilan tree grows intermixed with *Pseudotsuga* and simulates that tree to a truly remarkable degree. The two have not been distinguished by local people knowing the forests, and I must confess that I should not have been aware than an *Abies* was growing with *Pseudotsuga* in the Sierra Madera had I not chanced upon *Abies* cones cut down by squirrels.

Geographical distribution also suggests that distinct species of *Abies* are present in the Sierra Madera and about El Salto. The flora of the coniferous forests of the Sierra Madera is made up largely of species that have migrated along the Sierra Madre Oriental or have extended south from the United States by other routes. There is some evidence that a small proportion of the species may have reached the Sierra Madera by migrations from the Sierra Madre Occidental, but this group of species is made up of plants otherwise found in the forests of northern Chihuahua and adjoining Arizona. Since other species show absolutely no evidence of direct floristic connections between the Sierra Madera and the El Salto area, far away in the Sierra Madre Occidental in southwestern Durango, this fact lends additional support to the belief that the *Abies* of Coahuila and Durango are different.

The precise relationships of *A. coahuilensis* are not certain. Among the Mexican species it is probably most closely related to the undescribed plant of Durango. It is readily distinguished from *A. religiosa* of central Mexico by its non-exserted cone-bracts, proportionately shorter cone-scales, smaller seeds, and markedly bisulcate leaves. In many ways, however, it shows closer relationships with *A. concolor* and *A. grandis,* of the western United States. From the former it differs in its slender brownish hispidulous twigs, more slender green bisulcate leaves, and few or absent stomates on the upper leaf-surface. Its hispidulous twigs, more slender acutish leaves, not markedly glaucous beneath, and proportionately broader cone-scales readily separate *A. coahuilensis* from *A. grandis.*

TAXODIACEAE

Taxodium mucronatum Ten. Ann. Sci. Nat. III. **9:** 355 (1853).

VERNACULAR NAME: Sabino.

COAHUILA: Hac. Mariposa, *Wynd 694;* Muzquiz, Sabinas River, *Marsh 406;* Sabinas, along Sabinas River, *Johnston 7040;* Villa Juarez, *Marsh 2084.*

Reported in wet places near Parras, Fedde Repert. Spec. Nov. **14:** 100 (1915). To be expected also along the Rio Nazas west of Torreon.

CUPRESSACEAE

Cupressus arizonica Greene, Bull. Torr. Bot. Cl. **9:** 64 (1882).

VERNACULAR NAMES: Cedro; Pinabeta; Tasco.

COAHUILA: Sierra del Carmen, Cañon Sentenela, *Wynd & Mueller 502;* Sierra Madera, *Muller 3193, Johnston 8925;* mountains near Saltillo, *Pringle 13612;* Carneros area, 1880, *Palmer 1293;* Sierra Encarnacion, *Nelson 3894a;* sierras 24 km. northwest of Fraile, *Stanford et al. 383;* Sierra Parras, *Purpus 4987.* CHIHUAHUA: Sierra Rica, Cañon Madera, *Stewart 2464* and *2479;* Sierra Santa Eulalia, *Pringle 178.*

This species ranges from Texas (Chisos Mts.) and Arizona south to Zacatecas and San Luis Potosi. It appears to differ from *C. Benthami,* of central Mexico, in its larger and more leathery cones and somewhat coarser usually paler foliage. In the Sierra Madera I found this cypress common in the luxuriant coniferous forests on north slopes, where it grew with *Pinus Ayacahuite* and *Pseudotsuga taxifolia* and formed straight single trunks, commonly attaining 20–30 m. in height. About the lower edge of the conifer-belt it was occasional along arroyos associated with *Pinus arizonica.* In such situations it rarely reached 10 m. in height and was broadly conical in form. The younger branches are smooth and brown. The trunks of younger trees have irregular furrows in the thick persistent laminated old bark. The tall trees in the dense forest have a tight checkered bark. Mr. Stewart reports that the tree was common on Sierra Rica along the shady bottom of Cañon de la Madera and there formed a tree rarely up to 20 m. tall with a trunk 12 dm. thick. In that locality it was locally called "Pinabeta." Two of Mr. Marsh's collections, nos. *803* and *1999,* from the Sierra del Carmen and Sierra Gloria, are sterile but seem to represent this species.

Juniperus pachyphloea Torr. U. S. Rep. Explor. Miss. Pacif. **4**: 142 (1857).

VERNACULAR NAMES: Cedro; Tascate.

COAHUILA: Sierra del Carmen, Cañon Sentenela, *Wynd & Mueller 535;* west of Buena Vista Ranch [?Sierra Encantada], *Marsh 1359* and *2296;* Sierra del Pino, common in pine forest, *Johnston & Muller 528, Stewart 2294, 2295;* Carneros Pass area, March 1880, *Palmer 1296.* CHIHUAHUA: Sierra Rica, Cañon Madera, scarce on open slopes, *Stewart 2549.*

The above-cited specimens, agreeing with most Texan collections, have resin exuding from only a few scattered leaves or from none at all. Otherwise the plant agrees well with the "Alligator Juniper" of Arizona and New Mexico, the type of which came from the Zuni Mts. in western New Mexico. It is a large tree with heavy trunk covered with characteristic checkered bark. It is closely related to *J. Deppeana* Steud. (based on *J. mexicana* C. & S., not Spreng.), a Mexican tree, also with checkered bark, growing in the states of Vera Cruz, Puebla, and Hidalgo, and apparently also in Zacatecas, Durango, Chihuahua, and Sonora, which differs slightly in the less conspicuous resin-glands on its smoother less prominently keeled leaves. In *J. pachyphloea* the leaves are usually sulcate on either side of the gland and consequently appear to be three-ridged. Only in Sonora and Chihuahua do the ranges of *J. Deppeana* and *J. pachyphloea* appear to approach one another. The type of *J. Deppeana* came from the margin of the plateau in western parts of Vera Cruz, between Las Vigas and Perote, northwest of Jalapa and north of Cofre de Perote. Curiously it does not appear to have extended its range northward into the Sierra Madre of Nuevo Leon or Tamaulipas.

Juniperus flaccida Schlechtend. Linnaea **12**: 492 (1938).

VERNACULAR NAMES: Tascate; Cedro.

COAHUILA: Sierra del Carmen, Sept. 7, 1936, *Marsh 794;* Sierra San Manuel, Rancho Agua Dulce, *Wynd & Mueller 359;* Sierra del Carmen, 8 km. east of Hac. Encantada, *Stewart 1585;* Hillcoat Mesa, west of Hac. Encantada, *Marsh 1425;* Mesa Grande, 40 km. northwest of Hac. Encantada, *Stewart 1617;* Sierra Encantada, *Stewart 1424;* west of Rancho Buena Vista [?Sierra Encantada], *Marsh 1360;* Sierra del Pino, *Johnston & Muller 527, Stewart 1824;* Sierra Gloria, *Marsh 1972;* Sierra Madera, *Muller 3209, Johnston 8936;* Sierra Mojada, *Stewart 1058;* mountains near Saltillo, *Gregg 432;* Carneros area, *Pringle 2294, Palmer 1294* and *1295;* mountains 24 km. northwest of Fraile, *Stanford et al. 390;* General Cepeda, *Nelson 6122;* Sierra Pata Galana, *Purpus 1105;* Sierras Negras, 9 km. south of Parras, *Stanford et al. 222;* Sierra Jimulco, 11 km. northeast of Jimulco, *Stanford et al. 133.* CHIHUAHUA: Sierra Almagre, *Johnston & Muller 1176;* Sierra Diablo, *Stewart 942.*

Ranging from central Mexico (the type came from the mountains of Hidalgo), this tree extends northward into the Sierra Madre of Chihuahua and through our area into the Chisos and Davis Mountains of Texas. The leaves are decussate and the branchlets are distichous, making the leafy branchlets flat and more or less fan-like. The conspicuously two-ranked smooth elongate acute cuspidate leaves, the pendulous ("weeping") leafy branchlets, and the large resinous multi-seeded non-baccate fruits all unite in permitting the ready recognition of the species. It is a tree with reddish fibrous bark. In our area it commonly becomes 4–8 m. tall and appears to favor limestone. It grows scattered on slopes or more commonly along arroyo-banks, in sheltered places in the oak and lower pine belt.

Juniperus Ashei Buchholz, Bot. Gaz. **90:** 329 (1930).

Juniperus occidentalis var. *conjungens* Engelm. Trans. Acad. Sci. St. Louis **3:** 590 (1877).

Juniperus tetragona var. *oligosperma* Engelm. l. c. 591.

COAHUILA: Saltillo, frequent in highlands, shrub 5–10 ft., *Gregg 106* (isotype of var. *conjungens*); escarpment near mines, Potrero de la Mula, tree 12 ft., *Johnston 9195;* Sierra San Manuel near Rancho Agua Dulce, *Wynd & Mueller 360;* near Puerto Santa Anna, Hac. Mariposa, *Wynd & Mueller 284.*

This is the well known "cedar" of the Edwards Plateau of central Texas, which has passed as *J. sabinoides, J. mexicana,* and *J. tetragona.* These names, however, properly apply to very different species of southern and central Mexico. From our area the species extends north into central Texas and from thence to Missouri. Under the name *J. mexicana,* its distribution in the United States has been discussed by Hopkins, Rhodora **40:** 425 (1938). It forms a small tree and has dark blue globose berries about 8 mm. in diameter.

Juniperus erythrocarpa Cory, Rhodora **38:** 186 (1936).

VERNACULAR NAME: Tascate.

COAHUILA: Sierra Hechiceros, common along canyons, *Johnston & Muller 1290, Stewart 168* and *169;* Castillon, one tree on gypsum flat by corrals, *Johnston & Muller 1273;* Sierra del Pino, La Noria, frequent on flats at lower edge of pine-belt, *Johnston & Muller 525* and *526;* Sierra Cruces, arroyo 3 mi. southwest of Santa Elena, *Johnston & Muller 824;* Sierra Almagre, on flats, *Johnston & Muller 1160;* Sierra Madera, Charretera Canyon, 3 bushes on flat at lower edge of pine-belt, *Johnston 9114.* CHIHUAHUA: Sierra Rica, Cañon Madera, scarce on dry slopes, *Stewart 2483;* near Rancho El Pino, southeast of Sierra Rica, frequent, *Stewart 2426* and *2574;* low hills 13 mi. west of San Carlos, *Johnston & Muller 28.*

Forming a dense rounded bush 10–15 dm. tall or a tree up to 6 m. high. The fruit is not blue, but at maturity it is brownish or reddish, juicy, and commonly about 8 mm. in diameter. Berries with the seed more or less exposed are very common. Submature fruits are usually ovoid. This plant occurs in the Chisos, Chinati, and Davis Mountains of trans-Pecos Texas. I believe the type of *J. erythrocarpa,* from the Chisos Mts., is a form of this species collected late in the season, with the berries large, perhaps because they are fully developed. Mr. Cory, who formerly treated this species as *J. gymnocarpa,* is not satisfied that I am correct in identifying it with the plants he described as *J. erythrocarpa.* If his suspicions are correct our plant is without a name, for the name *J. gymnocarpa* (Lemmon) Cory is based upon a phase of true *J. monosperma* from the Sandia Mts., New Mexico.

Juniperus monosperma (Engelm.) Sargent, Silva No. Am. **10:** 89 (1896).

COAHUILA: Carneros Pass, *Pringle 2305;* Sierra Parras, *Purpus 1104;* Sierra Negras, 9 km. south of Parras, *Stanford et al. 150.* CHIHUAHUA: Sierra Santa Eulalia, *Pringle 710.* ZACATECAS: Near Picachos de las Bocas, 20 mi. S.W. of Concepcion del Oro, *Shreve 9374;* Cedros, *Kirkwood 146.*

In its typical form *J. monosperma* ranges in New Mexico and into adjoining Arizona and Colorado. It has coppery bluish immature fruits, which on maturity form a coppery-blue distinctly fleshy berry with a single plump seed. The old dried fruits are raisin-like. They are usually glaucous and, though blue, have a reddish tone that is very conspicuous if compared with the blackish blue mature berries of *J. Ashei.* The Mexican material I have cited is not typical *J. monosperma* and belongs to a group of unnamed forms, obviously closely related to *J. monosperma,* which occur in western Oklahoma, trans-Pecos Texas, Sierra Madre of western Chihuahua south into Durango, and in our area. The collections from Santa Eulalia Mts., from near Parras, and from Picachos de las Bocas have glaucescent foliage. The material from near Carneros has yellowish green non-glaucous foliage very suggestive of *J. erythrocarpa.* Possibly it was subjected to excessive heat in drying and the waxy bloom destroyed. Its fruit seems to agree well enough with the other forms of *J. monosperma* that I have here associated with it.

EPHEDRACEAE

Ephedra trifurca Torr. ex Wats. Bot. King Exped. 329 (1871).

VERNACULAR NAME: Hitomorial.

COAHUILA: Sierra del Carmen, Aug. 29, 1936, *Marsh 694;* gypsum ridge east of Laguna Jaco, *Johnston & Muller 1076;* 21 mi. west of El Oro, road to Guimbalete, *White 2010;* Laguna del Rey, gypsum on plain, *Stewart 3015.* CHIHUAHUA: 10 mi. south of Ojinaga, clays, *Johnston & Muller 13;* vicinity of Chihuahua, 1908, *Palmer 68, Pringle 868;* 12 mi. south of Camargo, *White 2233.*

A bush 10–15 dm. tall with a loose broom-like habit, ranging from trans-Pecos Texas to Arizona and south into adjoining Mexico. In Coahuila the plant is frequent on gypsum and on gypseous clays. During my several visits in Mexico, between July and October, I have never found a fruiting plant. The plant is easily distinguished in our area by having its leaves 3 at a node, elongate, persistent, and becoming shredded in age, by its coarse branches, and by its pungent terminal bud. This species and *E. Torreyana* have the scales of the cones dry and papery.

Ephedra Torreyana Wats. Proc. Am. Acad. **14:** 299 (1879).

CHIHUAHUA: 10 mi. south of Ojinaga, clays, a gray-green bush 1–2 ft. tall, *Johnston & Muller 14.*

This species probably occurs in the valley of the Rio Grande between Ojinaga and El Paso. It has been collected from western Texas to Arizona and Utah, frequently in gypseous soils. It is a small bush with slender widely divergent branchlets and short spreading ternate leaves.

Ephedra aspera Engelm. ex Wats. Proc. Am. Acad. **18:** 157 (1883).

VERNACULAR NAMES: Popotillo; Cañutilla; Pitamoreal; Hintimoreal.

COAHUILA: El Berrendo, *White 1800;* Puerto San Lazaro, *Wynd & Mueller 143;* La Rosa, *Shreve & Tinkham 9588;* Saltillo, 1898, *Palmer 69;* Carneros area, 1880, *Palmer 1288* (TYPE); low hills 10 mi. south of Picachos Colorados, *Johnston & Muller 152* and *154;* Sierra del Pino, La Noria, *Johnston & Muller 474, Stewart 1191;* Santa Elena, Sierra Cruces, *Stewart 2228, 2254, 2255;* western base of Picacho del Fuste, *Johnston 8452;* 3 km. southwest of Fraile, *Stanford et al. 338;* west of Castanuela, April 11, 1847, *Gregg 414;* Sierra Parras, March 1905, *Purpus 1102;* Sierras Negras, 9 km. south of Parras, *Stanford et al. 168.* CHIHUAHUA: Sierra San Carlos near the mines, *Johnston & Muller 60;* Santa Eulalia plain, *Wilkinson 118;* crest of Santa

Eulalia Mts., *Pringle 38*. Zacatecas: 15 km. west of Concepcion del Oro, *Stanford et al. 521;* Cedros, *Kirkwood 24, Kirkwood & Lloyd 86*.

This is the common *Ephedra* on rocky limestone slopes in Coahuila. Commonly a bush 8–10 dm. tall, with leaves opposite and cone-scales thick but not fleshy. The species ranges in southern New Mexico and trans-Pecos Texas south on the plateau to San Luis Potosi.

Ephedra pedunculata Engelm. ex Wats. Proc. Am. Acad. **18:** 157 (1881).

Vernacular names: Comida del Vibora; Popotillo; Tepopote; Canatilla; Sanguinaria; Retamo Real; Hintimoreal; Itamoreal; Pitamoreal.

Coahuila: Villa Juarez, 1880, *Palmer 1290;* Cañon de Jara, west of Cuatro Cienegas, *Johnston 8837, 8841, 8847;* Cuatro Cienegas, *Marsh 2057;* Sierra Gavia, 5 mi. north of Saucillo, *Johnston 7220;* Saltillo, 1880, *Palmer 1289;* Saltillo, 1898, *Palmer 283;* Valle de los Guajes, 8 km. east of Puerto del Aire, *Stewart 1319;* Santa Elena, Sierra Cruces, *Stewart 2265* and *2266;* Sierra Cruces, Cañon Tinaja Blanca, *Johnston & Muller 310;* La Botica, limestone slope, *Stewart 2939*. Chihuahua: Santa Eulalia plain, *Wilkinson 117* in pt.; Bachimba Canyon, *Pringle 134*. Zacatecas: Cedros, *Lloyd 75* and *214;* near Concepcion del Oro, 1902, *Palmer 372*. Durango: Between Mapimi and Jimenez, Apr. 18, 1867, *Gregg 484* (Mo).

Usually scrambling up through bushes and frequently reaching a height of 3 or 4 meters. Its branches cascade over the top of the supporting vegetation and become very conspicuous when covered with an abundance of red juicy fruits. At Ocampo it is very common in the hedge rows about the town. The plant is not always lofty. In Cañon de Jara, on very arid cemented gravels, I observed plants of this species forming depressed mats a meter broad and scarcely a decimeter high. Even with this unusual habit the species was readily recognized by its pedunculate fleshy red cones.

Ephedra compacta Rose, Contr. U. S. Nat. Herb. **12:** 261 (1909).

Vernacular name: Hitamo Real.

Coahuila: Battlefield near Buena Vista, rocky soil, May 19, 1848, *Gregg 53;* Sierras Negras, 9 km. south of Parras, *Stanford et al. 169a;* Sierra Jimulco, 11 km. northeast of Jimulco, *Stanford et al. 34*.

A depressed spreading grayish bush usually less than 5 dm. tall. The species is known from the States of Coahuila, San Luis Potosi, Puebla, and Oaxaca. It has opposite leaves and a sessile cone that produces two seeds and becomes red and fleshy at maturity.

Ephedra antisyphilitica Berl. ex C. A. Mey. Mém. Acad. Sci. St. Pétersb. VI. Sci. Nat. **5:** 291 (1846).

To be expected in northeastern Coahuila. Widely distributed in Texas and collected near the Rio Grande at various points between Laredo and the Big Bend. A bush becoming a meter tall, with opposite leaves and a sessile, single-seeded fleshy red cone.

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THE COMPARATIVE MORPHOLOGY OF THE WINTERACEAE I. POLLEN AND STAMENS

I. W. BAILEY AND CHARLOTTE G. NAST

With three plates

INTRODUCTION

THE genera *Drimys, Pseudowintera, Belliolum, Bubbia, Exospermum, Zygogynum, Tetracentron,* and *Trochodendron* are the only known living representatives of the dicotyledons that have retained a primitive vesselless type of secondary xylem. In fact, it was upon the basis of their exceptional wood structure that van Tieghem (6) segregated them in three families of a distinct order, the Homoxylées. *Tetracentron* and *Trochodendron* are monotypic, whereas the six winteraceous genera are now represented by approximately 88 species. Thus, the Winteraceae may no longer be regarded as a few bizarre relics, since they are a flourishing family, having representatives in Mexico, Central and South America, New Zealand, Australia, New Caledonia, New Guinea, the Solomons, the Philippines, and adjacent regions.

There has been much uncertainty in the past concerning the relationships and the morphological significance of the Winteraceae. Now that much new material has been accumulated, it seems desirable to institute a detailed re-investigation of the family. Our colleague, Dr. A. C. Smith (4, 5), has published two extensive taxonomic revisions of the family. In so doing, he assembled a large amount of material from American herbaria, which has provided us, in turn, with a wide range of accurately determined specimens, upon which to base a comprehensive study of the comparative morphology of the flowers, leaves, and stems of the Winteraceae. The first paper of our series deals with the pollen and stamens of the family. The succeeding paper will discuss the remarkable carpels of the Winteraceae, which rival their vesselless wood in morphological significance. The herbarium specimens upon which our studies are based have been listed in Dr. Smith's papers and need not be relisted here.

POLLEN

Wodehouse (7, 8) has advanced the intriguing hypothesis that there are two basically different types of pollen morphology. The single-grooved or *monocolpate* type (variously modified by phylogenetic changes) characterizes the gymnosperms from the Bennettitales to the Coniferales and is of common occurrence in monocotyledons, but is confined among dicotyledons to certain representatives of the Ranales. On the contrary, the 3-grooved or *tricolpate* type (and its derived forms) is characteristic of most dicotyledons. In recent comprehensive surveys of the pollen of various dicotyledonous families, we have accumulated considerable evidence in support of certain aspects of this hypothesis. It is evident, for example, that plants of ranalian affinities may be divided upon the basis of their pollen morphology into two distinct categories:

I. WITH MONOCOLPATE OR DERIVED TYPES OF POLLEN

Winteraceae	Annonaceae	Hernandiaceae	Lactoridaceae
Degeneriaceae	Myristicaceae	*Austrobaileya*	Piperaceae
Magnoliaceae	Monimiaceae	Canellaceae	Saururaceae
Himantandraceae	Lauraceae	Calycanthaceae	Cabomboideae
Eupomatiaceae	Gomortegaceae	Chloranthaceae	Nymphaeoideae

II. WITH TRICOLPATE OR DERIVED TYPES OF POLLEN

Schizandraceae	Trochodendraceae	Ranunculaceae	Menispermaceae
Illicium	Eupteleaceae	Lardizabalaceae	Nelumbonoideae
	Tetracentron	Berberidaceae	

All of the plants in the first category, with the exception of the aquatic Cabomboideae and Nymphaeoideae, have secretory cells of the well known ranalian type. In the second category, such cells occur in the Schizandraceae, *Illicium,* and *Tetracentron* only.

Wodehouse (7) homologizes the monocolpate pollen of angiosperms with similar one-furrowed pollen of the lower gymnosperms. In so doing, he assumes that the single germinal furrow is on the distal face of the pollen grains, i.e. the exposed outer surface of the pollen grains during the tetrad stage of development. The pollen of the Winteraceae is shed in tetrahedral tetrads, *Figs. 1–13,* and each of the four grains is provided with a circular germ pore in its distal (outer) face. Wodehouse interprets the pollen of *Drimys* as of a modified monocolpate type, and infers from this that the single germinal furrow of other ranalian plants is on the distal face of the grains. It is significant in this connection, however, that one of our co-workers, Mr. S. J. Golub, finds that the pollen of the Annonaceae not infrequently tends to be more or less coherent in tetragonal tetrads at the time of shedding. These tetrads, *Fig. 14,* demonstrate that the germinal furrow of annonaceous pollen, *Fig. 15,* is on the proximal (inner) face of the pollen grains; this raises the question whether such is not likewise the case in the Myristicaceae, Magnoliaceae, and other related ranalian families. The tetrads of the Winteraceae are firmly coherent, and only in one instance (*Drimys brasiliensis* var. *campestris* (St. Hil.) Miers, *Hoehne 28700*) have we encountered a few dissociated tetrads. As indicated in *Fig. 13,* the isolated pollen grains have, in addition to the distally located circular germ pore, proximal facets that closely resemble those of annonaceous pollen, compare *Figs. 13* and *15.* In other words, it cannot be assumed *a priori* that the distal germ pore of *Drimys* developed by a simple reduction in the size of the germinal furrow of Magnoliaceae, since the germinal furrow of annonaceous pollen is not a direct homologue of the distally oriented circular germ pore of winteraceous pollen, but rather of its unthickened proximal facets, compare *Figs. 12, 13* with *Figs. 14, 15.*

The morphological specializations of monocolpate types of pollen are numerous and diverse, apparently leading to the formation of dicolpate

(Calycanthaceae, Monimiaceae, monocotyledons), belted (Monimiaceae, Eupomatiaceae, Nymphaeaceae, monocotyledons), polycolpate (Chloranthaceae, monocotyledons), and acolpate (Chloranthaceae, Monimiaceae, Lauraceae, Hernandiaceae, monocotyledons) types. Such phylogenetic trends in the specialization of angiospermic pollen can be clarified only by intensive investigations of a wide range of Ranales and monocotyledons. Furthermore, it is essential to determine the effects of contacts not only within tetrads, but also within groups of contiguous tetrads.

In the case of the Winteraceae, the problems of phylogeny are complicated by the fact that the pollen of all investigated genera and species is shed in permanent tetrads. Since the structure of the individual grains of such tetrads frequently is much modified through excessive specialization, there are no reliable means of determining what the morphological characteristics of the ancestral free grains may have been. Nor is it possible to solve the difficulty by comparisons with the permanent tetrads of Lactoridaceae, *Hedycarya* (Monimiaceae), or *Victoria* (Nymphaeaceae), for in these tetrads specialization has progressed along different lines. The tetrads of the Winteraceae are morphologically unique among plants of ranalian affinities and cannot justifiably be cited as evidence of closer relationship to the Magnoliaceae than to other ranalian families.

The most comprehensive previous investigation of the pollen of the Winteraceae is that of van Tieghem (6), who studied representatives of all six genera of the family. Although providing no illustrations or detailed descriptions of the pollen, he noted certain significant morphological differences within the family. Thus, he emphasized the fact that the pollen of *Drimys Winteri, D. brasiliensis,* and *D. granadensis* forms protuberant papillae when moistened, whereas that of *D. membranea, D. piperita, Pseudowintera,*[1] *Bubbia, Belliolum, Exospermum,* and *Zygogynum* does not. In addition, he states that the pollen of *Belliolum, Exospermum,* and *Zygogynum* has a granular exine, whereas that of *Drimys, Pseudowintera,* and *Bubbia* exhibits a verrucose sculpture.

Our own investigations of numerous species of the genus *Drimys* indicate that in general the tetrads of the Old World Section (*Tasmannia*), *Figs. 2–5,* are conspicuously smaller than the tetrads of the New World Section (*Wintera*) of the genus, *Fig. 1.* In the case of Sect. *Tasmannia, Figs. 2, 3,* and *5,* as in *Pseudowintera, Bubbia, Belliolum, Exospermum,* and *Zygogynum,* the entire floor of the circular pore bulges outward more or less uniformly during re-expansion of the pollen, whereas in Sect. *Wintera* the central part of this floor bulges rapidly and precociously, leaving a constricting rim or collar of presumably thicker or less elastic material, *Figs. 1, 12,* and *13.* The individual pollen grains of *Drimys, Figs. 1–5, 9, 11,* and *13, Pseudowintera, Fig. 8,* and *Bubbia, Fig. 7,* are provided (between their distal germ pore and their adnate proximal facets) with a broad zone or belt, *Fig. 13,* of coarsely reticulate thickening, whereas those of *Exospermum* and *Zygogynum, Figs. 6* and *10,* have minutely re-

[1] *Pseudowintera* Dandy, i. e. *Wintera* sensu v. Tiegh., non Murray.

ticulate thickening. The pollen of *Belliolum crassifolium* (Baill.) v. Tiegh., *B. haplopus* (Burtt) A. C. Sm., *Fig. 11,* and *B. Burttianum* A. C. Sm. is coarsely reticulate and resembles that of the former category of genera. Therefore, we are unable to follow van Tieghem (6) in describing the pollen of *Belliolum* as granular rather than as verrucose. Since he provides no illustrations or detailed descriptions, it is difficult to determine just what he had in mind in using the unqualified general terms "verruqueuse" and "granuleuse". The more or less conspicuously buttressed reticulate thickenings, *Figs. 1–5, 7–9, 11,* and *13,* of the tetrads of *Drimys, Pseudowintera, Bubbia,* and *Belliolum* are composed of rows of more or less coalesced rods, appearing linear or granular at different focal levels, *Fig. 16.* Furthermore, the reticulate thickening appears more or less granular in surface view, depending upon the degree of coalescence in its constitutent rods and upon the amount of buttressing. In certain species of *Bubbia,* e.g. *B. Clemensiae* A. C. Sm., *B. longifolia* A. C. Sm., and *B. monocarpa* A. C. Sm., *Fig. 16,* the pollen has a finer mesh of more numerous, slender, partly coalesced rods. The reticulate thickenings of such tetrads are conspicuously granular appearing at lower focal levels. Similarly, in the case of *Exospermum* and *Zygogynum,* the exine appears finely reticulate, *Fig. 10,* or minutely granular, *Fig. 6,* at different focal levels. There is, however, in the material that we have studied, a wide structural gap between the minutely granular-reticulate exines of *Exospermum* and *Zygogynum* and the coarsely granular-reticulate exines of the other four genera of the Winteraceae.

There are families of dicotyledons in which the pollen is of very considerable taxonomic significance, not only in the differentiation of subfamilies and tribes, but also of genera and species. Our investigations of numerous collections of all four species of the New World Section (*Wintera*) of *Drimys* and of ten of the thirteen taxonomic entities recognized by Smith (4) indicate that, although the pollen of these plants may be easily differentiated from that of other representatives of the family, it is difficult to distinguish species and varieties within the Section *Wintera.* In the case of the Old World Section (*Tasmannia*) of *Drimys, Pseudowintera, Belliolum,* and *Bubbia,* the size and form of the tetrads, *Figs. 2–5,* the diameter of the germ pore, *Figs. 9* and *11,* the distribution of wart-like thickenings on the floor of the germ pore, *Figs. 9, 11,* and *16,* the detailed structure of the reticulate thickenings, *Figs. 9, 11,* and *16,* and other characters fluctuate more or less from species to species. More material must be examined, however, before attempting to construct a key for differentiating species and genera. Our investigations do suggest that the pollen of Sect. *Wintera* of *Drimys,* on the one hand, and of *Exospermum* and *Zygogynum,* on the other hand, represent two stabilized specializations from the more varied and generalized types of pollen encountered in *Belliolum, Bubbia, Pseudowintera,* and Sect. *Tasmannia* of *Drimys.*

STAMENS

In the Degeneriaceae (Bailey and Smith 1) and the Himantandraceae

(Diels 3, Bailey, Nast, and Smith 2), the stamens are not differentiated into filament, anther, and connective, but are essentially 3-veined microsporophylls of comparatively unmodified form. The two pairs of slender, vertically elongated sporangia are immersed beneath the abaxial surface of the sporophylls. They are situated between the median and lateral veins, and neither these veins nor their branches are directed toward the sporangia. Thus, the narrow shields of endothecia are not in contact with vascular tissue. Dehiscence is longitudinal and extrorse. The closely allied Magnoliaceae exhibit various modifications of such primitive 3-veined microsporophylls, leading to the formation of more typical stamineal organs. The much enlarged, conspicuously protuberant, paired sporangia (thecae) are lateral on a much constricted part (connective) above the broad base (filament) of the microsporophyll. The thecae may be turned slightly outward or inward, and the longitudinal dehiscence, therefore, fluctuates between extrorse and introrse. In certain representatives of the family, the lateral veins of the modified microsporophylls are much reduced and may at times be eliminated, leaving a single-veined stamen, such as characterizes so many of the dicotyledons.

Although the stamens of the Winteraceae vary considerably in external form, *Figs. 17–24,* they are throughout the family of the single, dorsally-veined type. Four of the genera, *Bubbia, Fig. 22, Pseudowintera, Fig. 23, Exospermum, Fig. 24,* and *Zygogynum* have short, comparatively broad, more or less truncated and apically flaring microsporophylls. The protuberant sporangia are attached to the broad apex of these sporophylls and are oriented either at right angles to the dorsal vein, *Figs. 22* and *23,* or in various diagonal positions, *Fig. 24.* Dehiscence is, therefore, apical and transverse or obliquely apical. On the contrary, the stamens of *Belliolum, Fig. 21,* are generically characterized by their more elongate form and particularly by having their laterally attached sporangia oriented parallel to the long axis of the sporophyll. Dehiscence is longitudinal and more or less conspicuously extrorse.

The microsporophylls of these five genera of the Winteraceae have no constricted part that may be designated as connective, and the sporangia are not excessively protuberant beyond the outlines of the sporophylls. The stamen illustrated in *Fig. 21* resembles in form the microsporophylls of *Himantandra* and *Austrobaileya.* It differs from those of the former genus in its more protuberant sporangia and in having no lateral veins, from those of the latter genus in its unbranched median vein, which does not extend beyond the level of the sporangia. In such species of *Belliolum* as *B. crassifolium* (Baill.) v. Tiegh. and *B. Burttianum* A. C. Sm. the unvascularized upper part of the sporophyll is considerably reduced in length. This suggests that the types of stamens illustrated in *Figs. 22–24* may have developed phylogenetically by elimination of this part of the microsporophyll, with concomitant shifting of the sporangia from longitudinal lateral orientations to obliquely apical and transversely apical ones.

The microsporophylls of *Drimys, Figs. 17–20,* fluctuate considerably in length, not only in different species, but also within the same flower. They are characterized, however, by having markedly protuberant thecae that are attached to the much constricted upper part of the sporophyll. The subapical thecae are oriented parallel to the long axis of the sporophyll or at acute angles to it. Dehiscence is, therefore, approximately longitudinal-lateral and more or less conspicuously extrorse. The microsporophylls of the New World Section (*Wintera*) of the genus are relatively broad, *Figs. 17–19,* but those of the Old World Section (*Tasmannia*) occasionally are much elongated and narrow, *Fig. 20.* The latter are more typically stamineal, obviously exhibiting differentiation into filament, connective, and anther.

The median (dorsal) vein of winteraceous stamens may extend throughout the sporophyll without branching, *Figs. 18, 21, 22,* and *24,* or it may give off one, *Fig. 19,* or more, *Figs. 17, 20,* and *23,* short branches that are directed toward the thecae. Branching of the dorsal vein is in general more extensive and conspicuous and occurs at a lower level in *Pseudowintera* and certain species of *Bubbia,* e.g. *B. pachyantha* A. C. Sm., than in other representatives of the Winteraceae. Spherical secretory cells, *Fig. 18,* are of common occurrence in the microsporophyll, as in other organs, of the Winteraceae. Their contents usually are dissolved during the clearing and mounting of the stamens and, therefore, are invisible in most figures of Plate III. The coriaceous floral appendages of certain species of *Bubbia, Exosperum,* and *Zygogynum* contain very numerous sclereids or clusters of sclereids. As indicated in *Fig. 24,* the stamens of such flowers may contain more or less numerous sclerenchymatous cells.

It should be emphasized in conclusion that there appear to be two distinct trends of specialization in the microsporophylls of the Winteraceae, leading in *Pseudowintera, Bubbia, Exospermum,* and *Zygogynum* to the formation of broadly truncated sporophylls bearing transversely oriented apical sporangia, and in *Drimys* to apically constricted sporophylls bearing laterally attached subapical sporangia.

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EXPLANATION OF PLATES

PLATE I

Unstained tetrads mounted in lactic acid and photographed at a magnification of 1180. FIG. 1. *Drimys brasiliensis* var. *campestris* (St. Hil.) Miers, *Hoehne 28700.* FIG. 2. *Drimys Beccariana* Gibbs, *Brass 11294.* FIG. 3. *Drimys oligandra* A. C. Sm., *Brass 12975.* FIG. 4. *Drimys piperita* Hook. f., *Williams 754.* FIG. 5. *Drimys obovata* A. C. Sm., *Brass 11295.* FIG. 6. *Zygogynum Vieillardi* Baill., *Franc 1740.* FIG. 7. *Bubbia megacarpa* A. C. Sm., *Brass 10249.* FIG. 8. *Pseudowintera axillaris* var. *colorata* (Raoul) A. C. Sm., *Raoul* in 1843.

PLATE II

Drawn with camera lucida from pollen mounted unstained in lactic acid. FIG. 9. *Drimys lanceolata* (Poir.) Baill., *Baker* in 1890. Tetrad showing detail of one pollen grain. × 1180. FIG. 10. *Zygogynum Vieillardi* Baill., *Franc 1740.* Drawn at a higher focal level than *Fig. 6,* showing finely reticulate exine. × 1180. FIG. 11. *Belliolum haplopus* (Burtt) A. C. Sm., *Kajewski 1994.* × 1180. FIG. 12. *Drimys brasiliensis* var. *campestris* (St. Hil.) Miers. *Hoehne 28700.* Outline of tetrad showing protuberances. × 617. FIG. 13. *The same.* Single grain from dissociated tetrad, showing protuberance from distal germ pore and the structure of proximal facet. × 1180. FIG. 14. *Asimina angustifolia* A. Gray, *Harbison 1143.* Outline of tetragonal tetrad, showing proximal position of germinal furrows. × 187. FIG. 15. *The same.* Detail of single grain from dissociated tetrad, showing proximal furrow, × 480. FIG. 16. *Bubbia monocarpa* A. C. Sm., *Kanehira & Hatusima 12105.* Detail of one grain of tetrad; (a) granular appearance at lower focal level. × 1180.

PLATE III

Stamens cleared in hot dilute NaOH and mounted unstained in diaphane. Magnification × 24. FIG. 17. *Drimys confertifolia* Phil., *Bock 49.* FIG. 18. *Drimys granadensis* var. *grandiflora* Hieron., *Archer 1202.* FIG. 19. *Drimys Winteri* var. *chilensis* (DC.) A. Gray, *Werdermann 73.* FIG. 20. *Drimys stipitata* Vickery, *White 7572.* FIG. 21. *Belliolum haplopus* (Burtt) A. C. Sm., *Brass 2959.* FIG. 22. *Bubbia Clemensiae* A. C. Sm., *Clemens 4596.* FIG. 23. *Pseudowintera axillaris* var. *typica* A. C. Sm., *Kirk.* FIG. 24. *Exospermum stipitatum* (Baill.) v. Tiegh., *Vieillard 2281.*

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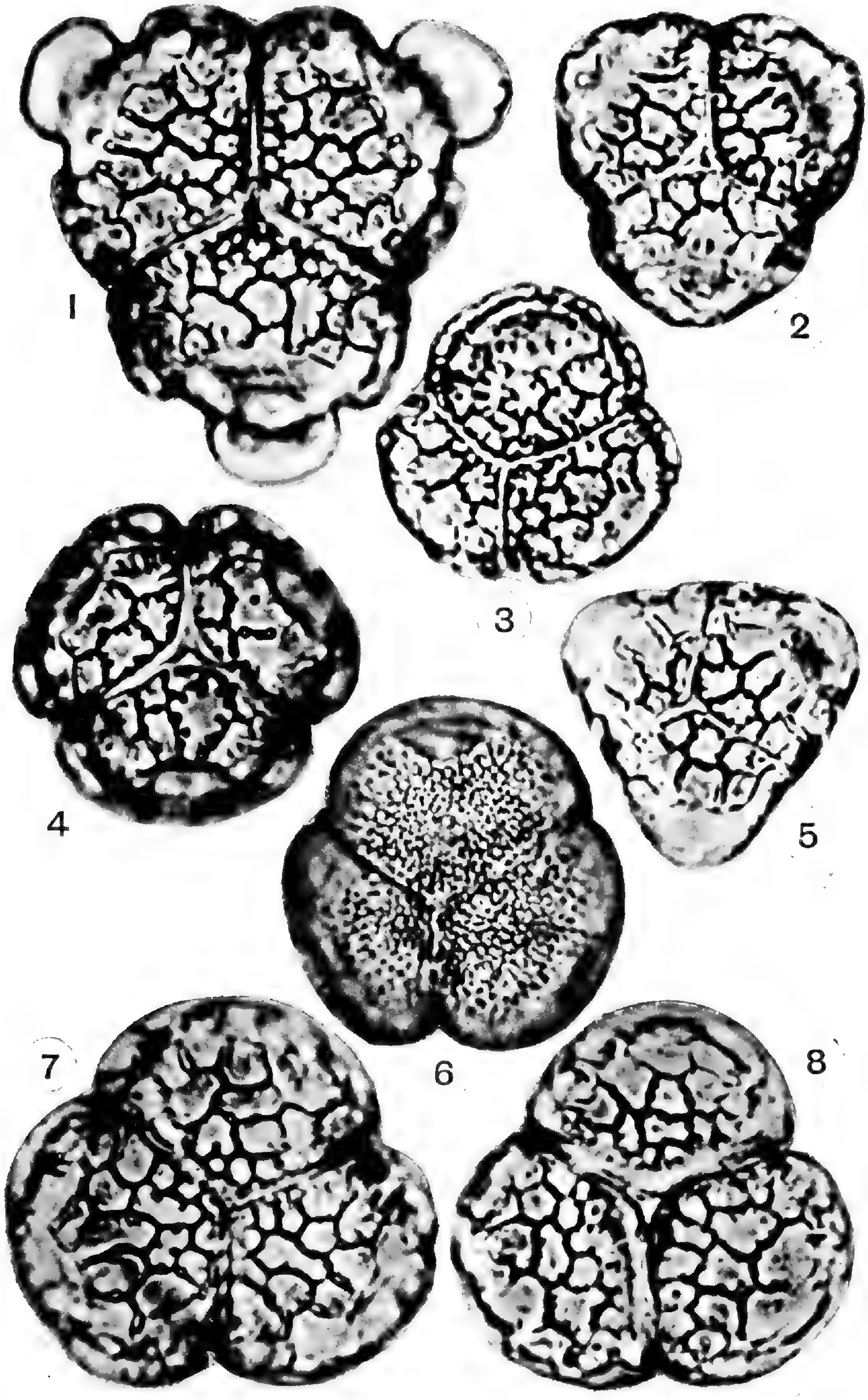
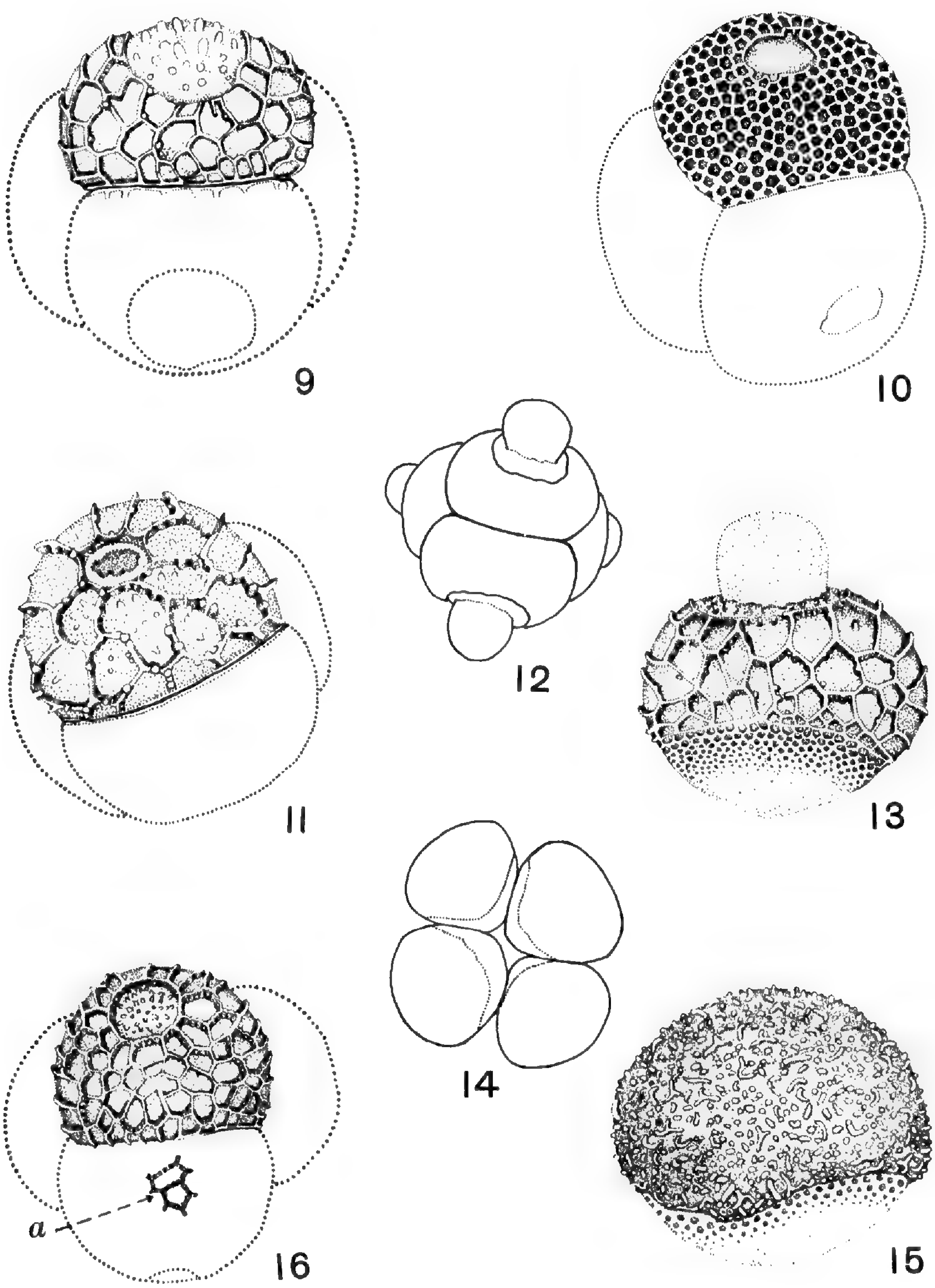
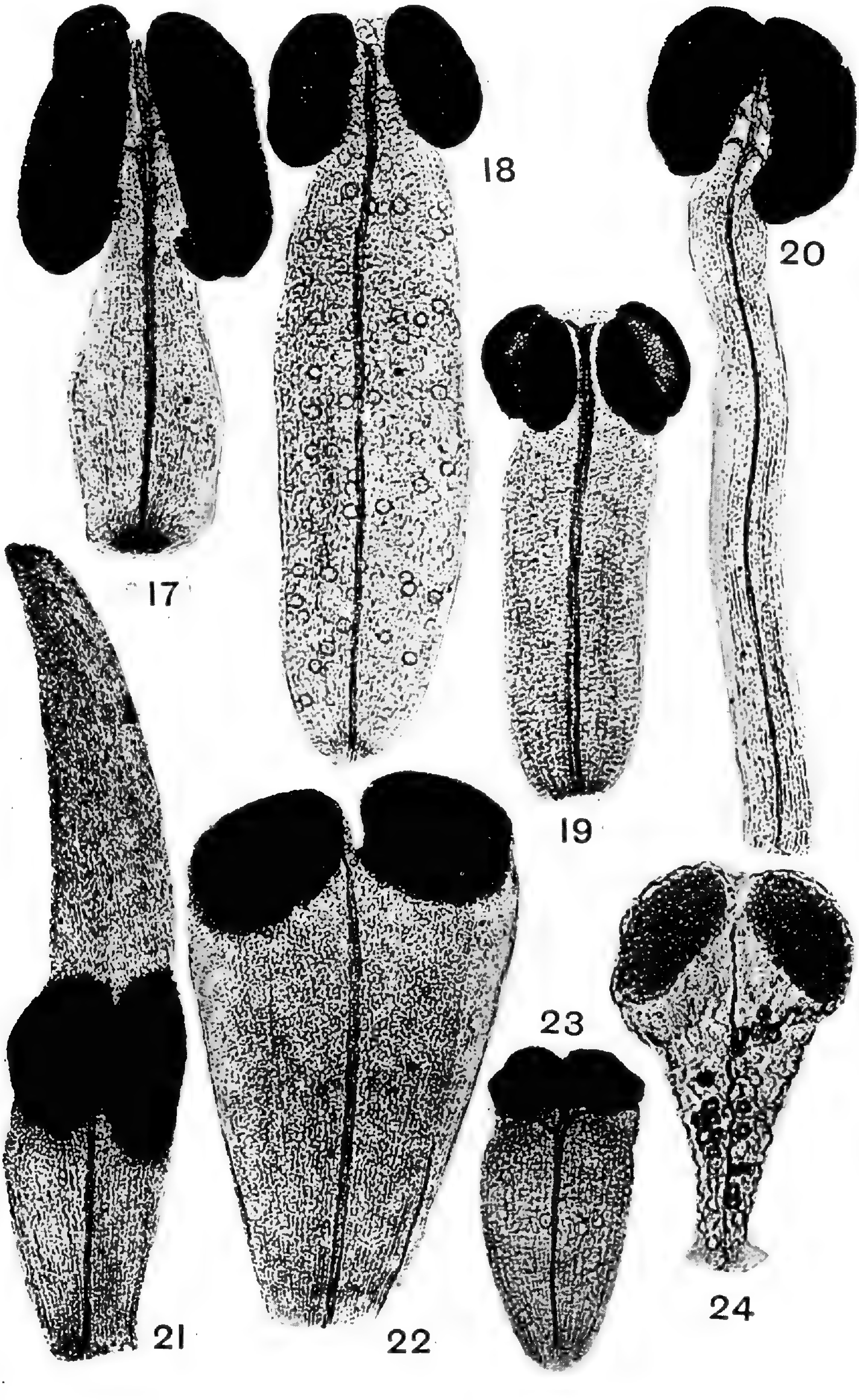


COMPARATIVE MORPHOLOGY OF THE WINTERACEAE



Comparative Morphology of the Winteraceae



COMPARATIVE MORPHOLOGY OF THE WINTERACEAE

STUDIES OF PACIFIC ISLAND PLANTS, II[1]
NOTES ON THE PACIFIC SPECIES OF PIPER

A. C. SMITH

IN attempting to name a series of specimens of *Piper* L. from Fiji, kindly forwarded by the Curator of the Bernice P. Bishop Museum, it was found desirable to prepare a consideration of the known species of the genus in Fiji. In the course of this study, the species from adjacent Pacific groups were examined, and notes on two of the difficult complexes are here included. A revision of all the Pacific species is highly desirable, but this can scarcely be undertaken without examination of extensive collections and of types deposited in European herbaria. I am indebted to the authorities of the following institutions for the privilege of studying herbarium material, the place of deposit being indicated by the parenthetical letters: Arnold Arboretum (A), Bishop Museum (Bish), Gray Herbarium (GH), New York Botanical Garden (NY), University of California (UC), U. S. National Herbarium (US).

PIPER PUBERULUM (BENTH.) BENTH. AND ITS VARIETIES

The most common species of § *Macropiper* in Fiji, Samoa, and Tonga is the shrub with the following essential characters: petioles 1–4 cm. long, vaginate from one-half to nearly their entire length; leaf-blades ovate, of moderate size, generally up to 15 by 10 cm. but sometimes up to 22 by 17 cm., either puberulent beneath or glabrous on both surfaces, obtuse to rounded or subcordate at base, and with 5 or 7 (sometimes 9) nerves divergent from the petiole; spikes axillary, usually solitary but sometimes (especially in distal axils) paired, comparatively long, usually 7–17 cm. long at anthesis excluding peduncle (both staminate and pistillate), rarely 4–19 cm. long (scarcely mature when less than 7 cm.).

This is the plant commonly passing in herbaria and literature as *P. Macgillivrayi* C. DC. An examination of the various treatments of this species demonstrates that de Candolle's binomial must be replaced by *P. puberulum* (Benth.) Benth. ex Seem.

The first description referable to this species was that of Bentham in 1843, of *Macropiper puberulum*, based on a Fijian collection of Hinds and Barclay. De Candolle, in his later considerations of the species, obviously should have made use of this specific epithet, but instead he proposed the name *Piper Macgillivrayi*, which has been associated with the species through practically every consideration up to the present. That de Candolle was aware of Bentham's earlier name is obvious from his citation of *Macropiper puberulum* in synonymy, both in Seemann's Flora Vitiensis (1868) and in the Prodromus (1869); the manuscript for Seemann's work

[1]See Bull. Torrey Bot. Club **68**: 397–406. 1941.

may possibly not have been seen by de Candolle before publication. In this work we find the binomial *Piper puberulum* Benth. occurring twice, once parenthetically on page 262 in the "explanation of plate 75," and again on the plate itself. This mention of *Piper puberulum,* since it is accompanied by a detailed plate, is here accepted as an authentic transfer of Bentham's *Macropiper puberulum.* I have no doubt that Seemann used the binomial *Piper puberulum* in good faith on his plate, but was deterred from taking it up in his text because of his discovery of de Candolle's manuscript name.[2]

Numerous varieties have been proposed within the comprehensive concept of *P. Macgillivrayi,* based upon Fijian and Samoan specimens. For the most part these varieties appear properly placed, but I believe that var. *fasciculare* Warb. (10:609) is best removed from the species to *P. Timothianum,* as stated below in my detailed consideration of the Fijian species. Var. *glabrum* Warb. (10:609) appears to be both a homonym and a synonym of var. *glabrum* C. DC.; cotype material of Warburg's variety (*Reinecke 75* [US]) does not differ from the glabrous Fijian form upon which de Candolle's varietal name is based. I am unable to pass upon the proper position of the following Samoan varieties: *abbreviatum* Warb., *scandens* Warb. (for these see 10: 609), *subrotundifolium* C. DC. (4: 264), and *upoluanum* C. DC. (nomen?, see 5: 258). Students of the Samoan flora should consider whether these are worth retaining as trinomials under *P. puberulum.*

The following varieties of *P. Macgillivrayi* have been based upon Fijian collections: *parvifolium* C. DC. and *glabrum* C. DC. (2: 335). The first of these probably represents a depauperate form of the common glabrous-leaved variety of *P. puberulum,* but the second is difficult to interpret. De Candolle's description of var. *glabrum* reads merely: "foliis utrinque glabris," but the only specimen he cites is "*Seemann 567* ! in h. DC." *Macropiper puberulum* Seem. in Bonplandia 1861, p. 259 is cited as a synonym. On the basis of *Seemann 567* in the Kew Herbarium, Bentham's description of *Macropiper puberulum,* and Seemann's description and plate in Flora Vitiensis (1868), one might suppose that var. *glabrum* is actually typified by the puberulent-leaved form. However, it is obvious from the varietal name and from the phrase "foliis utrinque glabris" that de Can-

[2]One might suspect that de Candolle avoided Bentham's specific epithet because of an earlier *Piper puberulum,* but I cannot find that this is the case. No such binomial is listed by Index Kewensis, but de Candolle, in 1923 (5: 272), indexes a cryptic "Piper puberulum Maxim. Diagn. I, 512." This refers to *Piper puberulum* (Benth.) Maxim. in Bull. Acad. Sci. St. Pétersb. **31**: 94. 1886 [in Mél. Biol. Acad. Sci. St. Pétersb. **12**: 532. 1886], which is based on *Chavica puberula* Benth. Fl. Hongk. 335. 1861. Because Maximowicz' binomial in 1886 is a later homonym of *P. puberulum* Benth. ex Seem. (1868), the Hongkong plant should be known as *Piper hongkongense* C. DC. (2: 347). This latter binomial is accounted for in de Candolle's key (5: 201); it is based upon a Seemann specimen. *Chavica puberula* is based upon a Hance specimen, which was the source of the misdetermination "*Piper arcuatum* Seem. Bot. Herald 415. 1857; non Miq.," cited by both Bentham and Maximowicz. As the Hance collections were deposited in Seemann's herbarium, it seems very likely that *Piper hongkongense* and *Chavica puberula* are based upon parts of the same collection.

dolle did not intend this interpretation. The specimen of *Seemann 567* in the Gray Herbarium is a mixture, having large puberulent leaves from one plant and smaller glabrous leaves from another. I believe, therefore, that de Candolle's specimen of this collection was the glabrous form, and I propose to interpret var. *glabrum* according to his obvious intent and his description, that is, excluding the synonym *Macropiper puberulum* and the puberulent-leaved portion of *Seemann 567*.

In Fiji, *P. puberulum* is divisible into two varieties, which I designate below as var. *typicum* and var. *glabrum*.

Piper latifolium L. f. and its allies

The nomenclatural confusion which has been attached to this binomial is due to the fact that it first appeared in the Emendanda to the younger Linnaeus' Supplementum Plantarum (1781) and thus replaced that author's *Piper methysticum* as described on page 91 of the same work. One is therefore justified in considering *P. methysticum* L. f. as a name published in synonymy and in taking *P. latifolium* L. f. as the correct name for the Tahitian plant described on page 91 of Linnaeus' work. This plant is characterized by its several axillary spikes and cannot be confused with the widely cultivated "kava" or "yanggona," which was first botanically described by G. Forster (Pl. Esc. Ins. Oc. Austr. 76. 1786) as *Piper methysticum*. It does not appear necessary to take Forster's name as a later homonym of *P. methysticum* L. f., which, having been corrected by the author in the same original work, has no nomenclatural status. Practically all modern taxonomists who have considered the matter are in agreement with Moore (6), whose lucid discussion of the problem indicates that *Piper methysticum* Forst. f. is the correct name for the common cultivated "kava."

In a consideration of the Pacific species of *Piper*, one of the most difficult problems is to fix the geographic limits of *P. latifolium*. Although the species was originally based on a single collection from Tahiti, numerous writers have taken the species to include plants from as far west as Tonga and the New Hebrides. This extension of the range was probably first indicated by G. Forster (Fl. Ins. Austr. Prodr. 5. 1786). C. de Candolle, in 1869 (2: 335) notes the range as "in Ins. Tahiti, ins. Societatis, Amicorum, Novarum Hebridum, Timor," but subsequently (5: 172) there is an indication of uncertainty, as he states the range merely as "Tahiti, etc."

The only Tahitian specimens I have seen which match the original description and de Candolle's interpretation in his key (5: 172) are *U. S. Expl. Exped. 3*, in part (GH) and *Setchell & Parks 274* (UC), the latter being cited as such by Setchell (9: 163). Setchell implies that the species is endemic to Tahiti. However, I believe that F. Brown's reference of Marquesan specimens to *P. latifolium* (1: 17) is correct; the several specimens which Brown cites from the Austral Islands are not now available to me, and they may possibly be similar to the Raratongan plants discussed below.

Another species which must be considered in connection with *P. lati-*

folium is *P. tristachyon* C. DC. (2: 335), at least as regards its Tahitian components, the species having been based on material from both Tahiti and the Hawaiian group. According to de Candolle's key (5), *P. tristachyon* differs from *P. latifolium* primarily in its leaf-blades being pubescent beneath. The Tahitian form of *P. tristachyon* appears to be represented by *Setchell & Parks 341* (UC) (see Setchell, 9: 163), *Tilden 429* (GH), and *U. S. Expl. Exped. 1* ♂ (GH). While *P. tristachyon* is superficially distinct from *P. latifolium* on the basis of its crispate-pilose lower leaf-blades and petioles, it is perilously similar in its other characters, such as leaf-shape and petioles almost completely vaginate. In general, its leaf-blades are slightly broader in proportion than those of *P. latifolium* and with less pronounced apices. The probability that these two entities are not specifically distinct is strengthened by the occurrence in Tahiti of a plant precisely resembling *P. tristachyon* in all details except its completely glabrous habit. This is represented by *U. S. Expl. Exped. 1* ♀ (GH, US), and *Setchell & Parks 212* (UC) and *340* (UC). The latter two specimens have been referred, and probably correctly, by Setchell (9: 163) to *P. excelsum* var. *tahitianum* C. DC. This variety appears not to be conspecific with *P. excelsum* Forst. f. of New Zealand, which has quite different leaves and has fruits immersed in the rachis (C. DC., 5: 171). I believe that *P. excelsum* var. *tahitianum* should definitely be separated from the New Zealand species and placed in the synonymy of *P. tristachyon,* of which it is no more than a glabrous form. One may consider the advisability of referring all the Tahitian plants here discussed to *P. latifolium,* which would then be characterized chiefly by its long and nearly completely vaginate petioles, broad many-nerved leaves, and several (3–5) axillary spikes.

The three Tahitian entities here discussed (*P. latifolium, P. tristachyon,* and *P. excelsum* var. *tahitianum*), on the basis of material now available and without consultation of the types, are kept apart only with difficulty. An essentially similar conclusion has already been expressed by Nadeaud (Enum. Pl. Indig. Tahiti 41. 1873).

The occurrence of *P. latifolium* on Raratonga in the Cook Islands has been noted by Cheeseman (in Trans. Linn. Soc. II. Bot. **6**: 293. 1903) and Wilder (in Bishop Mus. Bull. 86: 38. 1931). The plant observed by them is apparently common on Raratonga and is represented by: *H. E. & S. T. Parks 22036* (GH, UC, US), *22211* (UC), and *22301* (A, UC, US), and *Wilder 3* (A, NY, UC). Superficially it differs from the Tahitian forms of *P. latifolium* in having its petioles only one-third to one-half vaginate; its staminate flowers have consistently 3 or 4 stamens, while those of the Tahitian specimens have either 2 or 3 stamens. For the present I have not seen enough material to decide whether a reasonable concept of *P. latifolium* may be extended to include this Raratongan form or whether the latter should be separated as a subspecific unit.

The occurrence of *P. latifolium* in the New Hebrides, noted by Forster in 1786, has been further recorded by several writers, including Miquel (Syst. Piper. 219. 1843), whose concept of the species included even such forms as *P. guahamense* C. DC. (2: 336). Guillaumin has more recently mentioned *P. latifolium* from the New Hebrides (in Bull. Soc. Bot. Fr. **66:** 275. 1919, op. cit. **74:** 703. 1927, in Jour. Arnold Arb. **13:** 82. 1932). Among the specimens upon which Guillaumin's concept was based, *Kajewski 3, 436,* and *718* (all A) are available to me, and the most detailed examination fails to reveal any consequential characters by which this New Hebrides plant can be distinguished from a concept of *P. latifolium* which includes the various Tahitian and Raratongan forms discussed above.

While my conclusions are admittedly based upon insufficient material, for the time being I follow earlier students in thus accrediting *P. latifolium* with a range extending from the Marquesas to the New Hebrides, although its absence from Fiji, among the collections now available from that group, must remain surprising. One may anticipate that examination of abundant Pacific material and comparison with the historic collections will reveal lines upon which this present concept of *P. latifolium* may be intelligibly divided.

The Fijian species of Piper

The only previous treatment of the Fijian species of *Piper* is that of de Candolle in 1909 (3). In this paper five new Fijian species were described, two of which I cannot accurately place, the types not being available. I am able to recognize ten indigenous Fijian species, the total thus being probably twelve. An additional three species, which occur in Fiji either in cultivation or as weeds, are included in this consideration, being the first three species in my key. The indigenous Fijian species fall into the Sections *Eupiper* and *Macropiper,* as outlined by de Candolle (5). In the present treatment I describe three new species, propose a new name for *P. polystachyum* C. DC., and take up *P. puberulum* as an older name than the well-known *P. Macgillivrayi* C. DC.

Spikes leaf-opposed, solitary; leaf-blades plinerved or pinnate-nerved, at least the inner nerves partially concurrent; stipules sometimes free and then the petioles unwinged.

Inflorescence-scales copiously pilose; leaf-blades narrowly oblong-elliptic, inequilaterally rotund-subcordate at base, scabrid above, puberulent beneath (at least on nerves), pinnate-nerved, the lateral nerves 4–7 per side, ascending; weed, native to America (§*Steffensia*)............................1. *P. aduncum.*

Inflorescence-scales glabrous; leaf-blades smooth above, not scabrid, plinerved, the principal nerves concurrent for less than half the length of the costa (pinnate-nerved in no. 7) (§ *Eupiper*).

Erect shrub; leaf-blades large, 13–25 × 10–20 cm. at maturity, deeply cordate at base, minutely puberulent on nerves beneath, the principal nerves 9–13, freely spreading from petiole except the 3 innermost, these loosely concurrent for 5–15 mm.; mature spikes (excl. peduncle) 2–6 cm. long; in Fiji only in cultivation...2. *P. methysticum.*

Scandent plants (except no. 7); leaf-blades not exceeding 14 × 10 cm. (rarely toward base of liana up to 16 × 16 cm.), obtuse to shallowly cordate at base, the principal nerves 5–7, the inner ones firmly concurrent toward base.

Spikes at least 2 cm. long and usually much longer, on peduncles at least 6 mm. long; leaf-blades plinerved; scandent plants.

Fruits coalescing, fully embedded in pulp and concrescent with the rachis; filaments as broad as anthers; in Fiji only in cultivation......3. *P. Betle.*

Fruits no more than semi-immersed in the rachis, not coalescing; filaments much narrower than anthers; indigenous in Fiji.

Stipules free, inconspicuous, 5–12 mm. long; leaf-blades with the inner nerves usually long-concurrent, the costa with obvious lateral nerves, the veinlets usually prominulous on both surfaces; ovaries and fruits semi-immersed in the rachis; stamens usually 4, sometimes 3, per flower, the anthers small, 0.15–0.25 × 0.3–0.4 mm. (♂ inflorescence not known in no. 5).

Plant glabrous throughout, or inflorescence-rachis sparsely pilose....... ....4. *P. insectifugum.*

Branchlets distally, petioles, peduncles, and leaf-blades on both surfaces crispate-hispid, the upper leaf-surface eventually subglabrescent; inflorescence-rachis densely pilose..................5. *P. crispatum.*

Stipules free or adnate to petiole, conspicuous, 15–22 mm. long; leaf-blades clearly plinerved, the inner 3 nerves concurrent for only 7–20 mm., the costa without important lateral nerves, the veinlets obscure or slightly impressed above; ovaries apparently free; stamens apparently 2 per flower, the anthers comparatively large, about 0.25 × 0.7 mm....... ....6. *P. stipulare.*

Spikes (at least ♀) 1–1.5 cm. long, on peduncles 2–4 mm. long; ovaries free, not immersed in the rachis; leaf-blades essentially pinnate-veined, with 2–4 pairs of secondaries; shrub..................................7. *P. Degeneri.*

Spikes axillary; leaf-blades with nerves freely spreading from the petiole; stipules adnate to petioles, these at least partially vaginate; indigenous in Fiji (§ *Macropiper*).

Spikes solitary, sometimes paired in distal leaf-axils.

Leaf-blades hispid-pilose on both surfaces; inflorescence-scales ciliate-setose; carpels conspicuously narrowed toward apex and with obscure stigmas.......... ....8. *P. oxycarpum.*

Leaf-blades glabrous at least above; inflorescence-scales not ciliate-setose; carpels essentially rounded at apex, with obvious stigmas.

Spikes 7–19 cm. long, excluding peduncle, rarely only 4 cm. but then scarcely mature; floral parts comparatively large, the scales 0.5–1.1 mm. in diameter; leaf-blades (7–)8–15(–22) by (3–)4–10(–17) cm., 5–9-nerved.

Leaf-blades puberulent beneath..............9a. *P. puberulum* var. *typicum.*

Leaf-blades glabrous on both surfaces........9b. *P. puberulum* var. *glabrum.*

Spikes 2.5–5.5 cm. long at maturity, excluding peduncle; floral parts smaller, the scales 0.35–0.7 mm. in diameter; leaf-blades 6–11 by 2–5.5 cm., 3- or 5-nerved.....................................10. *P. melanostachyum.*

Spikes 3 or more per leaf-axil, rarely only 2.

Petioles of mature leaves 8–17 cm. long, usually vaginate only in the lower quarter; leaf-blades up to 25 by 28 cm., 11–13-nerved, cordate at base (deeply so on larger blades); spikes (at least ♂) 10–22 per leaf-axil..........11. *P. vitiense.*

Petioles shorter, 1–4.5 cm. long on mature leaves, vaginate nearly to apex or at least more than half their length; leaf-blades up to 17 by 15 cm., (5–)7–9-nerved, obtuse to subcordate at base; spikes (both ♂ and ♀) usually 3–5 per leaf-axil, rarely 2–7.

Spikes (both ♂ and ♀) 0.8–3.5 cm. long (excl. peduncle); stigmas glabrous or sparsely pilose...................................12. *P. Timothianum.*

Spikes (at least ♀) 5–8 cm. long (excl. peduncle); stigmas densely and obviously pilose...................................13. *P. kandavuense.*

1. **Piper** (§ *Steffensia*) **aduncum** L. Sp. Pl. 29. 1753; C. DC. in DC. Prodr. **16**(1): 285. 1869; B. E. Parham in Agr. Jour. Dept. Agr. Fiji **9**(3): 12. 1938.

DISTRIBUTION: Common throughout a large part of tropical America. Of recent introduction into Fiji; according to Parham, in 1938: "During the past five years this species of *Piper* has been noted as an aggressive weed plant in the south-eastern part of Viti Levu, it has apparently spread rapidly with Suva as the centre."

FIJI. VITI LEVU: Rewa: Lami, *Parks 20060* (Bish); between Suva and Lami, *Gillespie 2079* (A, Bish); 4 mi. west of Suva, *MacDaniels 1071* (Bish); R e w a or N a i t a s i r i: Mt. Kombalevu, alt. 400 m., *Parks 20282* (Bish).

NATIVE NAME: *Yanggona ni Onolulu* (according to Parham; i. e. "Honolulu Piper," a misnomer, as the species is probably not found in Hawaii).

As it occurs in Fiji, the plant is a shrub or slender tree up to 8 m. high, occurring on roadsides or in bush-land, most often near cultivation. It has not been reported from any other Pacific group.

2. **Piper** (§ *Eupiper*) **methysticum** Forst. f. Pl. Esc. Ins. Oc. Austr. 76. 1786, Fl. Ins. Austr. Prodr. 5. 1786; Seem. Fl. Vit. 260. 1868; C. DC. in DC. Prodr. **16**(1): 354. 1869, in Candollea **1**: 180. 1923; non L. f. Suppl. 91 [as synonym of *L. latifolium* L. f. in Emendanda]. 1781.

Macropiper methysticum Miq. Comm. Phyt. 36. *pl. 4, D.* 1840, Syst. Piper. 217. 1843; B. E. Parham in Agr. Jour. Dept. Agr. Fiji **8**(1): 2. 1935.

DISTRIBUTION: Throughout the Pacific Islands from New Guinea and Micronesia eastward. The species is found only in cultivation, at least in Fiji, and its source is questionable. Doubtless it was carried eastward by the early inhabitants of the Pacific, and one may suspect that it is indigenous farther west than Fiji. Its roots are the source of the important native beverage, which, like the plant itself, passes under a multitude of native names. In Fiji both the plant and the drink are known as *yanggona* (also spelled "yaqona" or "yangona"). Forster mentioned no type specimen, giving the localities of Tahiti and the Tongan and Hawaiian groups. There appear to be no Fijian specimens in American herbaria, but the plant is found in every Fijian village where conditions are suitable.

I have cited above only the basic literature referring to *P. methysticum* and treatments specifically discussing the plant in Fiji. The nomenclatural problems pertaining to the binomial have been competently discussed by Moore (6). F. Brown's account (1: 18–19) discusses the numerous varieties cultivated in the Marquesas. Seemann (8: 260–261) has described the use of the plant in Fiji, while Parham (7) has recently written an interesting account of the species in Fiji, considering its varieties, methods of cultivation, disease-control, etc.

3. **Piper** (§ *Eupiper*) **Betle** L. Sp. Pl. 28. 1753; C. DC. in DC. Prodr. **16**(1): 359. 1869, in Candollea **1**: 189. 1923; Quisumbing in Philip. Jour. Sci. **43**: 85. 1930; Jan in Agr. Jour. Dept. Agr. Fiji **8**(4): 49. 1937.

DISTRIBUTION: Malaya to India, widely cultivated throughout the tropics. The common betel pepper is used and cultivated to a certain extent by the Indian population of Fiji, as indicated by the discussion of Jan cited above. I have seen no herbarium specimens of the plant from Fiji.

4. **Piper** (§ *Eupiper*) **insectifugum** C. DC. ex Seem. Fl. Vit. 262. 1868, in DC. Prodr. **16**(1): 354. 1869; Bülow in Gartenflora **45**: 575. 1896; C. DC. in Jour. Linn. Soc. Bot. **39**: 164. 1909, in Candollea **1**: 178. 1923.

DISTRIBUTION: Fairly common in Fiji, where it occurs in forest or open woods at elevations up to 800 m. In habit it is a subscandent shrub, becoming a high-climbing liana; hence its native name in Fiji is *wa kawa* or *wa nggawa* (i. e. climbing Piper). The occurrence of the species in Samoa is noted only by Bülow, as indicated above, and possibly it is endemic to Fiji.

FIJI. VITI LEVU: *Seemann 569* ♂ (TYPE COLL., GH); T h o l o N o r t h: Vicinity of Nandarivatu, *Degener & Ordonez 13568* ster. (A, NY), *Degener 14368* fr. (A, NY, UC, US), *Greenwood 867* ster. (A); R e w a: Korombamba Mt., *Gillespie 2315* ster. (A, Bish). KANDAVU: Above Namalata and Ngaloa Bays, *Smith 75* ♂ (Bish, GH, NY, UC, US). VANUA LEVU: M b u a: Seatovo Range, *Smith 1545* ♂ (Bish, GH, NY, UC, US); T h a k a u n d r o v e: Savu Savu Bay region, *Degener & Ordonez*

13907 ♂ (A, NY, UC, US). TAVEUNI: Western slope between Somosomo and Wairiki, *Smith 841* ♂ (Bish, GH, NY, UC, US). WITHOUT DEFINITE LOCALITY: *Gillespie 2209* ♂ (A, Bish), *2225* ster. (Bish), *3876* ♂ (A, Bish).

This distinctive climbing species of § *Eupiper* is not correctly placed in de Candolle's key (5: 178). The stigmas are 3 and sessile, rather than 2 and on a style, while the stamens are 3 or 4 per flower. The presence of 4 stamens in flowers of § *Eupiper* is not indicated by de Candolle (5: 176), but there can be no doubt of the proper place of *P. insectifugum* in this section. Its actual alliance is difficult to ascertain, but its leaves are sometimes remarkably similar to those of *P. Betle*; in inflorescence characters the two species are quite different, and *P. Betle* is not indigenous in Fiji.

5. **Piper** (§ *Eupiper*) **crispatum** sp. nov.

Frutex scandens, ramulis apicem versus, petiolis, laminis utrinque, et pedunculis pilis stramineis vel pallide brunneis crispatis multicellulatis 0.5–1.5 mm. longis debiliter hispidis; ramulis subteretibus gracilibus nodis conspicue incrassatis et mox disarticulatis, internodiis apicem ramulorum versus 1–3.5 cm. longis; stipulis apice ramulorum lanceolatis ad 1 cm. longis hirtellis mox caducis; foliis alternatis, petiolis paullo canaliculatis 10–16 mm. longis, laminis chartaceis in sicco brunneis ovatis, 9–13 cm. longis, 6–8 cm. latis, basi inaequilateraliter rotundatis, apice gradatim acuminatis (acumine ipso 1–2 cm. longo ad apicem nervis marginalibus picto), margine integris, supra demum subglabrescentibus, plerumque 5-pli-nerviis, nervis paullo supra basim orientibus, costa utrinque valida superne nervos secundarios laterales conspicuos utrinsecus 2–4 utrinque valde prominulos mittente, nervis secundariis marginem versus anastomosantibus, rete venularum intricato utrinque plus minusve prominulo; inflorescentiis ♀ solis visis apicem ramulorum versus oppositifoliis, pedunculis 10–17 mm. longis, spicis sub anthesi gracilibus 4–5 cm. longis, rhachi pilis multicellulatis circiter 0.5 mm. longis dense pilosa; bracteis primo imbricatis membranaceis peltatis inconspicue glanduloso-punctatis 1–1.2 mm. diametro breviter stipitatis; ovario in rhachi semi-immerso rotundato-conico sub anthesi circiter 0.4 mm. diametro, stigmatibus ut videtur 3 minutis.

DISTRIBUTION: Known only from the type collection.

FIJI. WITHOUT DEFINITE LOCALITY: *Gillespie 3092* ♀ (A, Bish, TYPE), 1927–28 (woody vine, scrambling on tree).

Although doubtless a close relative of *P. insectifugum*, this plant seems specifically distinct by virtue of its crispate-hispid parts, as mentioned in my key. The numerous specimens of *P. insectifugum* examined bear no trace of the characteristic pubescence of the new species.

6. **Piper** (§ *Eupiper*) **stipulare** sp. nov.

Frutex dioecus scandens ubique praeter rhachem inflorescentiae interdum obscure pilosam glaber, ramulis gracilibus subteretibus nodis incrassatis, internodiis apicem ramulorum versus 1.5–6 cm. longis; stipulis liberis vel raro petiolo adnatis conspicuis oblongis 15–22 mm. longis interdum subpersistentibus; foliis alternatis, petiolis gracilibus 12–17 mm. longis, laminis chartaceis in sicco brunneo-olivaceis ovatis vel elliptico-ovatis, (7–)10–14 cm. longis, (4–)6–10.5 cm. latis, basi inaequilateraliter obtusis vel rotundatis, apice cuspidato-acuminatis (acumine ipso 5–10 mm. longo), margine integris, 7-pli-nerviis, nervis cum costa supra paullo subtus valde elevatis, interioribus 7–20 mm. concurrentibus apicem attingentibus, aliis antea evanescentibus, rete venularum obscuro vel subtus leviter prominulo; inflorescentiis ♂ et ♀ apicem ramulorum versus oppositifoliis, pedunculis 7–10 mm. longis, spicis sub anthesi gracilibus 4–5 cm. longis; bracteis membranaceis peltatis obscure pellucido-punctatis 0.7–0.8 mm. diametro breviter (ad 0.2 mm.) stipitatis; staminibus ut videtur 2, antheris subsessilibus subreniformibus vel transverse ellipsoideis, circiter 0.25 × 0.7 mm.; ovario ut videtur libero obscure luteo-glanduloso ovoideo-subgloboso sub anthesi circiter 0.7 mm. diametro, stigmatibus 3 sessilibus 0.3 mm. longis.

Distribution: Known only from Viti Levu.

Fiji. Vitu Levu: *Parks 20879* ♂ (Bish); Namosi: 2 miles from Namuamua, in woods near Namosi trail, alt. 300 m., *Gillespie 3074,* with decomposed spikes (A, Bish) (thick vine, climbing on tree); Naitasiri: 7.5 miles from Suva, near road past Tamavua village, in woods, alt. 150 m., *Gillespie 2423* ♀ (A, Bish, type), Aug. 27, 1927.

Piper stipulare is probably most closely allied to *P. Graeffei* Warb. and the several other Samoan species of § *Eupiper* proposed by C. de Candolle. However, it is distinguished from all of these by its large and often persistent stipules and its much shorter spikes.

7. **Piper** (§ *Eupiper*) **Degeneri** A. C. Sm. in Sargentia **1:** 10. 1942.

Distribution: Known only from the type collection.

Fiji. Vanua Levu: Thakaundrove: Eastern drainage of Yanawai River, alt. 150 m., *Degener & Ordonez 14096* ♀ (A, type, NY).

As remarked in the original consideration, this very distinct and apparently rare species has no close relatives in the Pacific.

8. **Piper** (§ *Macropiper*) **oxycarpum** C. DC. in Jour. Linn. Soc. Bot. **39:** 164. 1909, in Candollea **1:** 171. 1923.

Distribution: Endemic to Fiji and probably limited to the higher hills in the interior of Viti Levu. The type is *Gibbs 604,* from Nandarivatu, Tholo North.

Fiji. Viti Levu: In forest at 1250 m., *Parks 20738* ♀ (A, Bish); Tholo North: Nandarivatu, in open bush, alt. 1000 m., *Parks 20572* ♀ (Bish). Without definite locality: *Gillespie 3839* ♀ (Bish).

This very distinct species is at once distinguished from all other members of § *Macropiper* by having its branchlets distally, petioles, peduncles, and leaf-blades on both surfaces conspicuously hispid-pilose, its inflorescence-scales densely ciliate-setose, and its carpels conspicuously narrowed toward the apex and bearing 2 or 3 very obscure stigmas. Other essential characters of the species are as follows: petioles 1–3 cm. long, one-half to three-quarters vaginate; leaf-blades ovate, 8–17 cm. long, 5–12 cm. broad, subcordate at base, gradually acuminate at apex, 7- or sometime 9-nerved; spikes (at least ♀) solitary, 5–11 cm. long excluding peduncles, these slender, 2.5–5 cm. long. According to de Candolle the type collection is from a shrub 2 m. high.

9. **Piper** (§ *Macropiper*) **puberulum** (Benth.) Benth. ex Seem. Fl. Vit. 262, as synonym, and *pl. 75.* 1868; non *P. puberulum* Maxim. (1886).

Macropiper puberulum Benth. in Hook. Lond. Jour. Bot. **2:** 235. 1843.

Piper Macgillivrayi C. DC. ex Seem. Fl. Vit. 262. 1868; C. DC.[3] in DC. Prodr. **16**(1): 335. 1869; Engl. in Bot. Jahrb. **7**: 450. 1886, in Forschung. "Gazelle" **4**: Siphon. 25. 1889; C. DC. in Denkschr. Akad. Wiss. Wien **85**: 264. 1910; Turrill in Jour. Linn. Soc. Bot. **43**: 35. 1915.

DISTRIBUTION: Fiji, Samoa, Tonga, and probably some of the adjacent groups. In Fiji the species is reported as a low erect shrub up to 3 m. high, occurring at altitudes from sea-level up to 900 m. or possibly higher. Var. *typicum* occurs in thickets or on the edges of forest, apparently only below 500 m., being especially common in coastal thickets. Var. *glabrum* usually occurs in the forest and is not reported from the immediate coast. The species is known throughout Fiji as *yanggoyanggona* (often spelled "yaqoyaqona"). The two varieties recognized from Fiji are not very sharply differentiated and their value is dubious. Both varieties occur in Samoa, but I have seen only var. *glabrum* from Tonga.

The necessity of replacing the well-known binomial *P. Macgillivrayi* is pointed out in my discussion above, where I also consider the typification of the species and the two varieties which are known from Fiji.

9a. **Piper puberulum** var. **typicum** nom. nov.

Macropiper puberulum Benth. in Hook. Lond. Jour. Bot. **2**: 235. 1843; Miq. Syst. Piper. 221. 1843; Seem. in Bonplandia **9**: 259. 1861, in Jour. Bot. **2**: 73. 1864.

Piper puberulum Benth. ex Seem. Fl. Vit. 262, as synonym, and *pl. 75*. 1868; Bülow in Gartenflora **45**: 575, nomen. 1896.

Piper Macgillivrayi C. DC. ex Seem. Fl. Vit. 262. 1868, in Candollea **1**: 172. 1923.

Foliorum laminae subtus puberulae.

FIJI. VITI LEVU: *Parks 20173,* in part, ♀ (Bish), *20611* ♀ (Bish); Lautoka: North of Natalau, *Degener 15005* ♂ (A, NY, UC, US); Tholo West: Mbulu, *Degener 15042* ♀ (A, NY, UC, US). KANDAVU: Above Namalata and Ngaloa Bays, *Smith 56* ♀ (Bish, GH, NY, UC, US), *115* ♀ (Bish, GH, NY, UC, US); Mt. Mbuke Levu, *Smith 210* ♀ (Bish, GH, NY, UC, US). OVALAU: *U. S. Expl. Exped. 1,* in part, ♀ (GH). KORO: East coast, *Smith 1105* ♀ (Bish, GH, NY, UC, US). VANUA LEVU: *U. S. Expl. Exped. 1,* in part ♀ (GH); Thakaundrove: Savu Savu Bay region, *Degener & Ordonez 13871* fr. (A, NY, UC, US). VANUA MBALAVU: *Smith 1408* ♀ (Bish, NY). FULANGA: *Smith 1137* ♀ (Bish, NY). WITHOUT DEFINITE LOCALITY: *Seemann 567,* in part, ♀ (cotype coll. of *Piper Macgillivrayi,* GH), *Prince* (GH).

It should be noted that some specimens here cited (e.g. *Smith 115* and *Degener & Ordonez 13871*) bear essentially glabrous leaves on the same branches with puberulent leaves. The possibility that the degree of pubescence is merely a concomitant of shade conditions is thus indicated, and it may be questioned whether the two varieties have any genetic foundation.

9b. **Piper puberulum** var. **glabrum** (C. DC.) comb. nov.

Piper Macgillivrayi var. *glabrum* C. DC. in DC. Prodr. **16**(1): 335, excl. syn. *Macropiper puberulum.* 1869; Warb. (as var. nov.) in Bot. Jahrb. **25**: 609. 1898; C. DC. in Jour. Linn. Soc. Bot. **39**: 162. 1909, in Denkschr. Akad. Wiss. Wien **85**: 264. 1910, in Candollea **1**: 172. 1923.

Piper Macgillivrayi sensu Hemsl.[4] in Jour. Linn. Soc. Bot. **30**: 189. 1894; Burkill in Jour. Linn. Soc. Bot. **35**: 52. 1901.

[3]The cited references to *P. Macgillivrayi,* with the exception of the first, cannot be referred to a definite variety and therefore are listed under the species as an inclusive concept.

[4]The numerous Tongan specimens I have seen belong to var. *glabrum,* and it seems likely that only this variety occurs in Tonga; hence I have cited literature referring to Tongan collections here.

Leaf-blades glabrous on both surfaces.

FIJI. VITI LEVU: *Gillespie 2687* ♀ (Bish), *Parks 20173,* in part, fr. (Bish), *20232* ♀ (Bish), *20452* fr. (A, Bish), *20731* fr. (Bish), *20735* ♀, fr. (A, Bish); Tholo North: Vicinity of Nandarivatu, *Parks 20606* fr. (Bish), *Degener & Ordonez 13569* fr. (A, NY, UC, US), *Degener 14361* fr. (A), *14659* fr. (A, NY); Namosi: Voma Mt., *Gillespie 2927* ♀ (Bish); Serua: Vicinity of Ngaloa, *Degener 15140* ♂ (A, NY), *15179* ♂, ☿ [5] (A, NY, UC, US); Rewa: Mt. Korombamba, *Gillespie 2235* fr. (Bish). KANDAVU: Above Namalata and Ngaloa Bays, *Smith 167* ♀ (Bish, GH, NY, UC, US). OVALAU: *U. S. Expl. Exped.* ♀ (GH). VANUA LEVU: Thakaundrove: Savu Savu Bay region, *Smith 331* ♀ (Bish, GH, NY, UC, US), *395* ♀, fr. (Bish, GH, NY, UC, US), *Degener & Ordonez 13829* fr. (A, NY), *13908* ♀, fr. (A, NY, UC, US), *13967* fr. (A, NY); Maravu, near Salt Lake, *Degener & Ordonez 14156* fr. (A, NY, UC, US). WITHOUT DEFINITE LOCALITY: *Seemann 567,* in part, ♀ (TYPE COLL. of *Piper Macgillivrayi* var. *glabrum,* GH), *Gillespie 2697* ♀ (A, Bish), *2698* ♀ (Bish), *2914* fr. (Bish), *3004* ♂ (Bish), *3307.4* ♀ (A, Bish), *4658* ♀ (A, Bish).

10. **Piper** (§ *Macropiper*) **melanostachyum** C. DC. in Jour. Linn. Soc. Bot. **39:** 162. 1909, in Candollea **1:** 172. 1923.

DISTRIBUTION: Endemic to Fiji and possibly limited to Viti Levu. The type is *Gibbs 703,* from Nandarivatu, Tholo North.

FIJI. VITI LEVU: Tholo North: Nandarivatu, alt. 1000 m., *Parks 20546* fr. (Bish); Tholo West: Uluvatu, vicinity of Mbelo, near Vatukarasa, *Tabualewa 15556* ♂ (A, NY, UC, US); Rewa: Korombamba Mt., alt. 400–550 m., *Gillespie 2217* ♂ (A, Bish), *2350* ♀ (A, Bish). WITHOUT DEFINITE LOCALITY: *U. S. Expl. Exped. 3* ♂ (GH).

According to de Candolle, this is a slender shrub 1.5 m. high; the above-cited collections have no habit data. The plant probably occurs in woods or forests at middle elevations, although the Tabualewa and U. S. Exploring Expedition collections may have been obtained near sea-level. The essential characters of the species are as follows: petioles 0.8–2 cm. long, vaginate one-half or nearly all their length; leaf-blades ovate-oblong, 6–11 cm. long, 2–5.5 cm. broad, acute to obtuse at base, gradually acuminate at apex, 3- or 5-nerved from the petiole; spikes solitary, axillary, slender, short (2.5–5.5 cm. long excluding peduncle, even at anthesis or in fruit). In floral characters, *P. melanostachyum* differs from *P. puberulum* only in its slightly smaller parts, the peltate scales being 0.35–0.7 mm. in diameter; the minute stamens and the stigmas are always three.

Although this plant may be only a montane derivative from the common *P. puberulum,* I am inclined to agree with de Candolle in granting it specific status, at least until more adequate material establishes a complete series of forms between the two entities.

11. **Piper** (§ *Macropiper*) **vitiense** nom. nov.

Piper latifolium sensu Seem. Fl. Vit. 261, quoad spec. vit. 1868; non L. f.

Piper polystachyum C. DC. in Jour. Linn. Soc. Bot. **39:** 162. 1909, in Candollea **1:** 172. 1923; A. C. Sm. in Bishop Mus. Bull. **141:** 25. 1936; non *Piper polystachyon* Ait. Hort. Kew. **1:** 49. 1789 (= *Peperomia polystachya*).

[5]*Degener 15179* is remarkable for its polygamo-monoecious character, some spikes having only staminate flowers while others on the same plant have hermaphrodite flowers. The latter bear three stamens around a normal ovary. This is the only specimen of § *Macropiper* I have seen with hermaphrodite flowers, but it scarcely weakens the characters of the section as defined by de Candolle (5: 171).

DISTRIBUTION: Endemic to Fiji, or possibly also in the New Hebrides. Occurring in Fiji at elevations of 600 to 1100 m. in forest, often common locally. The type is *Gibbs 794,* from Nandarivatu, Tholo North, Viti Levu.

FIJI. VITI LEVU: Namosi: Naitarandamu Mt., *Gillespie 3360* ♀ (A, Bish). VANUA LEVU: Thakaundrove: Mt. Mariko, *Smith 458* ♂ (Bish, GH, NY, US). TAVEUNI: *Seemann 566* ster. (GH); Mt. Manuka, *Smith 791* ♂ (Bish, NY). WITHOUT DEFINITE LOCALITY: *Gillespie 3123* ♂ (A, Bish). See also Smith in 1936.

A new name is needed for de Candolle's species because of the earlier *Piper polystachyon* Ait. The epithets *polystachyon* and *polystachyum* must be considered orthographic variants, according to Article 70 of the International Rules of Botanical Nomenclature, 1935.

Piper vitiense, a member of the general alliance of *P. latifolium* L. f., differs from that species and its other relatives in its long-petiolate large-bladed leaves and its numerous long-pedunculate staminate inflorescences. Mature leaves of our specimens have the petioles up to 17 cm. long and the sheaths 2.5–3.5 cm. long; in general the petioles are vaginate only in the lower quarter, while *P. latifolium* has sheaths usually nearly as long as the petioles. The largest leaf-blades of *P. vitiense* now available are up to 25 by 28 cm. and 13-nerved. The number of staminate spikes in the leaf-axils is somewhat more variable than the 14 described by de Candolle. Our material shows these spikes to be about 10–22 in number, giving the species its most distinctive character. The staminate spikes are up to 6 cm. long and are borne on slender peduncles up to 5 cm. long. The only available pistillate specimen, *Gillespie 3360,* has broken detached spikes, which offer no unusual character except as to number (which one may anticipate approaches the number of staminate spikes); the stigmas are 3, as usual in this section of the genus.

12. **Piper** (§ *Macropiper*) **Timothianum** A. C. Sm. in Sargentia **1:** 10. 1942.

Piper Macgillivrayi var. *fasciculare* Warb. in Bot. Jahrb. **25:** 609, as "*fascicularis.*" 1898; C. DC. in Denkschr. Akad. Wiss. Wien **85:** 264, as "*fascicularis.*" 1910, in Ann. Cons. Jard. Bot. Genève **15:** 232, as "*fascicularis.*" 1912; Turrill in Jour. Linn. Soc. Bot. **43:** 35, as "*fascicularis.*" 1915; C. DC. in Candollea **1:** 172. 1923; Christoph. in Bishop Mus. Bull. **154:** 5. 1938.

Piper fascicularis (sic) vel *fasciculatum* Rechinger in Karsten & Schenck, Vegetationsbilder **6:** *pl. 5.* 1908; non *P. fasciculare* Rudge, Pl. Guian. Rar. **1:** 9. *pl. 4.* 1805 (= *Lacistema* sp.); non *P. fasciculatum* Ruiz & Pav. Syst. Veg. **1:** 362. 1798.

Piper Macgillivrayi var. *fascicularis* (sic) forma *b* C. DC. in Jour. Linn. Soc. Bot. **39:** 162. 1909.

DISTRIBUTION: Fiji and Samoa. In Fiji the species is common locally in rain-forest and ridge-thickets of Viti Levu at elevations of 550–1200 m.; it is a shrub 2–5 m. high. In Samoa (as *P. Macgillivrayi* var. *fasciculare*) it is said to occur in some abundance on Savaii and Upolu, in essentially similar habitats at elevations up to 1500 m.

FIJI. VITI LEVU: Tholo North: Nandarivatu, *Degener & Ordonez 13570* ♀ (A, TYPE, NY, UC, US), *Parks 20777* ♂ (Bish), *20786* fr. (Bish), *Gillespie 4214* fr. (A, Bish); Nauwanga, *Degener 14360* fr. (A, NY, UC, US), *14620* fr. (A, NY); Nandrau, *Degener 14891* fr. (A, NY); Namosi: Vicinity of Namosi, *Gillespie 2688* ♀ (A, Bish), *Parks 20238* fr. (Bish), *20251* fr. (Bish); Korombasambasanga Mt., *B. E. Parham 2212* fr. (A). VANUA LEVU: Thakaundrove-Mathuata boundary: Korotini Range, *Smith 548* ♀ (Bish, GH, NY, UC, US). WITHOUT DEFINITE LOCALITY: *Gillespie 2782* ♀ (Bish), *3124* fr. (Bish).

In proposing this entity as a new species in 1942, I considered its similarity to the Samoan plant which has been passing as *P. Macgillivrayi* var. *fasciculare*, but it seemed to me at that time, as at present, that the plant cannot be placed in "*P. Macgillivrayi*" (i.e. *P. puberulum*, as defined in the present treatment) without undue expansion of that concept. The other varieties of *P. puberulum* have the spikes usually solitary, but sometimes those at the upper nodes are paired. *Piper Timothianum*, on the other hand, has the spikes normally 3–7 per axil, very rarely 2. Several students of the Samoan flora, including Christophersen in 1938, have remarked that the number of spikes may vary from 1 to 4, but I have not observed fewer than 2 (and this very rarely) in the cited Fijian material. Furthermore the spikes (excluding peduncles), both staminate and pistillate, are only 0.8–3.5 cm. long. Christophersen finds that Samoan plants may have the pistillate spikes up to 5 cm. long and the staminate up to 10 cm. *Piper puberulum*, in the sense adopted by me, has the spikes between 4 and 19 cm. long, but the spikes of either sex are rarely less than about 7 cm. long. Although the two species are doubtless closely related and quite possibly interfertile, I fail to see how the present entity can be included in *P. puberulum* without expanding that concept to an unwarranted degree, perhaps even submerging it in *P. latifolium* L. f. Few students of *Piper* will wish to combine species to this extent, in which case the whole Section *Macropiper* would scarcely be divisible into species.

Apparently only Rechinger, in 1908, has thought *P. Macgillivrayi* var. *fasciculare* worthy of specific rank; he used the specific epithets "*fascicularis*" and "*fasciculatum*" indiscriminately, but neither is available for use in *Piper*. The plant was collected at Nandarivatu by both Gibbs and im Thurn, whose specimens were referred to Warburg's variety by de Candolle and Turrill.

13. **Piper** (§ *Macropiper*) **kandavuense** sp. nov.

Frutex 3 m. altus ubique inflorescentia excepta glaber, ramulis teretibus nodis valde incrassatis, internodiis apicem ramulorum versus 2–6 cm. longis; foliis alternatis, petiolis 2–3 cm. longis fere ad apicem conspicue vaginantibus (alis 3–4 mm. latis superne ad petiolum abrupte decurrentibus), laminis chartaceis in sicco olivaceis late ovatis, 10–15 cm. longis, 8–14 cm. latis, basi truncato-subcordatis, apice cuspidato-acuminatis, margine integris, 7(vel inconspicue 9-)-nerviis, nervis e basi divergentibus utrinque conspicue elevatis, rete venularum utrinque haud prominulo; inflorescentiis ♀ solis visis in axillis foliorum apicem ramulorum versus 4 vel 5 aggregatis, pedunculis validis glabris 1–2 cm. longis, spicis paullo post anthesin 2–3 mm. diametro 5–8 cm. longis; rhachi pilis pallidis 0.2–0.4 mm. longis sparse pubescente; bracteis liberis peltatis membranaceis circiter 0.8 mm. diametro breviter stipitatis; ovario globoso-ellipsoideo circiter 1 mm. diametro (immaturo), apice rotundato, stigmatibus 3 patentibus circiter 0.3 mm. longis dense et conspicue brunneo-pilosis et ciliatis coronato.

DISTRIBUTION: Known only from the type collection.

FIJI. KANDAVU: Mt. Mbuke Levu, alt. 200–500 m., *Smith 219* ♀ (Bish, GH, TYPE, NY, UC, US), Oct. 23, 1933 (shrub 3 m. high, in dense forest).

The specimen above described belongs among the allies of *P. latifolium*

L. f., but in several details it differs from my concept of that species. On the whole, it has shorter petioles than *P. latifolium,* at least on leaves of comparable size and maturity, and its petiolar sheaths are slighly broader in proportion and more abrupt distally. In the material of *P. latifolium* which I have seen from the eastern Pacific, the spikes, both staminate and pistillate, are never more than 3, but the original description states that the spikes are 5 or more; whether the original specimen was staminate or pistillate is not stated. Although the stigmas of *P. latifolium* are glandular-puberulent, they are never as conspicuously pilose as those of *Smith 219.*

In view of these differences, and especially the difference pertaining to the stigmatic character, I doubt if *Smith 219* can be referred to *P. latifolium.* No Fijian specimen which has yet come to my attention seems to agree precisely with material of *P. latifolium* from the eastern Pacific, but *Smith 219* seems closest, among Fijian plants, to Linnaeus' species, the limits of which are not yet entirely understood, as stated above.

INSUFFICIENTLY KNOWN ENTITIES FROM FIJI

PIPER (§ *Macropiper*) MACGILLIVRAYI C. DC. var. PARVIFOLIUM C. DC. in DC. Prodr. **16**(1): 335. 1869.

De Candolle's whole treatment of this is as follows: " . . . limbis 0,06 longis, 0,03 latis 5–7-nerviis . . . In ins. Fijee (Barclay ! in h. Kew.)." Leaves with these small dimensions have been observed among the available Fijian collections only on plants referred to *P. melanostachyum* C. DC., in which the leaf-blades are not 7-nerved. It seems probable that *P. Macgillivrayi* var. *parvifolium* is a very depauperate individual of *P. puberulum* var. *glabrum.*

PIPER (§ *Macropiper*) GIBBSIAE C. DC. in Jour. Linn. Soc. Bot. **39**: 163. 1909, in Candollea **1**: 173. 1923.

According to de Candolle, this species is characterized by its small leaf-blades (8 × 3.5 cm.), which are densely hirtellous beneath and 7-nerved, its hirtellous petioles and peduncles, its short pistillate spikes (3.5 cm. long), and especially its hirsute ovaries. On the basis of the original description this appears to be a distinct species, suggestive of *P. oxycarpum* and possibly *P. puberulum* var. *typicum.* No Fijian material available to me can be referred to *P. Gibbsiae,* which I hesitate to place without seeing the type, *Gibbs 722,* from Nandarivatu, Tholo North, Viti Levu.

PIPER (§ *Macropiper*) ERECTISPICUM C. DC. in Jour. Linn. Soc. Bot. **39**: 163. 1909, in Candollea **1**: 173. 1923.

From the original description and de Candolle's key (5: 173), one may assume that this species is a close relative of *P. Gibbsiae,* differing chiefly in its slightly larger (13 × 5.8 cm.) and more obviously acuminate leaf-blades, longer pistillate spikes (6 cm. long), and more sparsely pilose ovaries. Without examining the type, it is inadvisable to draw conclusions as to the value of the species, which is based on *Gibbs 599,* from Nandarivatu, Tholo North, Viti Levu.

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NOTES ON THE FLORA OF INDO-CHINA

HUI-LIN LI

THIS paper is based almost entirely on a part of the very excellent and extensive collections of botanical material from the extreme northeastern part of Tonkin, adjacent to the Kwangtung border, assembled by Mr. W. T. Tsang on the second, third, and fourth Lingnan Indo-China Expeditions. These expeditions were sponsored by the Botanical Survey of Lingnan University in co-operation with the Arnold Arboretum and were supported by grants from the latter institution. The second expedition was in the fall of 1936, the third in the spring and early summer of 1939, and the fourth from May to November, 1940. All the material of the first two expeditions, when received from the field, was stored in Canton in order that the necessary herbarium labels could be prepared. The fourth expedition was actually in the field when the Japanese occupied Indo-China, but Mr. Tsang succeeded in returning to Hong Kong with all of his material. Because of the rapidly deteriorating conditions in the Orient, all of the material from the three expeditions was assembled in Hong Kong, and, through the active interest of Prof. F. A. McClure, the Arnold Arboretum share of the collections was shipped to the United States in January 1941. Because of the critical situation in Canton and the increasingly critical one in Hong Kong, time did not permit the actual transcription of the field notes for the numbers involved on the fourth and last expedition; we do, however, have the localities and the inclusive dates of collection for each locality, and we were thus in a position to have the necessary printed herbarium labels prepared.

In the three collections there is a total of about 2000 numbers. Of the second and third expedition collections we normally have four sets of specimens for each number; but the number of duplicates of the fourth collection is very much larger, often running from ten to fifteen specimens for each number.

Mr. Tsang, on all three expeditions, operated in the coastal regions in the vicinity of Ha Coi and the mountainous region inland from Ha Coi and Tien Yen, much of the material being from the mountain ranges immediately south of the juncture of the Kwangsi-Kwangtung-Tonkin boundaries. Naturally, in the collection as a whole, a great many Chinese elements are represented in the form of genera and species originally described from Kwangtung, Kwangsi, and neighboring provinces, as well as the Island of Hainan. When the entire collection is studied, group by group, many additions to the Indo-Chinese flora will result. All specimens cited are deposited in the herbarium of the Arnold Arboretum.

This study was made possible through a grant made from the Milton Fund of Harvard University to Dr. E. D. Merrill, Director of the Arnold

Arboretum, to be utilized in completing the identification work on the recently received botanical collections from various parts of China and neighboring regions.

PROTEACEAE

Helicia Loureiro

Helicia Henryi Diels, Repert. Sp. Nov. **13:** 528. 1915.

Helicia pallidiflora W. W. Smith, Notes Bot. Gard. Edinb. **10:** 179. 1918.

INDO-CHINA: Tonkin, northwest of Mon-cay, Pac-si and vicinity, *W. T. Tsang 26961,* Oct. 1–8, 1936, 7 ft. high, fairly common, growing in thickets, on dry clayey soil, fruits yellow or black; Taai Wong Mo Shan, Chuk-phai, *W. T. Tsang 27078,* Oct. 23–31, 1936, *27252,* Nov. 10–17, 1936, *29299,* July 1–13, 1939, 7–9 ft. high, fairly common, growing in thickets, on dry clayey or sandy soil, fruits yellow or black. Yunnan, Kwangsi, Hainan. New to Indo-China.

Helicia vestita W. W. Smith, Notes Bot. Gard. Edinb. **10:** 181. 1918.

INDO-CHINA: Tonkin, Dam-ha, Sai Wong Mo Shan, Lung Wan Village, *W. T. Tsang 30083,* May 18 – July 5, 1940. Yunnan. New to Indo-China.

Helicia Tsangii sp. nov.

Arbor parva circiter 3–5 m. alta, ramulis junioribus dense ferrugineo-tomentosis serius glabrescentibus; foliis chartaceis vel subcoriaceis, breviter petiolatis (5–10 mm.), anguste oblongo-obovatis vel oblongo-oblanceolatis, 17–26 cm. longis, 5.5–9.5 cm. latis, apice plus minusve abrupte acuminatis, basi angustatis, acutis vel cuneatis, margine crasse et remote serratis, supra glabris subnitidis, in sicco olivaceis, subtus glabris costa nervisque leviter subcastaneo-tomentosis exceptis, in sicco brunneis, costa utrinque elevata, nervis lateralibus utrinsecus 12–15, supra distinctis, subtus prominentibus, venis tertiariis utrinque subconspicuis; inflorescentiis axillaribus erectis ad 16 cm. longis, dense subcastaneo-tomentosis, multifloris, bracteis bracteolisque ovato-lanceolatis, ad 2–3 mm. longis, tomentellis, pedicellis 2–4 mm. longis, subcastaneo-tomentosis mox glabrescentibus, solitariis vel binis vel plerumque 2–4-fasciculatis; floribus circiter 15 mm. longis, albis, extus leviter tomentosis; antheris circiter 1.5 mm. longis; ovario circiter 1 mm. longo glabro, stylo gracili glabro; squamis hypogynis oblongo-quadratis, basi leviter cohaerentibus; fructibus valde immaturis subglobosis, circiter 1 cm. diametro, brunneis.

INDO-CHINA: Tonkin, northeast of Mon-cay, Pac-si and vicinity, *W. T. Tsang 26880,* Sept. 27–30, 1936, 10 ft. high, abundant, growing in thickets, fruits brown; Ha-coi, Taai Wong Mo Shan, Chan Uk Village near Chuk-phai, *W. T. Tsang 28974,* May 3–10, 1939, *29174* (TYPE), June 1–9, 1939, 10–15 ft. high, fairly common, growing in thickets, on dry clayey soil, flowers white, fragrant.

A species allied to *Helicia silvicola* W. W. Smith, but distinguished by the much broader, narrowly obovate to oblong-oblanceolate, coarsely toothed, short-petioled leaves, and by the longer flowers, which are hairy on the outside.

LORANTHACEAE

Elytranthe Blume

Elytranthe cochinchinensis (Lour.) G. Don var. **tonkinensis** (Lecomte) comb. nov.

Elytranthe ampullacea G. Don var. *tonkinensis* Lecomte, Fl. Gén. Indo-Chine **5:** 205. 1915.

INDO-CHINA: Tonkin, Tien-yen, Kau Nga Shan and vicinity, *W. T. Tsang 27491,* Jan. 1–9, 1937, 2 ft. high, fairly common, on trees in thickets, fruits purplish-red, flowers fragrant.

Three varieties are recognized by Lecomte in Indo-China. The other two are **Elytranthe cochinchinensis** (Lour.) G. Don var. **puberula** (Lecomte) comb. nov. (*E. ampullacea* G. Don var. *puberula* Lecomte, Fl. Gén. Indo-Chine **5:** 205. 1915), from Cambodia, and var. **Harmandii** (Lecomte) comb. nov. (*E. ampullacea* G. Don var. *Harmandii* Lecomte, l. c.), from Laos. Danser (Bull. Jard. Bot. Buitenz. III. **16:** 5. 1938) refers all three to the type of *Macrosolen cochinchinensis* (Lour.) van Tieghem = *Elytranthe cochinchinensis* (Lour.) G. Don, as representing different forms of a polymorphic species. But the specimens from Indo-China show enough differences to prove that Lecomte is not unjustified in proposing these varieties.

Loranthus Linnaeus

Loranthus cordifolius Wall. in Roxb. Fl. Ind. **2:** 222. 1824.

INDO-CHINA: Tonkin, Dam-ha, Sai Wong Mo Shan, Lomg Ngong Village, *W. T. Tsang 30430,* July 18 – Sept. 9, 1940; Tien-yen, Kau Nga Shan and vicinity, *W. T. Tsang 30570,* Sept. 23 – Oct. 7, 1940. Eastern India. New to Indo-China.

This belongs in *Scurrula* Linn. in accordance with Danser's scheme of classification.

Loranthus tienyensis sp. nov.

Frutex parasiticus, ramis ramulisque teretibus dense castaneo-tomentosis; foliis firmiter chartaceis, petiolatis, juventute utrinque breviter dense ferrugineo-tomentosis vel subtus secus costam tomentosis, maturitate mox glabris ellipticis, 2.5–4.5 cm. longis, 1.5–2.3 cm. latis, utrinque late rotundatis, in sicco supra olivaceis, subtus paullo pallidioribus, costa supra obscura subtus elevata, nervis lateralibus obsoletis vel subobsoletis; petiolo circiter 7 mm. longo ferrugineo-pubescente; inflorescentiis axillaribus solitariis plerumque bifloris, pedunculis teretibus circiter 5 mm. longis dense breviter subcastaneo-tomentosis; pedicellis teretibus circiter 7 mm. longis; bracteis minutis; calyce subellipsoideo 2–3 mm. longo, margine integro; corolla dense breviter subplumoso-tomentosa, ad 4.5 mm. longa, 3 mm. diametro, apice 4-lobata, lobis obtusis 1 mm. latis; filamentis circiter 1 mm. longis, antheris oblongis 1.5 mm. longis; stylis glabris filiformibus, corollae lobis aequalibus vel paullo longioribus, stigmate capitato.

INDO-CHINA: Tonkin, Tien-yen, Ho Yung Shan and vicinity, *W. T. Tsang 30689* (TYPE), Oct. 13 – Nov. 22, 1940.

A very distinct species, characterized by its small elliptic leaves, which are rounded at both ends, without distinct lateral nerves, and with a dense tomentum along the lower portion of the midrib beneath, the mature leaves otherwise being wholly glabrous. It is remotely allied to *Loranthus notothixoides* Hance, differing, among other characters, in the larger leaves and very much longer flowers. In Danser's classification it falls into *Scurrula* Linn.

ANNONACEAE

Goniothalamus Hooker f. & Thomson

Goniothalamus chartaceus sp. nov.

Frutex vel arbor parva, ramis ramulisque glabris nigris; foliis subchartaceis glabris breviter petiolatis anguste oblongo-lanceolatis vel lanceolatis, 11–17 cm. longis, 1.7–2.8 cm. latis, breviter obtuse acuminatis, basi acutis, margine leviter revolutis, in sicco olivaceis utrinque concoloribus, minute puncticulatis, costa supra leviter impressa subtus distincte elevata, nervis lateralibus utrinsecus 10–12, utrinque subconspicuis, tenuibus, fere ad medium inter costam atque marginem curvato-anastomosantibus, venis tertiariis inconspicuis; petiolo circiter 5 mm. longo; floribus axillaribus solitariis, pedicellis circiter 1.2 mm. longis, glabris, prope basim 3-bracteatis, bracteis 1 1.5 mm. longis acuminatis; sepalis coriaceis oblongo-ovatis, perspicue acuminatis, circiter 9 mm. longis et 4 mm. latis, fere liberis, glabris; petalis exterioribus liberis lanceolatis longe acuminatis, circiter 1.8 cm. longis, petalis interioribus superne coalitis, ovato-triangularibus, breviter acuminatis, circiter 1 cm. longis; staminibus numerosis circiter 1.5 mm. longis; carpellis numerosis minutis brunneo-tomentosis.

INDO-CHINA: Tonkin, Dam-ha, Sai Wong Mo Shan, Lung Wan Village, *W. T. Tsang 30097* (TYPE), May 18 – July 5, 1940.

A species characterized by its thin, narrow, puncticulate leaves and long and slenderly acuminate outer petals, being quite unlike any previously described species from this region, perhaps most closely allied to *Goniothalamus elegans* Ast.

HAMAMELIDACEAE

Embolanthera Merrill

Embolanthera glabrescens sp. nov.

Frutex vel arbor parva, glabra, ramis brunneo-cinereis teretibus, ramulis gracilibus obscure brunneis; foliis firmiter chartaceis glabris, petiolatis, lanceolatis vel oblongo-lanceolatis, 7–12 cm. longis, 1.5–4 cm. latis, longe acuminatis, basi plerumque perspicue inaequilateralibus, uno latere acutis, altero rotundatis vel late acutis, margine integris subcartilagineis, supra subnitidis, nervis 5–7-jugis arcuatim adscendentibus anastomosantibus, supra paullo elevatis, subtus perspicuis, venulis reticulatis, supra subconspicuis, subtus conspicuis; petiolis canaliculatis, 2–5 mm. longis; inflorescentiis terminalibus solitariis spicatis multifloris, 8–12 cm. longis, glabris, pedunculis 1–1.5 cm. longis; floribus hermaphroditis sessilibus, calyce toto glabro, circa 3.8 mm. longo, infra cum ovario connato, ad basim 2-partito, lobo uno apice breviter fisso, lobis apice ciliatis; petalis perigynis saepissime 5 raro 4–6, in alabastro corrugato-involutis, maturis luteis linearibus, circa 2 cm. longis, 1–1.5 mm. latis, breviter acuminatis, basi utrinque valde auriculatis vel alatis; staminibus 5 raro 4–6 cum petalis alternis eorumque basi leviter connatis, 1.5–2 mm. longis, filamento 1–1.3 mm. longo, connectivo breviter producto, thecis 2 ovoideis rubro-brunneis basifixis, locellis 4; staminodiis nullis; ovario semi-infero 2-loculari supra pubescente; stylis 2 glabris 6 mm. longis cylindricis acuminatis, ovulo in loculo quove singulo pendulo; fructu capsulari, basi annulato, ovoideo, in valvis 2 dehiscente, 8–10 mm. longo, 1 mm. crasso, epicarpio levi corneo crasso, endocarpio corneo nigricante, calycis limbo circumscisso-deciduo, semine ignoto.

INDO-CHINA: Tonkin, Tien-yen, Ho Yung Shan and vicinity, *W. T. Tsang 30709* (TYPE), Oct. 13 – Nov. 22, 1940.

This is an interesting addition to the flora of Indo-China. The genus

Embolanthera was described from a single Philippine collection from Palawan, its type species being *E. spicata* Merr. As a genus, it is strongly characterized by the spicate inflorescences, manifestly auriculate bases of the petals, membranaceous irregularly 2- or 3-lobed calyces, and the absence of staminodes. The present species differs from *E. spicata* Merr. in the narrower, more slenderly acuminate, and generally fewer-nerved leaves, shorter petioles, glabrous spikes which are mostly terminal, and glabrous calyces. The fruits were previously unknown, but unfortunately I am not able to describe the seeds, for in the abundant material now available the seeds are all fallen.

This new species considerably extends the range of the genus. The type was collected at Tien-yen in northeastern Tonkin, near the Kwangtung-Kwangsi border. It is highly probable that the same species, or related ones, may eventually be found also in southern Kwangsi, when the latter area is more extensively explored. The flora of Kwangsi is particularly close to that of Tonkin, as is shown by numerous species in recent collections being present in both areas.

STERCULIACEAE

Reevesia Lindley

Reevesia macrocarpa sp. nov.

Arbor, ramis glabris teretibus, ramulis glabris; foliis firmiter chartaceis, utrinque glabris, pallidis, nitidis, oblongo-ellipticis, 13–18 cm. longis, 4.5–6 cm. latis, acuminatis, basi subrotundatis, leviter trinerviis, costa utrinque elevata, nervis lateralibus utrinsecus 6–8, supra distinctis, subtus perspicuis valde elevatis, prope marginem arcuato-anastomosantibus, venis tertiariis utrinque elevatis; petiolo 2.5–4.5 cm. longo, glabro; floribus ignotis; fructibus longe pedicellatis lignosis obovoideo-oblongis, 5.5–6 cm. longis, 2.5–2.7 cm. latis, 5-lobatis, apice rotundatis, basi acutis, extus griseo-furfuraceis; pedicello circiter 4.5 cm. longo; seminibus (cum alis) circiter 3 cm. longis, alis brunneis circiter 2.2 cm. longis, 0.7 cm. latis, oblongis, apice rotundatis.

INDO-CHINA: Tonkin, Dam-ha, Sai Wong Mo Shan, Lomg Ngong Village, *W. T. Tsang 30473* (TYPE), July 18 – Sept. 9, 1940.

A species distinguished in this small genus by its rather large entirely glabrous leaves and the large fruits. It is nearest to *Reevesia longipetiolata* Merr. & Chun of Hainan, but it differs in its vegetative characters as well as in its larger fruits. This is the second actual record of *Reevesia* as occurring in Indo-China. Gagnepain, in Lecomte, Fl. Gén. Indo-Chine **1:** 486. 1910, includes the description of *Reevesia thyrsoidea* Lindl. on the basis of a *Bon* specimen which perhaps came from Tonkin. He states: "L'origin tonkinoise de cette espèce n'est pas certaine, le P. Bon ayant herborisé à Hong-Kong." Merrill, Jour. Arnold Arb. **19:** 53. 1938, has credited *Reevesia pubescens* Nast to Tonkin.

DILLENIACEAE

Actinidia Lindley

Actinidia tonkinensis sp. nov.

Frutex scandens, ramis glabris, ramulis junioribus subdecidue breviter puberulis; foliis chartaceis, longe petiolatis, ovatis vel elliptico-ovatis, 7–12.5 cm. longis, 4.5–6.8 cm. latis, apice acutis vel breviter acuminatis, basi angustatis, margine infra medium integris, sursum distanter serrulatis, in sicco olivaceo-viridibus, utrinque subconcoloribus vel subtus paullo pallidioribus, supra glabris subnitidis, subtus minute consperse stellato-puberulis, nervis lateralibus utrinsecus 6–8 gracilibus utrinque manifestis subtus elevatis, venis tertiariis plus minusve parallelis, supra subconspicuis, subtus distinctis; petiolo 2.2–4.8 cm. longo, primo puberulo demum subglabro; inflorescentiis dense subferrugineo-pubescentibus, cymosis, 4–5 cm. longis, 5–20-floris; pedunculis 2–3 cm. longis; floribus ♂ 5-meris, circiter 1 cm. diametro, pedicellis 0.7–1 cm. longis; sepalis ovatis obtusis extus dense pubescentibus, circiter 4 mm. longis; petalis oblongis glabris, circiter 5 mm. longis et 2 mm. latis, apice rotundatis; staminibus circiter 40, 1-seriatis, filamentis 2–3 mm. longis gracilibus, antheris oblongo-ovatis 1 mm. longis; ovario subgloboso dense pubescente; floribus hermaphroditis non visis.

INDO-CHINA: Tonkin, Dam-ha, Sai Wong Mo Shan, Lung Wan Village, *W. T. Tsang 29907* (TYPE), May 18 – July 5, 1940.

A species apparently in the alliance of *A. latifolia* (Champ.) Merr., but distinguished, among other characters, by the leaf base being acute or broadly acute instead of cordate or broadly rounded, the lower surface less pubescent, with scattered stellate hairs, and the more delicate and lax inflorescences with longer and more slender peduncles and pedicels and somewhat smaller flowers.

FLACOURTIACEAE

Bennettiodendron Merrill

Bennettiodendron cordatum Merr. Jour. Arnold Arb. **20:** 352. 1939.

INDO-CHINA: Tonkin, Ha-coi, Chuk-phai, Taai Wong Mo Shan, *W. T. Tsang 27043,* Oct. 16–22, 1936, *27122,* Oct. 23–31, 1936, *29261,* June 23–30, 1939, 5–30 ft. high, fairly common, growing in thickets, in sandy soil; Dam-ha, Sai Wong Mo Shan, Lung Wan Village, *W. T. Tsang 30058,* May 18 – July 5, 1940.

The type, a flowering specimen, was from Mount Bavi, Tonkin; the above-cited collections are all in fruit. Infructescences narrowly paniculate, 9 to 12 cm. long, sparingly pubescent, ultimately glabrous or nearly so, the longest branches not exceeding 2 cm. in length. Fruits globose, dark brown, glabrous, about 7 mm. in diameter.

THYMELAEACEAE

Wikstroemia Sprengel

Wikstroemia nutans Champ. in Hook. Jour. Bot. Kew Gard. Misc. **5:** 195. 1853.

INDO-CHINA: Tonkin, Tien-yen, Kau Nga Shan, *W. T. Tsang 27340,* Dec. 13–22, 1936, 4 ft. high, fairly common, in thickets, flowers yellow. Kwangsi, Kwangtung, Hainan. New to Indo-China.

ARALIACEAE

Dendropanax Decaisne & Planchon

Dendropanax parviflorus (Champ.) Benth. Fl. Hongk. 137. 1861; Merr. Brittonia **4:** 132. 1941; Li, Sargentia **2:** 45. 1942.

Hedera parviflora Champ. ex Benth. in Hook. Jour. Bot. Kew Gard. Misc. **4:** 122. 1852.

Gilibertia parviflora Harms in Engl. & Prantl, Nat. Pflanzenfam. **3**(8): 41. 1894.

Textoria parviflora Nakai, Jour. Jap. Bot. **15:** 7. 1939.

INDO-CHINA: Tonkin, northwest of Mon-cay, Pac-si and vicinity, *W. T. Tsang 26981,* Oct. 1–8, 1936; Ha-coi, Chuk-phai, Taai Wang Mo Shan, *W. T. Tsang 27241,* Nov. 10–17, 1936. Kwangtung and Kwangsi. New to Indo-China.

CORNACEAE

Cornus Linnaeus

Cornus hongkongensis Hemsl. Jour. Linn. Soc. Bot. **23:** 345. 1888.

Benthamia japonica Sieb. & Zucc. var. *sinensis* Benth. in Hook. Jour. Bot. Kew Gard. Misc. **4:** 165. 1852.

Dendrobenthamia hongkongensis Hutchinson, Ann. Bot. **6:** 93. 1942.

INDO-CHINA: Tonkin, Mount Bavi, *A. Pételot 2147,* June 24, 1939; Dam-ha, Sai Wong Mo Shan, Lung Wan Village, *W. T. Tsang 29942,* May–July, 1940. Southern and eastern China. New to Indo-China.

This species has been much confused with *Cornus capitata* Wall., a species of wide distribution, which also occurs in Tonkin. It differs from Wallich's species chiefly in having a truncate, entire calyx. In addition, it can be distinguished by its leaves being generally broader, more coriaceous, slightly lustrous above and pale green, not grayish nor whitish beneath. In leaf form, size, and length of acumen, the two species are similar.

SAPOTACEAE

Madhuca J. F. Gmelin

Madhuca Tsangii sp. nov.

Arbor ramulis atrobrunneis glabris; foliis ad ramulorum apices subverticillatim dispositis, chartaceis vel subcoriaceis, petiolatis, obovatis, 4.5–6.5 cm. longis, 2.5–3.5 cm. latis, apice obtusis vel late rotundatis, deorsum angustatis, basi cuneatis, utrinque glabris, subtus minutissime puncticulatis, costa subtus valde prominente, nervis lateralibus supra inconspicuis, subtus gracilibus, utrinsecus circa 12–15 rectis prope marginem obscurissime arcuatim anastomosantibus; petiolis 1–2 cm. longis; floribus axillaribus 2–7-fasciculatis, pedicellis dense subadpresse pubescentibus, ad 2.5 cm. longis; calyce 6–7 mm. longo extus pubescente, lobis 4 biseriatis ovatis, 5 mm. latis, toto pubescentibus; corollis exsertis, 8 mm. longis, glabris, tubo 2–3 mm. longo, petalis 8 oblongis, 5 mm. longis, 2.5 mm. latis, subrotundatis; staminibus 16 fauce insertis, filamentis 1 mm. longis, antheris 2.5 mm. longis acuminatis; ovario ovoideo pubescente 8-loculari, stylis 1 cm. longis, basi pubescentibus; fructu ignoto.

INDO-CHINA: Tonkin, Dam-ha, Sai Wong Mo Shan, Lomg Ngong Village, *W. T. Tsang 30271* (TYPE), July 18 – Sept. 9, 1940.

In the pubescent ovary and obovate leaves, this new species resembles *Madhuca Thorelii* (Merr.) H. J. Lam and **Madhuca cambodiana** (H. Lecomte) comb. nov. (*Payena cambodiana* H. Lecomte, Fl. Gén. Indo-Chine **3:** 912. 1930). The former is an incompletely known species which, on the basis of the original description, differs from the present species in the smaller leaves, shorter pedicels, and smaller flowers. The latter has larger leaves with loosely arranged veinlets, as well as shorter pedicels and smaller flowers.

Sideroxylon Linnaeus

Sideroxylon Wightianum Hook. & Arn. var. **tonkinense** var. nov.

A typo speciei differt foliis lanceolatis, ad 13–16 cm. longis, 3–4 cm. latis, longe acuminatis, basi valde attenuatis, petiolis 1.5–2 cm. longis.

INDO-CHINA: Tonkin, Ha-coi, Chuk-phai, Taai Wong Mo Shan, *W. T. Tsang 27044* (TYPE), Oct. 16–22, 1936, 10 ft. high, fairly common, in thickets, on dry sandy soil, flowers pale.

The type of the species was from Kwangtung. This variety differs from the typical form in the much more lanceolate leaves. Lecomte, Fl. Gén. Indo-Chine **3:** 887. 1930, gives an extensive description of *Sideroxylon Wightianum* Hook. & Arn. var. *Balansae* Lec. but his description applies to a form distinctly different from the one above characterized, its leaves being but 10–12 cm. long, obtusely acuminate, and its petioles being 8–12 mm. in length.

SARCOSPERMATACEAE

Sarcosperma Hooker f.

Sarcosperma laurinum (Benth.) Hook. f. in Benth. & Hook. f. Gen. Pl. **2:** 655. 1876; Lam & Varos, Blumea **3:** 195. 1938.

Reptonia laurina Benth. Fl. Hongk. 208. 1861.

INDO-CHINA: Tonkin, Ha-coi, Chuk-phai, Taai Wong Mo Shan, *W. T. Tsang 27162,* Nov. 1–9, 1936, 20 ft. high, fairly common, in thickets, flowers pale yellow, fragrant; Tien-yen, Kau Nga Shan, *W. T. Tsang 27415,* Dec. 23–29, 1936, 10 ft. high, fairly common, in thickets, flowers light yellow, fragrant; Tien-yen, Ho Yung Shan, *W. T. Tsang 30726,* Oct. 13 – Nov. 22, 1940. Kwangtung, Kwangsi, Hainan, and southern Yunnan. New to Indo-China.

EBENACEAE

Diospyros Linnaeus

Diospyros Morrisiana Hance, Walp. Ann. **3:** 14. 1852–53, Jour. Bot. **18:** 299. 1880.

INDO-CHINA: Tonkin, northeast of Mon-cay, Pac-si, *W. T. Tsang 26973,* Oct. 1–8, 1936, 10 ft. high, fairly common, in thickets on dry clayey soil, fruit yellow; Ha-coi, Chuk-phai, Taai Wong Mo Shan, *W. T. Tsang 27313,* Nov. 18 – Dec. 2, 1936, 10 ft. high, fairly common, in thickets, fruit yellow; Tien-yen, Kau Nga Shan, *W. T. Tsang 27385,* Dec. 13–22, 1936, 15 ft. high, fairly common, in thickets, on steep slopes, fruits yellow; same locality, *W. T. Tsang 30484,* Sept. 23 – Oct. 7, 1940; Dam-ha, Sai Wong Mo Shan, Lung Wan Village, *W. T. Tsang 29809,* May 18 – July 5, 1940. Kwangtung, Kwangsi, Fukien, Chekiang, Formosa. New to Indo-China.

Diospyros potingensis Merr. & Chun, Sunyatsenia **5:** 164. 1940.

INDO-CHINA: Tonkin, northeast of Mon-cay, Pac-si, *W. T. Tsang 26925,* Oct. 1–8, 1936, 10 ft. high, fairly common, in thickets, on dry sandy soil, fruits yellow; Ha-coi, Chuk-phai, Taai Wong Mo Shan, *W. T. Tsang 27159,* Nov. 1–9, 1936, *28996,* May 3–10, 1939, woody, 20 ft. high, fairly common, in thickets, on dry sandy soil, fruits yellow; Dam-ha, Sai Wong Mo Shan, Lomg Ngong Village, *W. T. Tsang 30191,* July 18 – Sept. 9, 1940. Hainan. New to Indo-China.

STYRACACEAE

Rehderodendron Hu

Rehderodendron indochinense sp. nov.

Arbor circiter 13 m. alta, ramulis glabris subcinereis; foliis chartaceis glabris utrinque concoloribus elliptico-oblongis, 7–10 cm. longis, 3–3.5 cm.

latis, falcato-acuminatis, basi anguste acutis, margine minute distanter glanduloso-denticulatis, nervis lateralibus utrinsecus 6–8 curvatis circiter ad marginem arcuato-anastomosantibus, cum venulis reticulatis utrinque perspicuis; petiolis 5–7 mm. longis glabris; paniculis axillaribus ad 5 cm. longis, dense substellatim cinereo-tomentosis, pedicellis 6–10 mm. longis, bracteolis ad basim pedicelli lanceolatis, cinereo-tomentulosis, 4 mm. longis, deciduis; calyce campanulato 4 mm. alto, 5-dentato, dentibus triangularibus acuminatis; corolla 5-partita, lobis elliptico-oblongis obtusis, 1.4 cm. longis, 5 mm. latis, utrinque substellatim cinereo-tomentulosis; staminibus 10, corollae tubo adnatis, exsertis, alternis longioribus, stylis cinereo-tomentulosis, 1.5 mm. longis, stigmate capitato; ovario 5-loculari; fructibus glabris magnis cylindrico-oblongis, 7.5 cm. longis, 2.8 cm. crassis, apice planis vel leviter depressis, in sicco rubro-brunnescentibus, 10-costatis, exocarpio duro 1 mm. crasso, mesocarpio 8–10 mm. crasso inter processos endocarpii fibroso-spongioso, endocarpio lignoso 8–10 mm. crasso, processis circiter 10 longitudinalibus 8–10 mm. latis et 1 mm. crassis ornato; seminibus oblongo-linearibus, 5 cm. longis.

INDO-CHINA: Tonkin, Chapa, *A. Pételot 6258* (TYPE, flowering specimen), in forests, alt. about 1500 m., February 1931; Ha-coi, Chuk-phai, Taai Wong Mo Shan, *W. T. Tsang 27094,* Oct. 23–31, 1936 (fruiting specimen), a tree 40 ft. high, fairly common, growing in thickets, on dry loamy soil, fruit brownish yellow.

This species is allied to *Rehderodendron kwangtungense* Chun, *R. Hui* Chun, and *R. praeteritum* Sleumer, all from Kwangtung, but it may be distinguished by its entirely glabrous, much smaller leaves and the larger, longer, and relatively narrower fruits. This is the second species of the genus known from Indo-China. The other one is *R. macrocarpum* Hu, a species extending from Szechuan through Kweichow to Kwangsi, which is represented by *A. Pételot 4767* from Tonkin.

Huodendron Rehder

Huodendron parvifolium sp. nov.

Arbor parva circiter 7 m. alta inflorescentiis exceptis glabra, ramulis gracilibus teretibus; foliis chartaceis oblongo-ellipticis, 5.5–7.5 cm. longis, 2–2.5 cm. latis, utrinque subopacis subconcoloribusque, distincte acuminatis, basi acutis, margine leviter revolutis, nervis lateralibus utrinsecus 5–7 arcuatis ad marginem curvato-anastomosantibus, utrinque elevatis distinctis, venis tertiariis transversis, utrinque subconspicuis; petiolis 1–1.3 cm. longis glabris in sicco nigris; floribus ignotis; infructescentiis axillaribus puberulis, racemosis, ad 3 cm. longis; fructibus ovoideis cinereo-puberulis, 7.5 mm. longis, 5 mm. latis, loculicide dehiscentibus, pedicellis 0.7–1 cm. longis, manifeste recurvis; calycibus persistentibus puberulis, cupuliformibus, 4 mm. longis, minute 5-dentatis; seminibus brunneis, 2–3 mm. longis.

INDO-CHINA: Tonkin, northeast of Mon-cay, Pac-si and vicinity, *W. T. Tsang 26886* (TYPE), Sept. 27–30, 1936, a small tree, 20 ft. high, fairly common, in thickets, on dry clayey soil, fruit light gray.

This is the second species of this characteristic Chinese genus to be known from Indo-China. It differs from the other Indo-Chinese species of the genus in its smaller leaves, which are dull on both sides, in the relatively larger fruits, which are racemosely arranged in short, simple infructescences, and in the very small calyx teeth.

Styrax Linnaeus

Styrax argentifolius sp. nov.

Frutex circiter 3–5 m. altus, ramulis novellis dense adpresse furfuraceo-lepidotis, indumento cinereo-brunneis; ramis gracilibus glabris; foliis firmiter chartaceis, supra glabris viridibus opacis, subtus dense minute adpresse lepidulotis et indumento cinereo-albido nitidis, oblongis, 7–17 cm. longis, 2–5 cm. latis, longe acuminatis, basi acutis, margine integris, nervis lateralibus utrinsecus 6–8, supra subconspicuis, subtus elevatis prominentibus, curvatis, arcuato-anastomosantibus, venis tertiariis dense reticulatis, utrinque subconspicuis; petiolis 0.7–1 cm. longis, adpresse furfuraceo-lepidotis; inflorescentiis ignotis; infructescentiis axillaribus vel terminalibus, ad 6 cm. longis, dense adpresse furfuraceo-lepidotis; fructibus subovoideis distincte rostratis, ad 2.5 cm. longis et 1.8 cm. crassis, dense adpresse lepidulotis, calyce deciduo minuto, 4 mm. longo, irregulariter cupuliformi, extus dense lepidoto.

INDO-CHINA: Tonkin, Ha-coi, Chuk-phai, Taai Wong Mo Shan, *W. T. Tsang 27127,* Oct. 23–31, 1936, *29335,* July 1–13, 1939, 10–16 ft. high, fairly common, in thickets, on moist sandy soil, fruits dirty white to gray; Dam-ha, Sai Wong Mo Shan, Lomg Ngong Village, *W. T. Tsang 30238* (TYPE), July 18 – Sept. 9, 1940.

This species simulates *Styrax suberifolius* Hook. & Arn. of southern China, but may be readily distinguished by its appressed furfuraceous-lepidote indumentum never being stellate, and by its larger, distinctly rostrate fruits.

SYMPLOCACEAE

Symplocos Jacquin

Symplocos Delavayi Brand, Repert. Nov. Sp. **3:** 218. 1906.

INDO-CHINA: Tonkin, Ha-coi, Chuk-phai, Taai Wong Mo Shan, *W. T. Tsang 27206,* Nov. 10–17, 1936, a small tree, 20 ft. high, fairly common, growing in thickets, fruits black. Yunnan, southeastern Tibet, and northern Burma. New to Indo-China.

Symplocos indochinensis sp. nov. Subgen. *Hopea,* § *Bobua, Lodhra.*

Arbor 5–7 m. alta, ramis cinereo-brunneis, ramulis novellis ferrugineis, longe patule villosis, ramis vetustioribus glabris; foliis chartaceis breviter petiolatis oblongo-ellipticis, 7–12 cm. longis, 2–4 cm. latis, acuminatis, basi late acutis, margine minute distanter denticulatis vel integris, utrinque subconcoloribus, supra parce pilosis vel glabrescentibus haud nitidis, subtus consperse villosis, costa supra impressa, nervis lateralibus utrinsecus circa 4 vel 5 arcuato-anastomosantibus, supra impressis, subtus elevatis prominentibus, venis tertiariis reticulatis, supra subelevatis subconspicuis, subtus elevatis; petiolis brevibus ad 5 mm. longis, dense patule ferrugineo-villosis; inflorescentiis axillaribus glomeratis paucifloris sessilibus, axillaribus et in axillis defoliatis in ramulis annotinis; floribus sessilibus, bracteis late ovatis dense pubescentibus, 1 mm. longis; calycis tubo crasso circa 1 mm. longo, lobis late ovatis pubescentibus, 1 mm. longis; petalis 5 oblongis, 3 mm. longis, utrinque glabris; staminibus circa 25, filamentis gracilibus liberis glabris, circa 4 mm. longis; disco annulari cinereo-pubescente, ovario 3-loculari, stylo 4 mm. longo; fructibus globosis levibus glabris, 6 mm. diametro, calyce persistente.

INDO-CHINA: Tonkin, northeast of Mon-cay, Pac-si, *W. T. Tsang 26902* (TYPE), Sept. 27–30, 1936, a small tree, 17 ft. high, fairly common, in thickets on dry clayey soil, flowers white, fragrant; Ha-coi, Chuk-phai, Taai Wong Mo Shan, *W. T. Tsang*

27027, Nov. 10–17, 1936, a tree 20 ft. high, fairly common, in thickets, fruits blackish-blue; Chan Uk Village near Chuk-phai, Taai Wong Mo Shan, *W. T. Tsang 29130*, May 21–31, 1939, a tree 15 ft. high, fairly common, in thickets, on dry clayey soil, fruits black; Dam-ha, Sai Wong Mo Shan, Lung Wan Village, *W. T. Tsang 30047*, May 18 – July 5, 1940.

In the pubescence of the branches and leaves, and in the sessile glomerulate inflorescences, this species is apparently close to *S. yunnanensis* Brand. It differs from the latter by its thinner, much shorter, and relatively broader leaves. Most of the inflorescences are in the axils of fallen leaves, and the smooth, globose sessile fruits are all borne on the older leafless branches.

OLEACEAE

Linociera Swartz

Linociera verticillata Gagnep. Bull. Soc. Bot. France **79**: 788. 1932 [1933], et in Lecomte, Fl. Gén. Indo-Chine **3**: 1072. *f. 122, 1.* 1933.

INDO-CHINA: Tonkin, Tien-yen, Ho Yung Shan and vicinity, *W. T. Tsang 30697*, Oct. 13–22, 1940. Annam. New to Tonkin.

Olea Linnaeus

Olea cordatula sp. nov.

Arbor parva circiter 10 m. alta, ramis ramulisque dense breviter pubescentibus, consperse lenticellatis; foliis amplis rigidis coriaceis subsessilibus vel brevissime petiolatis late oblongo-oblanceolatis, 14–29 cm. longis, 4.5–9.5 cm. latis, acuminatis, basi anguste cordatis, margine remote dentato-serratis, supra costa nervisque valde impressis exceptis glabris, in sicco olivaceo-brunneis, subtus paullo pallidioribus perspicue breviter molliter pubescentibus, costa supra impressa subtus distincte elevata, nervis lateralibus 18–22 adscendentibus prope marginem arcuato-anastomosantibus, supra impressis, subtus valde elevatis, rete venularum supra leviter impresso subtus obscuro; petiolo subnullo vel ad 4 mm. longo, dense pubescente, supra canaliculato; inflorescentiis paniculatis axillaribus, ad 6 cm. longis et 2.5 cm. latis, molliter pubescentibus, floribus (immaturis) minutis, pedicellis 1 mm. longis; calycibus 0.5 mm. altis ad medium 4-lobatis, lobis ovatis acutis extus pubescentibus; corolla pallide lutea, 1 mm. longa, 1.5 mm. diametro, ad medium lobata, lobis acutis valvatis margine revolutis; antheris subsessilibus ad 0.5 mm. longis; ovario ovoideo, stylo brevi, stigmate inconspicuo; fructibus ovoideis nigris glabris, 1–1.2 cm. longis, 5–6 cm. crassis.

INDO-CHINA: Tonkin, Ha-coi, Chuk-Phai, Taai Wong Mo Shan, Chan Uk Village, *W. T. Tsang 29241* (TYPE), June 10–22, 1939, a tree 30 ft. high, fairly common, in thickets, on dry clayey soil, flowers pale yellow; Dam-ha, Sai Wong Mo Shan, Lung Wan Village, *W. T. Tsang 30081*, May 18 – July 5, 1940, with young fruits; Dam-ha, Sai Wong Mo Shan, Lomg Ngong Village, *W. T. Tsang 30170*, July 18 – Sept. 9, 1940, with mature fruits.

This species is characterized by its large broadly oblong-oblanceolate rigid coriaceous distinctly toothed leaves, which are narrowly cordate at the base, nearly sessile, and softly pubescent beneath. The flowers, probably not fully developed, show the corolla divided to about the middle. It seems to be more appropriate to refer this species to *Olea* rather than to *Linociera*, although it suggests no close relationships to any of the described species of either genus.

Ligustrum Linnaeus

Ligustrum retusum Merr. Lingnan Sci. Jour. **14:** 49. 1935.

INDO-CHINA: Tonkin, Tien-yen, Ho Yung Shan and vicinity, *W. T. Tsang 30644*, Oct. 13 – Nov. 22, 1940. Hainan. New to Indo-China.

RUBIACEAE

Xanthophytopsis Pitard

Xanthophytopsis Balansae Pitard in Lecomte, Fl. Gén. Indo-Chine **3:** 90. *fig. 10, 7, 8.* 1922; Chun & How, Sunyatsenia **4:** 13. *pl. 4.* 1939.

INDO-CHINA: Tonkin, Tien-yen, Kau Nga Shan and vicinity, *W. T. Tsang 30583*, Sept. 23 – Oct. 7, 1940; Tien-yen, Ho Yung Shan and vicinity, *W. T. Tsang 30704*, Oct. 13 – Nov. 22, 1940.

The second collection of this new genus from Tonkin. This species has also been recorded from Kwangtung, near the Indo-Chinese border.

Xanthophytopsis kwangtungensis Chun & How, Sunyatsenia **4:** 14. *pl. 5.* 1939.

INDO-CHINA: Tonkin, northeast of Mon-cay, Pac-si and vicinity, *W. T. Tsang 26293*, Oct. 1–8, 1936, a shrub 2 ft. high, abundant, growing in thickets on dry clayey soil, flowers white, odorless; Ha-coi, Chuk-phai, Taai Wong Mo Shan and vicinity, *W. T. Tsang 27037*, Oct. 16–22, 1936, *29015*, May 3–10, 1939, *29433*, Aug. 1–31, 1939, a shrub 2 ft. high, fairly common, growing in thickets, on dry clayey soil, flowers white, fruits brown; Dam-ha, Sai Wong Mo Shan, Lung Wan Village, *W. T. Tsang 29880*, May 18 – July 5, 1940.

This species, the second one of the genus, was originally described from western Kwangtung, near the Tonkin border. New for Indo-China.

Randia Linnaeus

Randia leucocarpa Champ. ex Benth. in Hook. Jour. Bot. Kew Gard. Misc. **4:** 194. 1852.

INDO-CHINA: Tonkin, Dam-ha, Sai Wong Mo Shan, Lomg Ngong Village, *W. T. Tsang 20420*, July 18 – Sept. 9, 1940. This is a fruiting specimen; its leaves are larger than are those of the Chinese form. Kwangtung. New to Indo-China.

Randia acuminatissima Merr. Philip. Jour. Sci. **15:** 259. 1919.

INDO-CHINA: Tonkin, Dam-ha, Sai Wong Mo Shan, Lung Wan Village, *W. T. Tsang 29904*, May 18 – June 5, 1940. China: Kwangtung, Hainan. New to Indo-China.

Mussaenda Linnaeus

Mussaenda erosa Champ. in Hook. Jour. Bot. Kew Gard. Misc. **4:** 193. 1852.

INDO-CHINA: Tonkin, Tien-yen, Kau Nga Shan, *W. T. Tsang 27461*, Jan. 1–9, 1937, climber, 7 ft. high, fairly common, growing among scattered shrubs, fruits black; same locality, *W. T. Tsang 30540*, Sept. 23 – Oct. 7, 1940; Ha-coi, Taai Wong Mo Shan, *W. T. Tsang 29071*, May 11–20, 1939, *29550*, Sept. 11–23, 1939, climber, 7–10 ft. high, fairly common, growing in thickets, fruits yellow; Dam-ha, Sai Wong Mo Shan, Lung Wan Village, *W. T. Tsang 29990*, May 18 – July 5, 1940. Southern China. New to Indo-China.

Mussaenda longipetala sp. nov.

Frutex scandens, ramulis teretibus perspicue subpatule ciliato-villosis; foliis membranaceis vel submembranaceis, in paribus aequalibus, oblongo-ovatis vel elliptico-ovatis, 8–12 cm. longis, 3.5–6 cm. latis, longe acuminatis, basi late acutis vel subrotundatis, utrinque perspicue molliter villosis, nervis lateralibus utrinsecus 6–8, curvato-adscendentibus, utrinque conspicuis, venis tertiariis subconspicuis vel inconspicuis; petiolis 0.5–1 cm.

longis dense villosis; stipulis linearibus 6–8 mm. longis caducis; inflorescentiis terminalibus cymosis compactis circiter 5 cm. longis, breviter ramosis, perspicue patule albido-villosis vel ciliatis, bracteis bracteolisque linearibus 5 mm. longis, floribus sat numerosis subsessilibus confertis; calycis tubo crasso, 2 mm. longo, dense ciliato, lobis normalibus 4 vel 5 linearibus, 6–8 mm. longis, 1–2 mm. latis, dense villosis, longe acuminatis, uno interdum petaloideo ovato, 4.5–5.5 cm. longo, acuminato, utrinque longe consperse villoso, stipitato; stipite perspicue ciliato ad 2 cm. longo, nervis 5–7; corollae tubo circiter 3 cm. longo et 2 mm. lato, sursum leviter ampliato, extus perspicue villoso, intus superne leviter pubescente, lobis 5 lanceolatis, 1.2 cm. longis, 1.5 mm. latis, longe acuminatis, extus villosis; staminibus medio tubi affixis, antheris 4 mm. longis, basi bifidis; stylo tubi longitudinem aequante, glabro, apice vix lobato.

INDO-CHINA: Tonkin, Dam-ha, Sai Wong Mo Shan, Lung Wan Village, *W. T. Tsang 29811* (TYPE), May 18 – July 5, 1940.

This species is near *Mussaenda subsessilis* Pierre, differing in the leaves being mostly rounded at the base, the much smaller petaloid sepals, the much narrower and longer corolla-lobes, and the stamens inserted near the middle of the corolla-tube, which is slender throughout and only slightly enlarged from the insertion of the anthers upward.

Urophyllum Wallich

Urophyllum chinense Merr. & Chun, Sunyatsenia **2:** 19. *pl. 10.* 1934.

INDO-CHINA: Tonkin, Ha-Coi, Taai Wong Mo Shan and vicinity, *W. T. Tsang 27220,* Nov. 10–17, 1936, *29219,* June 10–22, 1939, *29516,* Sept. 1–10, 1939, a shrub 5–7 ft. high, fairly common, in thickets, flowers white, fragrant, fruits yellow or black; Tien-yen, Kau Nga Shan, *W. T. Tsang 27434,* Dec. 23–29, 1936, a shrub 5 ft. high, abundant, in thickets, fruits yellow; Dam-ha, Sai Wong Mo Shan, Lung Wan Village, *W. T. Tsang 30094,* May 18 – June 5, 1940; Tien-yen, Ho Yung Shan, *W. T. Tsang 30673,* Oct. 13 – Nov. 22, 1940. Also represented by the following collections from Kwangsi Province: *W. T. Tsang 23879, 24055, 24690.* It was originally described from Kwangtung specimens. New to Indo-China.

Gardenia Ellis

Gardenia stenophylla Merr. Philip. Jour. Sci. **19:** 678. 1922.

INDO-CHINA: Tonkin, Ha-coi, Chuk-phai, Taai Wong Mo Shan, *W. T. Tsang 27063,* Oct. 23–31, 1936, *28955,* May 3–10, 1939, *29019,* May 11–20, 1939, *29598,* Sept. 11–23, 1939, a shrub 1.2–2 ft. high, fairly common, growing in thickets, in sandy soil, flowers white, fragrant, fruits yellow; Dam-ha, Sai Wong Mo Shan, *W. T. Tsang 29820,* May 18 – July 5, 1940, *30402,* July 18 – Sept. 9, 1940. Hainan. New to Indo-China.

Psychotria Linnaeus

Psychotria rubra (Lour.) Poir. var. **lanceolata** var. nov.

A typo speciei differt foliis oblongo-lanceolatis, 12–16 cm. longis, 2–3 cm. latis, apice longe acuminatis, basi longe attenuatis.

INDO-CHINA: Tonkin, Ha-coi, Taai Wong Mo Shan, Chan Uk Village near Chuk-phai, *W. T. Tsang 28959* (TYPE), May 3–10, 1939, a shrub 4 ft. high, abundant, growing in thickets on sandy soil, flowers pale yellow, fragrant.

ARNOLD ARBORETUM,
HARVARD UNIVERSITY.

JOURNAL
OF THE
ARNOLD ARBORETUM

VOL. XXIV OCTOBER, 1943 NUMBER 4

PLANTS OF COAHUILA, EASTERN CHIHUAHUA, AND ADJOINING ZACATECAS AND DURANGO, II

IVAN M. JOHNSTON

TYPHACEAE

Typha truxillensis H.B.K. Nov. Gen. et Sp. **1:** 68 (1815).

CHIHUAHUA: 3 mi. west of Camargo, *White*.

Widely distributed in our area along the rivers and elsewhere about permanent water.

NAIADACEAE

Naias guadalupensis (Spreng.) Morong, Mem. Torr. Bot. Cl. **3:** 60 (1893).

COAHUILA: Monclova, in the river, *White 1768*. CHIHUAHUA: 3 mi. west of Camargo, *White 2279*.

A submerged aquatic, widely distributed in America.

POTAMOGETONACEAE

Zannichellia palustris L. Sp. Pl. 969 (1753).

COAHUILA: Monclova, *Marsh 1688*.

An aquatic of saline waters, world-wide in distribution.

Ruppia maritima L. Sp. Pl. 127 (1753).

COAHUILA: Laguna de Jaco, washed up on the beach, *Stewart & Johnston 1978*.

A nearly cosmopolitan species, usually in saline waters.

Potamogeton pectinatus L. Sp. Pl. 127 (1753).

Collected in ponds in the Rio Grande bottoms, near San Elizario (*Wright 1895*).

Widely distributed over the world in brackish waters.

Potamogeton illinoensis Morong, Bot. Gaz. **5:** 50 (1880).

COAHUILA: Monclova, *Marsh 1672*, det. by E. C. Ogden.

Widely distributed in the United States and ranging south to Central America.

Potamogeton nodosus Poir. in Lam. Encyc. Suppl. **4:** 535 (1816).

CHIHUAHUA: Sierra Hechiceros, Rancho Encampanada, along creek, *Stewart 196;* Ojo Caliente, Oct. 16, 1852, *Thurber 823*.

An aquatic, nearly world-wide in distribution.

ALISMACEAE

Echinodorus cordifolius (L.) Gris. Abh. K. Ges. Wiss. Goettingen **7**: 257 (1857).

COAHUILA: Torreon, periodically flooded land, 1898, *Palmer 466*. CHIHUAHUA: Guadalupe, about pond, Oct. 11, 1852, *Thurber 805*.

Lophotocarpus calycinus (Engelm.) J. G. Smith, Lophot. U. S. 3 (Sept. 1899).

COAHUILA: Hermanas, *Marsh 2260*.

Eastern United States west to South Dakota and New Mexico, and south in Coahuila.

Lophotocarpus fluitans (Engelm.) J. G. Smith, Lophot. U. S. 1 (Sept. 1899).

The type of this species, of southern New Mexico and trans-Pecos Texas, was collected by Wright (nos. *1899* and *679*) in ponds in the bottom-land of the Rio Grande near San Elizario, Texas.

Sagittaria longiloba Engelm. ex Torr. Bot. Mex. Bound. 212 (1859).

This species has been repeatedly collected in the wet bottom-lands along the Rio Grande between El Paso and old Fort Quitman, Texas. It ranges from central United States south into Mexico. The type came from near San Elizario, Texas.

GRAMINEAE

Bromus Schaffneri (Fourn.) Scribn. & Merr. U. S. Dept. Agric., Div. Agrost. Bull. **24**: 30 (Jan. 1901); Scribn. Bull. Torr. Bot. Cl. **28**: 246 (April, 1901).

COAHUILA: Saltillo, 1898, *Palmer 5, 266;* Parras, May 15, 1847, *Gregg*. ZACATECAS: Valley 15 km. west of Concepcion del Oro, *Stanford et al. 556*.

A common, chiefly ruderal species of central Mexico. Collections have been generally identified as *B. laciniatus* Beal, but that is a montane plant obviously distinct from the weedy species concerned here.

Bromus sp.

CHIHUAHUA: Sierra Organos, 1937, *LeSueur 211* in pt.

The collection is similar to the plant of Arizona and New Mexico referred to *B. carinatus*.

Bromus sp.

COAHUILA: Mesa Grande, 40 km. northwest of Hac. Encantada, common in meadows, *Stewart 1633;* Hillcoat Mesa, west of Encantada Ranch, July 25, 1938, *Marsh 1439*.

Similar to the plants of the Chisos and Davis Mountains of Texas passing as *B. marginatus* and *B. polyanthus*.

Bromus anomalus Rupr. ex Fourn. Mex. Pl. **2**: 126 (1886).

COAHUILA: Sierra del Carmen, Aug. 26, 1936, *Marsh 628;* Hillcoat Canyon, west of Buena Vista Ranch, July 13, 1938, *Marsh 1309;* trail between Encantada Mesa and Fresno Mesa, July 20, 1938, *Marsh 1399;* Sierra Gloria, *Marsh 1945, 1947;* Carneros Pass area, July 1880, *Palmer 1372;* Sierra del Pino, La Noria, in shaded arroyo and damp meadow, *Johnston & Muller 497, Stewart 1213;* Sierra Madera, Cañon Charretera, rocky arroyo in oak belt, *Johnston 8926*. CHIHUAHUA: Sierra Organos, 1937, *LeSueur 211* in pt.

Widely distributed in western United States and south to southern Mexico. A very variable species, particularly in the amounts and distribution of indument. The material from the Sierra del Pino and the Sierra

Madera represents a hairy robust form with broad leaves and a large drooping panicle.

Brachypodium mexicanum (R. & S.) Link, Hort. Berol. **1:** 41 (1833).

COAHUILA: Sierra del Carmen, Aug. 26, 1936, *Marsh 613;* Sierras Negras, 9 km. south of Parras, *Stanford et al. 230.*

Coahuila and Nuevo Leon south to Central America. A very variable species with forms differing greatly in appearance, apparently even in a single locality. The cited collections have very narrow leaves and short-awned lemmas.

Festuca ligulata Swallen, Am. Jour. Bot. **19:** 436 (1932).

COAHUILA: Mountains 24 km. northwest of Fraile, *Stanford et al. 405.*

A coarser, densely tufted plant, with the spikelets larger than in the type of the species from the Guadalupe Mts., Texas, but apparently better referred to *F. ligulata* than to the more northern *F. Thurberi.*

Poa sp.

COAHUILA: Parras, March 1905, *Purpus 1112;* Sierra de Parras, April 1905, *Purpus 1146;* Sierras Negras, 9 km. south of Parras, *Stanford et al. 167.* ZACATECAS: 15 km. west of Concepcion del Oro, *Stanford et al. 477.*

I am unable to name this species. The collection from the Sierras Negras has been identified as *P. involuta* Hitchc.

Poa sp.

COAHUILA: 6 mi. east of Saltillo, 1880, *Palmer 1366.*

The cited specimen has been identified as *P. Ruprechtii* Peyr.

Poa Bigelovii Vasey & Scribn. Descr. Cat. Grasses U. S. 81 (1885).

COAHUILA: Saltillo, 1905, *Palmer 532.*

Oklahoma and western Texas to southern California and south into northern Mexico. The species has been repeatedly collected about El Paso, Texas, and is to be expected in adjacent northern Chihuahua.

Poa annua L. Sp. Pl. 68 (1753).

COAHUILA: Saltillo, 1905, *Palmer 711;* Saltillo, 1898, *Palmer 6;* Saltillo, *Gregg.* CHIHUAHUA: Chihuahua, 1908, *Palmer 28.*

A European grass, widely established in the United States and Mexico.

Eragrostis obtusiflora Scribn. U. S. Dept. Agric., Div. Agrost. Bull. **8:** 10. *t. 5* (1897).

CHIHUAHUA: Margin of Laguna de Santa Maria, April 20, 1852, *Wright 193* (ISOTYPE); near Laguna Santa Maria, 1899, *Nelson 6413.*

Known only from saline soils in northwestern Chihuahua, southwestern New Mexico, and southeastern Arizona. It much resembles *Distichlis stricta* in general habit.

Eragrostis curtipedicellata Buckl. Proc. Acad. Nat. Sci. Phila. **1862:** 97 (1863).

COAHUILA: Don Martin Dam, *Harvey 932.*

Kansas and New Mexico to Texas and northeastern Coahuila.

Eragrostis reptans (Michx.) Nees, Agrost. Bras. 514 (1829).

COAHUILA: Don Martin Dam, mud flats, *Harvey 927, 928.*

Kentucky to South Dakota and Texas, south into northeastern Mexico.

Eragrostis megastachya (Koel.) Link, Hort. Berol. **1:** 187 (1827).

COAHUILA: Near Don Martin Dam, *Harvey 948;* Sabinas, *Nelson 6823* (US); Saltillo, 1898, *Palmer 389;* valley-floor east of Puerto Caballo, near bushes by ephemeral charco, *Johnston 8330;* Sierra Cruces, 4 mi. west of Santa Elena, black loam on flats, *Stewart 828;* north of Sierra Cruces, west of San Rafael, on sabaneta, *Johnston & Muller 1038;* 7 mi. south of Jaco, about mogote, *Johnston & Muller 1110.* CHIHUAHUA: Rancho El Pino, southeast of Sierra Rica, slopes, *Stewart 2399;* Pirámide, under oak tree on gravelly flat, *Johnston 8119;* 10 mi. southeast of Organos, under bushes at foot of grassy slope, *Stewart & Johnston 2036A;* Cañon del Coyote, 20 km. northwest of Santa Fe, in mogote, *Stewart 2607;* Chihuahua, *LeSueur 83, 122;* 20 km. south of Camargo, arroyo, *Harvey 1377.* DURANGO: Tlahualilo, barren hills, *Pittier 475* (US).

A European weed, widely introduced in America. Where I have seen this plant in Coahuila and Chihuahua, however, it behaves like an indigenous species, associating with indutable native species and growing with them in remote undisturbed places where a single introduced species is certainly not to be expected.

Eragrostis diffusa Buckl. Proc. Acad. Nat. Sci. Phila. **1862:** 97 (1863).

COAHUILA: Saltillo, 1898, *Palmer 811, 812;* 7 mi. south of Jaco, about a mogote, *Johnston & Muller 1109;* Torreon, low ground along the Rio Nazas, 1898, *Palmer 510.* CHIHUAHUA: Pirámide, moist rocky soil, *Johnston 8137;* Ojo Almagre, Sierra Almagre, wet sand in canyon, *Johnston & Muller 1214;* Chihuahua, *Pringle 416, LeSueur 78;* 3 mi. north of Charca Piedra, under bushes on silty plain, *Johnston 7929;* Camargo, banks of the Rio Conchos, *Harvey 1404;* 50 km. west of Camargo, *Harvey 1414;* Jimenez, banks of the Rio Florido, *Harvey 1313.*

Central Texas to Arizona and south into northern Mexico.

Eragrostis sp.

COAHUILA: Saltillo, 1898, *Palmer 376;* Sierra del Pino, La Noria, meadows and open hillsides, *Stewart 1205.* CHIHUAHUA: Rancho El Pino, southeast of Sierra Rica, slopes, *Stewart 2400;* canyon west of Organos, damp gravelly arroyo, *Stewart & Johnston 2081.*

Closely related to *E. diffusa* and perhaps only a form of it, differing in its dense elongate inflorescence. The branches of the panicle are very short and strict and bear crowded strictly ascending spikelets. In typical *E. diffusa* the panicle is open, with elongate spreading branches. I have seen the plant from Coahuila, Chihuahua, trans-Pecos Texas, and New Mexico.

Eragrostis mexicana (Hornem.) Link, Hort. Berol. **1:** 190 (1827).

COAHUILA: Monclova, 1939, *Marsh 1834;* Saltillo, 1898, *Palmer 409—412;* Saltillo, 1905, *Palmer 710;* San Lorenzo Canyon, 6 mi. southeast of Saltillo, about old goat pen in canyon, 1904, *Palmer 398;* Chojo Grande, 27 mi. southeast of Saltillo, 1904, *Palmer 334, 335;* Parras, 1880, *Palmer 1367.*

Texas to Arizona and south through Mexico to South America.

Eragrostis neomexicana Vasey, Contr. U. S. Nat. Herb. **2:** 542 (1894).

COAHUILA: Sierra del Carmen, El Jardin del Sur, Sept. 3, 1936, *Marsh 766.*

Western Texas to Arizona.

Eragrostis caudata Fourn. Mex. Pl. **2:** 115 (1881).

Eragrostis Palmeri Wats. Proc. Am. Acad. **18:** 182 (1883).

Eragrostis erosa Scribn. ex Beal, Grasses No. Am. **2:** 483 (1896).

COAHUILA: Villa Juarez, 1880, *Palmer 1368* (type of *E. Palmeri*); Sierra del Pino, La Noria, arroyo banks, *Johnston & Muller 664;* Sierra Cruces, 5 mi. south of Santa

Elena, rocky flat among bushes, *Johnston & Muller 1378;* western base of Picacho del Fuste, brushy rocky slope, *Johnston 8413;* Sierra Madera, Cañon Charretera, edge of thickets on rocky flat, *Johnston 9062;* west end of Sierra Fragua, Aguaje Pajarito, rocky ridge, *Johnston 8676;* high rocky west ridge of Sierra Fragua, north of Puerto Colorado, *Johnston 8760;* Sierras Negras, 9 km. south of Parras, *Stanford et al. 135.* CHIHUAHUA: Sierra Santa Eulalia, Oct. 1885, *Pringle 415* (isotype of *E. erosa*).

Southern and western Texas south into Chihuahua, Coahuila, and northern Tamaulipas. An isotype of *E. caudata* (from Matamores) at the Gray Herbarium is evidently conspecific with the type of *E. Palmeri.* From isotypic material of *E. erosa* they differ only in their slightly smaller spikelets.

Eragrostis intermedia Hitchc. Jour. Wash. Acad. **23:** 450 (1933).

COAHUILA: Allende, *Marsh 2237;* Sierra del Carmen, Sept. 2, 1936, *Marsh 800;* Santo Domingo, igneous hill, *Wynd & Mueller 476;* Palm Canyon near Muzquiz, *Marsh 979;* Hillcoat Mesa, west of Encantada Ranch, July 25, 1938, *Marsh 1452;* between south end of Hillcoat Mesa and Buena Vista headquarters, July 27, 1938, *Marsh 1510;* Rancho Santa Teresa, south of Castaños, *Wynd & Mueller 200;* Saltillo, 1909, *Arsène;* Saltillo, 1898, *Palmer 408;* Sierra del Pino, La Noria, hillsides and along arroyo, *Johnston & Muller 498, Stewart 1203.*

Central Texas west to Arizona and south into northern Mexico. A densely tufted perennial with tall erect culms. Habitally very similar to *E. caudata* but differing in having hairy nodes in the panicle, spreading spikelets, and a more open usually proportionately broader inflorescence. Some of the collections from northeastern Coahuila have rather small spikelets and approach *E. lugens* Nees, a widely distributed species in tropical America, which extends northward through Mexico to eastern Texas.

Monanthochloë littoralis Engelm. Trans. Acad. Sci. St. Louis **1:** 437 (1859).

COAHUILA: 4 mi. west of Cuatro Cienegas, common in strongly saline and gypseous soil on flat, *Johnston 7129.*

This species has been known only from salt marshes about the Gulf of Mexico and along the Pacific coast of Mexico and adjacent United States. The material from Cuatro Cienegas is sterile, but in all vegetative details it agrees with material from coastal salt marshes. The plant grows only a few centimeters high, from well-developed scaly rhizomes, and covers small areas of very saline gypsiferous soil.

Distichlis texana (Vasey) Scribn. U. S. Dept. Agric., Div. Agrost. Cir. **16:** 2 (1899).

COAHUILA: Torreon, large masses on sandy banks of Rio Nazas, 18–24 inches high, with runners rooting at the nodes, Oct. 1898, *Palmer 507.*

A coarse grass with long trailing stolons, growing in sandy places. The species has been collected near the Rio Grande at Presidio and Castolon, Texas, and hence it may be expected in northern Coahuila and northeastern Chihuahua.

Distichlis stricta (Torr.) Rydb. Bull. Torr. Bot. Cl. **32:** 602 (1905).

COAHUILA: Cuatro Cienegas, saline soil, *Johnston 7125, Harvey 1234, Marsh 2080;* Laguna de Jaco, salt flats at south end of lake, *Johnston & Muller 1089.* CHIHUAHUA: Laguna de Santa Maria, 1899, *Nelson 6416.*

A salt grass widely distributed over western United States and Mexico. It has been collected at many stations along the Rio Grande.

Arundo Donax L. Sp. Pl. 81 (1753).

VERNACULAR NAME: Carrizo.

COAHUILA: Palm Canyon, near Muzquiz, *Marsh 975;* Monclova, 1880, *Palmer 1345;* Monclova, *Harvey 1132.*

Texas to California and southward. A plant of the Old World, now widely established in the warmer parts of America. Well established along the Rio Grande and elsewhere about ponds and streams in our area.

Phragmites communis Trin. Fund. Agrost. 134 (1820).

Collected along the Texan bank of the Rio Grande and hence to be expected in northern Coahuila and Chihuahua. Widely distributed in the warmer parts of the world.

Melica montezumae Piper, Proc. Biol. Soc. Wash. **18**: 144 (1905).
Melica alba Hitchc. Contr. U. S. Nat. Herb. **17**: 367 (1913).

COAHUILA: San Lorenzo Canyon, 6 mi. southeast of Saltillo, 1905, *Palmer 551;* Sierra Mojada, April 19, 1892, *Jones 482* (US). CHIHUAHUA: Sierra Santa Eulalia, shaded places, April 6, 1885, *Pringle 430* (ISOTYPE); Chihuahua, *Wilkinson* (US).

Edwards Plateau and Big Bend, Texas, south into our area. Piper and Hitchcock independently named this species, basing their names on the same group of specimens and indicating the same collections as the type. The species has been taken to be endemic to our area, but Mr. W. S. Boyle, who is monographing the genus, has properly indicated, through his identification of the Gray Herbarium material, that the species is also present in Texas.

Melica nitens Nutt. ex Piper, Bull. Torr. Bot. Cl. **32**: 387 (1905).

COAHUILA: Along arroyo south and west of Sierra Azul, Buena Vista Ranch, July 8, 1938, *Marsh 1230, 1260.*

Eastern United States west to Kansas and Arizona and south through eastern Coahuila to Nuevo Leon.

Triodia pulchella H.B.K. Nov. Gen. et Sp. **1**: 155 (1816).

VERNACULAR NAMES: Zacate borreguerro; Zacate pelillo; Zacatito.

COAHUILA: Sierra del Carmen, Aug. 29, 1936, *Marsh 692;* between Santo Domingo and Piedra Blanca, open country, *Wynd & Mueller 496;* Cuatro Cienegas, *Marsh 2050;* Puerto del Norte, Cuatro Cienegas, *Harvey 1204;* near Sacramento, gravelly wash, *Johnston 7085;* Saltillo, 1898, *Palmer 257, 413;* 10 mi. east of Fraile, stony bahada, *Johnston 7307;* near Santa Elena, eastern foothills of Sierra Cruces, gravelly flat, *Stewart 840;* Puerto Ventanillas, south of Las Delicias, limestone slope, *Stewart 2967;* Parras, 1880, *Palmer 1359.* CHIHUAHUA: Laguna Santa Maria, *Nelson 6414;* Chihuahua, *LeSueur 11;* 20 mi. south of Camargo, *Harvey 1399.* DURANGO: Torreon, rocky hills, *Hitchcock 7547* (US); Tlahualilo, barren hills, *Pittier 480;* Cerro San Ignacio, *Purpus 4616* (US). ZACATECAS: Concepcion del Oro, very common, 1904, *Palmer 263;* valley 15 km. west of Concepcion del Oro, *Stanford et al. 560;* Cedros, footslopes and hills, *Lloyd 89* (US).

Western Texas to southern Nevada and southern California, south to central Mexico. A common but unobtrusive widely distributed, almost ubiquitous, grass among the desert scrub on dry slopes and in desert valleys. A capable xerophyte that flowers throughout the summer and appears to remain unaffected by long droughts. Although it is frequently locally abundant, horses and cattle ignore it if any other food is available. During long dry spells the plants appear to become shaggy-white-villous. The shaggy indument disappears after a rain and is apparently composed of myriads of hair-like water-soluble crystals which are products of transpiration.

Triodia pilosa (Buckl.) Merr. U. S. Dept. Agric., Div. Agrost. Cir. **32:** 9 (1901).

COAHUILA: Don Martin Dam, *Harvey 933;* calcareous soil near Piedras Negras, *Pringle 8306;* Puerto Santa Anna, *Marsh 942;* Yerda Spring, *Marsh 296;* Hillcoat Mesa, west of Encantada Ranch, July 25, 1938, *Marsh 1448;* Cañon Espantosa, Sierra San Vicente, *Schroeder 136.*

Kansas and Texas to Nevada and Arizona, south into northeastern Mexico.

Triodia avenacea H.B.K. Nov. Gen. et Sp. **1:** 156 (1816).

COAHUILA: 3 km. southwest of Fraile, in arroyo, *Stanford et al. 331.* ZACATECAS: Concepcion del Oro, stony mesa, 1904, *Palmer 280;* valley 15 km. west of Concepcion del Oro, *Stanford et al. 561.*

Northern Zacatecas and Nuevo Leon southward to central Mexico. A low spreading plant, with stolons.

Triodia grandiflora Vasey, Contr. U. S. Nat. Herb. **1:** 59 (1890).
Triodia Nealleyi Vasey, U. S. Dept. Agric., Div. Bot. Bull. **12**^{2}: *t. 36* (1891).

COAHUILA: Saltillo, 1898, stony hillside, *Palmer 414, 813;* Saltillo, 1905, *Palmer 735;* base of mountains 3 mi. southeast of Saltillo, *Johnston 7252;* La Rosa, limestone hills, *Shreve & Tinkham 9575;* hills 20 mi. west of Saltillo, *Shreve & Tinkham 9824;* Sierra Guajes, Cañon Madera, east of Buena Vista, hillside, *Stewart 1505;* Sierra del Pino, rocky crest of ridge west of La Noria, *Johnston & Muller 602;* western base of Picacho del Fuste, rocky slope, *Johnston 8441;* Sierra Madera, Cañon Charretera, ledge on sunny hillside, *Johnston 9102;* San Antonio de los Alamos, top of tuff cliffs, *Johnston 8253;* Sierra Cruces, Cañon Tinaja Blanca, crest of sierras, *Johnston & Muller 297;* eastern foothills of Sierra Cruces, north of Santa Elena, rocky flats, *Johnston & Muller 1384;* west of Santa Elena, sunny hillside, *Stewart 827.* CHIHUAHUA: Sierra Virulento, rocky slope, *Johnston 8093A;* Sierra Santa Eulalia, Aug. 12, 1885, *Pringle 406.* ZACATECAS: Concepcion del Oro, 1904, *Palmer 265.*

Although I am following Hitchcock in delimiting this species, I am convinced that it is an aggregate containing several undifferentiated species. Typical *T. grandiflora* is a plant with the habit of *T. pilosa,* having usually pale well-developed spikelets with acute or subulate lemma-lobes. *Triodia Nealleyi* is a species more closely related to *T. avenacea* and has a spicate crowded inflorescence, in which the individual spikelets are less obvious, smaller, usually reddish, and the lemma-lobes elongate-spreading and obtuse. Both of these forms are present in our area. Plants from Chihuahua and Arizona are distinguishable, but are unnamed. Certain plants from the Sierra Guajes, Sierra del Pino, and Sierra Madera are also separable, but without a name. The aggregate of forms here included ranges from western Texas to Arizona and south in eastern Mexico to Hidalgo and Oaxaca.

Triodia texana Wats. Proc. Am. Acad. **18:** 180 (1883).

COAHUILA: Rio Grande Valley near Piedras Negras, *Pringle 9019;* Allende, *Marsh 1798;* 11 mi. south of Allende, tree-lined arroyo, *Johnston 7017;* Yerda Spring, *Marsh 286;* Monclova, 1880, *Palmer 1371;* near Rancho Teresa, south of Castaños, moist place in desert, *Wynd & Mueller 178.*

Central and southern Texas and northeastern Mexico.

Triodia albescens Vasey, U. S. Dept. Agric., Div. Bot. Bull. **12²:** *t. 33* (1891).

COAHUILA: Rio Grande Valley near Piedras Negras, *Pringle 9023;* 21 mi. south of Sabinas, *Johnston 7041.*

Texas and Kansas to Colorado and New Mexico, south into northeastern Coahuila.

Triodia mutica (Torr.) Scribn. Bull. Torr. Bot. Cl. **10:** 30 (1883).

COAHUILA: Sierra del Carmen, Sept. 13, 1936, *Marsh 908;* Hillcoat Mesa, west of Encantada Ranch, July 25, 1938, *Marsh 2270;* 2 mi. northwest of Fronteras, road to Natadores, silty *Larrea* desert, *Johnston 7174;* near Sacramento, silty bajada, *Johnston 7091;* Santa Teresa, south of Castaños, *Wynd & Mueller 196;* 3 mi. east of Cuatro Cienegas, rocky bajada, *Johnston 7110;* between Hac. La Rosa and Hac. Lechuguilla, dry desert, *Wynd & Mueller 62;* 14 mi. east of Paila, *Shreve & Tinkham 9891;* hills 20 mi. west of Saltillo, *Shreve & Tinkham 9820;* mountains west of Saltillo, 1880, *Palmer 2020;* foothills of the Sierra Cruces north of Santa Elena, stony flats among brush, *Johnston & Muller 1016, 1377;* western base of the Picacho del Fuste, bushy rocky flat, *Johnston 8414.* CHIHUAHUA: Sierra Santa Eulalia, dry calcareous soil, *Pringle 405;* arroyo 20 km. south of Camargo, *Harvey 1376.* DURANGO: Tlahualilo, barren hills, *Pittier 468* (US).

Texas to Arizona and south into northern Mexico.

Blepharidachne Bigelovii (Wats.) Hack. in DC. Monogr. Phan. **6:** 261 (1889).

COAHUILA: Several miles west of Buenavista, on road between San Antonio de los Alamos and Puerto Caballo, banks of gypsiferous shales, small clumps 1–3 inches broad, pale, frequent, leaves very pungent, *Johnston 8309;* south of Laguna de Leche, confined to gypsiferous shales, rigid, erect, local, leaves pungent, *Johnston 8615;* northern foothills of the Sierra Cruces, about 10 mi. north of Santa Elena, gypsiferous shales, local, *Johnston 9411;* east base of Picacho de San José, gypsiferous shales, *Johnston 9401.* TEXAS: Rustler Springs, Culberson Co., 1928, *Cory 1238;* rocky hills near Frontera, north of El Paso, in small compact bunches, May 4, 1852, *Wright 2028* (TYPE); rocky hills near Frontera, May 4, 1852, *Bigelow;* Frontera, July 1852, *Parry.*

Known only from the collections cited. Where I have seen the plant it was confined to thin gypsum seams in Upper Cretaceous shales. Since gypsum is present in the areas in Texas where it has been collected, the probabilities are that the species is gypsophilous. The plant forms very strict stiff tufts less than a decimeter tall. The pale rigid leaves have a pungent tip. Because of its distinctive appearance it is readily recognizable, even in the sterile state.

Cottea pappophoroides Kunth, Rév. Gram. **1:** 84 (1829).

COAHUILA: Sierra Hechiceros, Cañon Indio Felipe, sides of dry arroyo, *Stewart 175;* gypsum beds in the valley between La Vibora and Matrimonio Viejo, *Johnston 9340;* 16 mi. south of Laguna del Rey, gypsum plain, *Johnston 7816;* Rancho Las Uvas, Valle Acatita, frequent on gypsum flats, *Stewart 2695.* CHIHUAHUA: Chihuahua, rocky hills near Millers Dam, Sept. 12, 1885, *Pringle 420;* 20 km. south of Camargo, *Harvey 1395.* DURANGO: Torreon, rocky hill, *Hitchcock 7543* (US).

Southern and western Texas to Arizona and south to southern Mexico; also in South America. The type came from Peru. Although obviously not confined to gypsum, the species frequently occurs on gypsum in Coahuila, and where I have seen it, it is locally confined to that substratum. On gypsum the plants form a very dense caudex of stem-bases and cleistogenes that becomes 3–7 cm. in diameter, although supporting only a relatively few leafy stems. Plants from other substrata develop very loose caudices or none at all. I can detect no other differences between these plants.

Pappophorum Wrightii Wats. Proc. Am. Acad. **18:** 178 (1883).

COAHUILA: Mt. Carmel Canyon, Rio Grande, *Parry;* Saltillo, in graveyard, 1898, *Palmer 395;* near Rosario, about mogote, *Johnston 8823;* 42 mi. west of Saltillo, *Shreve & Tinkham 9838;* San Antonio de los Alamos, summit of tuff cliffs, gravelly flat, *Johnston 8256;* valley between La Vibora and Matrimonio Viejo, margin of gypsum beds, *Johnston 9351;* Parras, 1880, *Palmer 1361;* Castillon, on gypsum flat, *Johnston & Muller 1269;* north of Sierra Cruces, sabaneta west of San Rafael, *Johnston & Muller 1039;* gypsum ridge east of Laguna de Jaco, *Stewart & Johnston 1965.* CHIHUAHUA: Pirámide, gravelly flat under liveoak, *Johnston 8116;* San José del Progreso, south end of Sierra Seca, gypsum flats, *Stewart 2324;* Charco de Grado, Oct. 1852, *Thurber 825;* Chihuahua, *LeSueur 45;* Jimenez, banks of the Rio Florido, *Harvey 1329;* 6 mi. west of Piloncillo, lava hillside, *Johnston 7876.*

Central Texas to Arizona and south to Oaxaca; western South America. As with *Cottea,* this grass, although not restricted to gypsum, is encountered most frequently about gypsum beds and usually in greater abundance there than on other substrata.

Pappophorum mucronulatum Nees, Agrost. Bras. 412 (1829).

COAHUILA: Cuatro Cienegas, *Marsh 2048;* west of Puerto de las Monjas, mouth of arroyo, *Johnston 8641;* Saltillo, dry ground near irrigated field, *Hitchcock 450;* Saltillo, common in graveyard, 1898, *Palmer 377;* near La Rosa, *Shreve & Tinkham 9904;* Parras, 1880, *Palmer 1360.*

Texas to Arizona and northern Mexico.

Pappophorum bicolor Fourn. Mex. Pl. **2:** 133 (1886).

COAHUILA: Don Martin Dam, *Harvey 939;* 21 mi. south of Sabinas, bank of arroyo, *Johnston 7047;* Hermanas, *Marsh 1591;* Monclova, 1880, *Palmer 1362;* near Rancho Santa Teresa, south of Castaños, *Wynd & Mueller 203;* hills 20 mi. west of Saltillo, *Shreve & Tinkham 9834;* on plain 1 mi. south of Ocampo, in mogote, *Johnston 8885;* 7 mi. south of Jaco, near mogote, *Johnston & Muller 1107.*

Texas to Arizona and south into northeastern Mexico.

Scleropogon brevifolius Phil. Ann. Univ. Chile **36:** 206 (1870).

VERNACULAR NAMES: Colo del Zorro; Zacate del Burro.

COAHUILA: Sierra del Carmen, Sept. 13, 1936, *Marsh 898;* Muzquiz, *Marsh 1118;* Saltillo, colonies in depressions on mesas, 1898, *Palmer 386;* Chojo Grande, 27 mi. southeast of Saltillo, level places on mesas, 1904, *Palmer 340;* Parras, Oct. 1910, *Palmer 5005.* CHIHUAHUA: Candelaria, *Stearns 254* (US); Villa Ahumada, *LeSueur 72;* Santa Eulalia Plains, 1885, *Wilkinson* (US); 15 km. south of Camargo, *Harvey 1401, 1402.* ZACATECAS: Cedros, *Lloyd 169* (US).

Western Texas to Colorado and Arizona and south to southern Mexico; Argentina. A common and characteristic grass of the silty valley soils in Coahuila, especially of the flat area where some run-off temporarily accumulates during rains. Frequently associated with tobosa (*Hilaria mutica*) and common about the margin of well-developed tobosa flats. The sabanetas of Coahuila, level grassy places of varying size scattered in the desert scrub on the gentle slopes of the major valleys or in the broad open canyons, are usually dominated by this grass. The plant spreads by rhizomes and large areas may be covered by a pure colony of the plant. The awns are usually stramineous but occasional plants have the awns pink and so permit an observer to determine the extent of an individual plant in the colony. I have noted plants covering three or four square meters and so dominating its particular area that adjoining plants of the species scarcely transgress upon it. The plants are extremely prolific and during the summer the female plants are a mass of fruiting inflorescences; although useless as animal food, they are an attractive element in the desert scene.

Agropyron sp.

COAHUILA: Hillcoat Canyon, west of Buena Vista Ranch, July 13, 1938, *Marsh 1304;* Sierra Gloria, *Marsh 1949.*

The cited specimens belong to the group of *A. arizonicum* and *A. spicatum,* but differ from them in their large, elongate, attenuate, awn-tipped glumes.

Elymus canadensis L. Sp. Pl. 83 (1753).

COAHUILA: Sierra del Carmen, Cañon Sentenela, *Wynd & Mueller 529;* Sierra del Carmen, Aug. 9, 1936, *Marsh 635;* Hillcoat Mesa, west of Encantada Ranch, July 25, 1938, *Marsh 1440;* Saltillo, in orchard, 1898, *Palmer 260;* Saltillo, frequent, July 16, 1848, *Gregg 263.* CHIHUAHUA: 5 km. west of Camargo, *Harvey 1406.*

Widely distributed in the United States, extending south into Chihuahua, Coahuila, and Nuevo Leon.

Sitanion Hystrix (Nutt.) J. G. Smith, U. S. Dept. Agric., Div. Agrost. Bull. **18:** 15 (1899).

COAHUILA: Sierra del Carmen, Sept. 8, 1936, *Marsh 788;* Hillcoat Canyon, west of Buena Vista Ranch, July 13, 1938, *Marsh 1312;* Hillcoat Mesa, west of Encantada Ranch, July 25, 1938, *Marsh 1436;* north end of Carneros Pass, infrequent, tufts among cacti, spikes nodding, *Johnston 7290.* ZACATECAS: 15 km. west of Concepcion del Oro, 18–30 inches tall, *Stanford et al. 555.*

Western United States and adjacent Mexico; south along the eastern Sierra Madre to central Mexico.

Koeleria cristata (L.) Pers. Syn. Pl. **1:** 97 (1905).

COAHUILA: Sierra del Carmen, Cañon Sentenela, *Wynd & Mueller 539;* Sierra del Carmen, Aug. 26, 1936, *Marsh 631;* Hillcoat Canyon, west of Buena Vista Ranch, July 13, 1938, *Marsh 1315;* Hillcoat Mesa, west of Encantada Ranch, July 25, 1938, *Marsh 1445;* Sierra Gloria, *Marsh 1902, 1944.*

Widely distributed in the United States; in Mexico extending south in the mountains to Central America.

Sphenopholis obtusata (Michx.) Scribn. Rhodora **8:** 144 (1906).

COAHUILA: Rio Grande Valley at Piedras Negras, April 17, 1900, *Pringle 8285.*

Widely distributed in the United States and south to southern Mexico.

Trisetum deyeuxioides (H.B.K.) Kunth, Rév. Gram. 102 (1829).

Hitchcock, Contr. U. S. Nat. Herb. **17:** 325 (1913), reports a collection of Pringle (no. *1432*) from wet banks of a stream in the Mapula Mts. In his published diaries Pringle mentions collecting the species in the Mapula Mts. on Oct. 30, 1886. The species is known from the mountains of Chihuahua and south to southern Mexico.

Avena fatua L. Sp. Pl. 80 (1753).

COAHUILA: Saltillo, old field, April 1898, *Palmer 8.*

A European weed, widely introduced in the United States and Mexico.

Danthonia mexicana Scribn. Proc. Acad. Nat. Sci. Phila. **1891**: 301 (1891).

COAHUILA: West base of Picacho del Fuste, coarse tufts on limestone ledges on north slope, *Johnston 8382;* Carneros Pass, limestone ledges, Sept. 20, 1890, *Pringle 3279* (ISOTYPE); Sierra de Parras, April 1905, *Purpus 1125* in pt.

A rare species, known only from the stations cited above, and from Tehuacan, Puebla.

Agrostis semiverticillata (Forsk.) C. Chr. Dansk. Bot. Arkiv 4^3: 12 (1922).

COAHUILA: Muzquiz, Sabinas River, 1936, *Marsh 410;* Muzquiz, 1938, *Marsh 1157, 1169;* Hermanas, 1939, *Marsh 1621;* Monclova, 1939, *Marsh 1697;* Saltillo, 1905, *Palmer 527;* Saltillo, 1898, *Palmer 806;* San Juan de la Vaqueria, May 25, 1847, *Gregg 711;* Parras, 1880, *Palmer 2019;* Parras, Feb. 1905, *Purpus 1111.* CHIHUAHUA: Chihuahua, low meadows, 1908, *Palmer 29;* Chihuahua, wet river bank in shade, 1908, *Palmer 160;* 2 km. west of Jimenez, *Harvey 1315.*

A species of the Old World, now widely distributed in wet soils in the warmer parts of America.

Agrostis exarata Trin. Gram. Unifl. 207 (1824).

COAHUILA: Sierra del Carmen, Cañon Sentenela, *Wynd & Mueller 547.*

From Alaska south through western United States into northern Mexico.

Agrostis hiemalis (Walp.) B.S.P. Prelim. Cat. N. Y. 68 (1888).

COAHUILA: Sierra del Carmen, Cañon Sentenela, *Wynd & Mueller 544.*

Boreal North America south into the mountains of northern Mexico.

Polypogon monspeliensis (L.) Desf. Fl. Atlant. **1**: 67 (1798).

CHIHUAHUA: 2 km. west of Jimenez, *Harvey 1317.*

A European weed, widely distributed in the United States and northern Mexico.

Polypogon elongatus H.B.K. Nov. Gen. et Sp. **1**: 134 (1815).

COAHUILA: Saltillo, along water in ditch, in garden, 1898, *Palmer 2.* CHIHUAHUA: Presa de Chihuahua, 1936, *LeSueur 150.*

Wet soils from southern Arizona south through Mexico, reaching South America.

Lycurus phleoides H.B.K. Nov. Gen. et Sp. **1**: 142. *t. 45* (1815).

Lycurus phleoides var. *glaucifolius* Beal, Grasses No. Am. **2**: 271 (1896).

COAHUILA: Sierra del Carmen, Aug. 14, 1936, *Marsh 658;* limestone hill near Santo Domingo, *Wynd & Mueller 454;* Hillcoat Canyon, west of Buena Vista Ranch, July 13, 1938, *Marsh 1274, 1285;* Mesa Grande, 40 km. northwest of Hac. Encantada, meadows, *Stewart 1631;* base of mountains 3 mi. southeast of Saltillo, *Johnston 7250;* Chojo Grande, 27 mi. southeast of Saltillo, bunches in sandy gravel in canyon, 1904, *Palmer 339;* Sierra del Pino, La Noria, flats and meadows, *Johnston & Muller 460, Stewart 1210;* west base of Picacho del Fuste, banks of cemented gravels, *Johnston 8444;* Sierra Cruces, Cañon Tinaja Blanca, rocky slopes on crest at head of canyon, *Stewart 1950;* San Antonio de los Alamos, gravelly flats above cliffs, *Johnston 8252a.* CHIHUAHUA: rocky hills near Chihuahua, May 28, 1885, *Pringle 426* (isotype of var. *glaucifolius*); Chihuahua, 1935, *LeSueur 76.* ZACATECAS: Valley 15 km. west of Concepcion del Oro, *Stanford et al. 476.*

Ranging from Oklahoma and western Texas west to Arizona and south in Mexico to Guanajuato (the type locality), Hidalgo, and Puebla. The species is frequent on rocky soils in our area.

Hitchcock, Contr. U. S. Nat. Herb. **17:** 305 (1913), reports *L. phalaroides* H.B.K. from Cedros, Zac. (*Lloyd 179*). The report needs verification. Perhaps a slender specimen of *L. phleoides* is involved.

Muhlenbergia biloba Hitchc. Contr. U. S. Nat. Herb. **17:** 294 (1913).

Bealia mexicana Scribn. in Hack. True Grasses 103 (1890).

CHIHUAHUA: Hills northwest of Chihuahua, Oct. 7, 1886, *Pringle 819* (ISOTYPE).

Known from a few stations in Baja California, Chihuahua, and Durango.

Muhlenbergia texana Buckl. Proc. Acad. Nat. Sci. Phila. **1862:** 91 (1863).

CHIHUAHUA: Volcanic hills 20 km. north of Chihuahua, open canyon, in gravel of stream-bed, *Stewart & Johnston 2139;* hills northeast of Chihuahua, wet ledges, Oct. 7, 1885, *Pringle 399;* rocky hills northwest of Chihuahua, gravel bars of stream, Oct. 21, 1885, *Pringle 400.*

Trans-Pecos Texas to Arizona and south along the Sierra Madre, in Chihuahua and Sonora, to Durango.

Muhlenbergia crispiseta Hitchc. No. Am. Fl. **17:** 440 (1935).

CHIHUAHUA: Mapula Mts., thin soil of summits, Nov. 11, 1886, *Pringle 824.*

Known from a few collections in San Luis Potosi and the mountains of Chihuahua.

Muhlenbergia implicata (H.B.K.) Kunth, Rév. Gram. **1:** 63 (1829).

CHIHUAHUA: Portrero Peak, east of Mapula station, rocky banks of stream, Oct. 12, 1886, *Pringle 818.*

North through Mexico to Hidalgo, Durango, and Chihuahua.

Muhlenbergia depauperata Scribn. Bot. Gaz. **9:** 187 (1884).

COAHUILA: Along seepage on limestone ledges at top of escarpment at west side of Potrero de la Mula, locally abundant, depressed, *Johnston 9250.* CHIHUAHUA: Pirámide, shaded crevices at base of large rock-masses, *Johnston 8122;* Sierra Santa Eulalia, thin dry soil of ledges, 1885, *Pringle 404.*

Trans-Pecos Texas to Arizona and south to Central Mexico.

Muhlenbergia arenacea (Buckl.) Hitchc. Proc. Biol. Soc. Wash. **41:** 161 (1928).

COAHUILA: Sierra del Carmen, Sept. 13, 1936, *Marsh 907;* northeastern foothills of the Sierra Cruces, 5 mi. south of San Rafael, silty flat in arroyo, *Johnston & Muller 1032;* 3 mi. east of San José, silty flats, *Johnston 8217.* CHIHUAHUA: 50 km. north of Jimenez, in arroyo, *Harvey 1375.* ZACATECAS: Valley 15 km. west of Concepcion del Oro, *Stanford et al. 517.*

Western Texas and adjacent New Mexico south into our area.

Muhlenbergia asperifolia (Nees & Meyen) Parodi, Rev. Fac. Agron. Buenos Aires **6:** 117 (1928).

DURANGO: Mapimi, dense masses in bottom of damp arroyo, 1898, *Palmer 554.*

Western United States south into northern Mexico; also in southern South America. The species has been collected along the Rio Grande near El Paso and is to be expected in northern Chihuahua.

Muhlenbergia glauca (Nees) Mez, Rep. Sp. Nov. **17:** 214 (1921).

COAHUILA: Sierra de la Paila, Oct. 1910, *Purpus 5006;* Sierra Madera, Cañon Charretera, gravelly bed of arroyo, one plant, *Johnston 8906;* Sierra del Pino, La Noria, shaded arroyo-bank, gravelly soil, *Johnston & Muller 466.* CHIHUAHUA: Rocky hills northeast of Chihuahua, cold wet ledges, Sept. 28, 1885, *Pringle 395.*

Trans-Pecos Texas to Arizona and south to central Mexico.

Muhlenbergia Emersleyi Vasey, Contr. U. S. Nat. Herb. **3:** 66 (1892).

COAHUILA: Sierra del Carmen, Aug. 9–26, 1936, *Marsh 624, 655;* trail from southern extremity of Hillcoat Mesa to Buena Vista headquarters, July 27, 1938, *Marsh 1511;* Sierra Madera, Cañon Charretera, bed of arroyo and on rocky flats, *Johnston 8950, 9072;* Sierra Gloria, *Marsh 1948;* San Lorenzo Canyon, 6 mi. southeast of Saltillo, high on canyon side, 1904, *Palmer 401;* Sierra del Pino, La Noria, *Stewart 1208, Johnston & Muller 462, 587.* CHIHUAHUA: Encampanada, Sierra Hechiceros, sunny open slopes, *Stewart 202;* Pirámide, sheltered crevices about base of rock-masses, *Johnston 8118;* Organos, rocky open canyon, *Stewart & Johnston 2066.*

Trans-Pecos Texas to Arizona and south to Durango and Hidalgo. A species of the oak-belt, forming coarse clumps in rocky soil, commonly at the edges of thickets or on sheltered arroyo-banks. The material from eastern Coahuila has a denser stiffer plumbeous, rather than pinkish, panicle, and shorter awns than typical *M. Emersleyi.* This aberrant eastern material, well exemplified by *Palmer 401,* may deserve nomenclatural recognition.

Muhlenbergia lanata (H.B.K.) Hitchc. No. Am. Fl. **17:** 459 (1935).

CHIHUAHUA: Rocky hills northeast of Chihuahua, cool slopes, Oct. 10, 1885, *Pringle 391.*

Known from scattered stations in Chihuahua, and from San Luis Potosi to Puebla.

Muhlenbergia abata sp. nov.

Planta perennis gracilis humilis e rhizomatibus gracilibus oriens; caulibus numerosissimis gracilibus stricte ramosis saepe 1–3 dm. longis rigidulis laxe decumbentibus vel procumbentibus; vaginis quam internodiis 1/4 brevioribus vel eis non raro subaequilongis, maturitate solum partem infra medium internodii culmi amplectantibus, margine scabridulis; ligula ad 1 mm. longa apice rotundata basi decurrente; lamina rigidula plus minusve curvata, 3–6 cm. longa, 1–2 mm. lata, saepe arcte involuta, subtus glabra supra minute scabridula; paniculis scabridulis 2–4 cm. longis paucifloris interruptis angustis subspicatis infra medium brevissime stricteque pauciramosis; spiculis ca. 3 mm. longis strictis acutis elongatis 0.3–5 mm. longe pedicellatis; glumis subaequilongis hyalinis pallidis obscure uninervatis acutis 1.8–2 mm. longis; lemmatibus plumbeis obscurissime nervatis elongatis, supra medium sparse minuteque scabridulis, alibi glabris, apice acutis vel breviter sed distincte rostratis.

TEXAS: Big Springs, 1902, *Tracy 8218;* San Elizario, in field, Sept. 26, 1849, *Wright 746.* NEW MEXICO: Cook's Spring, northern Luna Co., Nov. 3, 1887, *Bigelow;* Ft. Bayard Watershed, Grant Co., 1905, *Blumer 1781;* Mangas Springs, 18 mi. northwest of Silver City, Grant Co., *Metcalfe 774;* valley of the Rio Grande 10–100 mi. above El Paso, *Wright 1982* (TYPE, Gray Herb.). CHIHUAHUA: Chihuahua, Oct. 1935, *LeSueur 50.* SONORA: El Bilito, northeast of El Tigre, Bavispe Area, *Santos 2134.* SAN LUIS POTOSI: 14 mi. northwest of Cedral, dense pure colony in depression near road on desert plain, 1938, *Johnston 7609;* valley of San Luis Potosi, 1876, *Schaffner 1025* in pt.

This is the species accepted as *M. repens* by Hitchcock, No. Am. Fl. **17:** 451 (1935) and Man. Grasses U. S. 362. *fig. 737* (1935). As discussed under the following species, the name "*M. repens*" properly applies to the plant which Hitchcock called *M. utilis*. From the true *M. repens* (that is, *M. utilis*), the present plant differs in its distinctly larger spikelets, scabrid lemmas and pedicels, looser paler acute glumes more than half as long as the lemma, somewhat larger ligule, and coarser stems and leaves. It ranges in western Texas and southern New Mexico south through Chihuahua to San Luis Potosi.

Muhlenbergia repens (Presl) Hitchc. in Jepson, Fl. Calif. **1**: 111 (1912).
Sporobolus repens Presl, Rel. Haenk. **1**: 241 (1830).
Vilfa utilis Torr. Pac. R. R. Rep. **5**[1]: 365 (1857).
Muhlenbergia utilis (Torr.) Hitchc. Jour. Wash. Acad. **23**: 453 (1933).
Vilfa sacatilla Fourn. Mex. Pl. **2**: 101 (1886).

COAHUILA: Parras, May 16, 1847, *Gregg;* Parras, thick masses on alkali bottom, 1898, *Palmer 452*. CHIHUAHUA: Valley of the Sacramento near Chihuahua, by stream, Nov. 6, 1885, *Pringle 418*.

Central Texas, southern California (where probably introduced), Durango, San Luis Potosi, and central Mexico. Hitchcock has treated this plant as *M. utilis*, cf. No. Am. Fl. **17**: 451 (1935) and Man. Grasses U. S. *362. fig. 738* (1935), and applied the name *M. repens* to the plant I have called *M. abata*. The original description of *Sporobolus repens* Presl, and Scribner's illustration, Ann. Mo. Bot. Gard. **10**: 53. *t. 30* (1899), of the isotype of Presl's species at St. Louis leave little doubt as to the precise identity of the species. It is obviously one of the forms of *M. utilis* found in central and southern Mexico.

Muhlenbergia montana (Nutt.) Hitchc. Bull. U. S. Dept. Agric. **772**: 145, 147 (1920).

CHIHUAHUA: High summits of the Sierra Santa Eulalia, 1885, *Pringle 392*.

Western United States south into Chihuahua and Sonora.

Muhlenbergia Porteri Scribn. in Beal, Grasses No. Am. **2**: 259 (1896).

COAHUILA: Don Martin Dam, *Harvey 946;* 2 mi. northwest of Frontera, road to Natadores, silty *Larrea* desert, culms numerous, tangled, spreading, *Johnston 7172;* eastern margin of Llano de Guaje, near La Pistola, forming tangled masses supported by bushes in mogote, *Johnston & Muller 357, 764;* San Antonio de los Alamos, one colony at base of tuff cliffs, *Johnston 8265;* 4 mi. west of Lag. de Leche, sprawling or vining in protection of shrubs, scattered on shrubby desert hillside, *Muller 3285;* Torreon, large masses at base of bushes, 1898, *Palmer 511*. CHIHUAHUA: Presidio del Norte [Ojinaga], July 1852, *Parry;* Juarez, dry mesa, Sept. 26, 1902, *Pringle 11233;* Chihuahua, hills and plains, *Pringle 478* (US); Parral-Chihuahua road, 10 km. north of Rio San Pedro, *Harvey 1430*.

Texas and Colorado to California and south into northern Mexico. A common grass in silty valley soils, usually growing in the shelter of bushes. The globose entangled masses of stems, 3–4 dm. in diameter and supported by the shrubbery a meter or more above the ground, are very characteristic features of the mogotes in Coahuila. The plant, when covered with its very abundant open airy purplish panicles, is conspicuous and attractive.

Muhlenbergia arizonica Scribn. Bull. Torr. Bot. Cl. **15**: 8 (1888).

CHIHUAHUA: Rocky hills northeast of Chihuahua, thin dry soil, Sept. 16, 1885, *Pringle 402*.

Arizona southward in the mountains of Sonora and Chihuahua to Sinaloa and Durango.

Muhlenbergia arenicola Buckl. Proc. Acad. Nat. Sci. Phila. **1862:** 91 (1863).

COAHUILA: Western base of Picacho del Fuste, silty places on slopes, tufted, not common, *Johnston 8422;* tableland north of Cañon del Cuervo Chico, common on wide grassy valley, *Johnston 8538;* between Palos Blancos and San Pedro, east of Cuesta Zozaya, common on grassy valley on tableland, *Johnston 9273, 9275;* foot slopes at mouth of Cañon Santa Cruz, 20 km. south of Ocampo, *Johnston 9174;* 10 mi. east of Fraile, silty place at edge of bahada, *Johnston 7304;* north of Sierra Cruces, about mogote 5 mi. west of San Rafael, *Johnston & Muller 1042;* gypsum ridge east of Laguna Jaco, fairly common, *Stewart & Johnston 1962;* eastern foothills of Sierra Cruces, 8 mi. north of Santa Elena, stony flat, *Johnston & Muller 1024;* 3 mi. east of San José, silty flat about mogote, *Johnston 8219;* San Antonio de los Alamos, flat at summit of tuff cliffs, frequent, *Johnston 8258;* 10–15 km. east of San Antonio de los Alamos, sabaneta, in broad valley, *Johnston 8288.* CHIHUAHUA: 1 mi. east of Pozo de Villa on Coahuilan boundary, silty plain, *Johnston 8180;* 2 mi. south of San Fernando, silty plain, *Johnston 7938;* Chihuahua, plains, *Pringle 479* (US); arroyo 50 km. north of Jimenez, *Harvey 1370.*

Kansas to Texas and Arizona and south into Zacatecas.

Muhlenbergia setifolia Vasey, Bot. Gaz. **7:** 92 (1882).

COAHUILA: Sierra del Pino, La Noria, banks of arroyo, *Johnston & Muller 662, 665;* escarpment on west side of Potrero de la Mula, rocky sunny ridges, *Johnston 9243;* Sierra Madera, Cañon Charretera, openings in oak-chapparal on rocky flat, frequent, *Johnston 9061;* Saltillo, summit of a stony mountain, 1898, *Palmer 415;* San Lorenzo Canyon, 6 mi. southeast of Saltillo, bunch grass of medium size on canyon side, 1904, *Palmer 400.*

Western Texas south into Coahuila. The species is closely related to *M. rigida* and apparently separable from it by no single character. Its range is mostly just beyond the northern limit of *M. rigida,* but it grows with that species, along the northeastern limits of the latter, in eastern Coahuila. It is a smaller more slender plant than *M. rigida,* with looser tufts of stems and leaves, filiform involute leaf-blades, and narrower fewer-flowered green or brownish (not purple) panicles.

Muhlenbergia rigida (H.B.K.) Kunth, Rév. Gram. **1:** 63 (1829).

COAHUILA: Sierra del Carmen, Sept. 8, 1936, *Marsh 719;* Mesa Grande, 40 km. northwest of Hac. Encantada, meadows and hillsides, common, *Stewart 1628, 1630;* Sierra del Pino, La Noria, gravelly flats among clumps of scrub oaks, *Johnston & Muller 659;* Puerto San Lazaro, dominant grass on upper slopes, *Muller 3095;* north end of Carneros Pass, among cacti, not common, *Johnston 7289.* CHIHUAHUA: Sierra Organos, south of Organos at base of oak-clad slope, coarse tufts, rocky places, *Stewart & Johnston 2065;* Sierra Santa Eulalia, Sept. 17, 1885, *Pringle 401.*

Trans-Pecos Texas to Arizona and south to Central America. The species appears to be absent in northeastern Mexico and to reach its eastern limit along the western base of the Sierra Madre in Coahuila and Nuevo Leon. It has been collected in Hidalgo. In eastern Coahuila it is connected by intergrades with the closely related and generally more northerly ranging *M. setifolia.*

Muhlenbergia dubia Fourn. ex Hemsl. Biol. Centr. Am. Bot. **3:** 540 (1885).

COAHUILA: Sierra Madera, Cañon Charretera, coarse tufts in rocky arroyo-bottom just below pine-belt, 3–4 ft. tall, *Johnston 8975, 9069;* Saltillo, among large rocks on outer rim of treeless mountain, 1898, *Palmer 416;* Saltillo, deep ravines, 1898, *Palmer 379;* San Lorenzo Canyon, 6 mi. southeast of Saltillo, high up canyon, large bunch grass, 1904, *Palmer 399;* Chojo Grande, 27 mi. southeast of Saltillo, bunch grass on canyon side, 1904, *Palmer 341;* north end of Carneros Pass, coarse tufts between bushes, *Johnston 7288.* CHIHUAHUA: Rocky hills northeast of Chihuahua, cool slopes, Oct. 20, 1885, *Pringle 403.*

Trans-Pecos Texas to New Mexico and adjoining Mexico, south through Nuevo Leon and eastern Coahuila to eastern San Luis Potosi. The type of *M. dubia* came from the Chinantla, Puebla. I have seen no authentic material and no collections from south of San Luis Potosi. Our plant is the same as the Texan material described as *M. acuminata* Vasey. Perhaps that name is the proper one for our present plant.

Muhlenbergia villiflora Hitchc. No. Am. Fl. **17:** 470 (1935); Johnston, Jour. Arnold Arb. **22:** 155 (1941).

COAHUILA: Locally common on the gypsum ridges east of Laguna de Jaco, *Johnston & Muller 1074, Stewart & Johnston 1963;* 10 mi. east of Fraile, abundant on valley floor, local, *Johnston 7305;* 6 mi. north of La Ventura, common on gypsum plain, local, *Johnston 7642, Shreve & Tinkham 9607.*

Known only from scattered stations in Coahuila, San Luis Potosi, Nuevo Leon, and southern Tamaulipas, apparently confined to gypsum.

Muhlenbergia parviglumis Vasey, Contr. U. S. Nat. Herb. **3:** 71 (1892).

COAHUILA: Sierra del Carmen, Sept. 9, 1936, *Marsh 717;* Sierra Madera, Cañon Charretera, banks of arroyo in oak-belt, erect, tufted, *Johnston 9076.*

Known from Uvalde, Val Verde, and Jeff Davis Counties, Texas, and from Nuevo Leon and eastern Coahuila.

Muhlenbergia polycaulis Scribn. Bull. Torr. Bot. Cl. **38:** 327 (1911).

CHIHUAHUA: Hills northeast of Chihuahua, cool wet ledges, 1885, *Pringle 394.*

Trans-Pecos Texas to Arizona and south in the mountains of Baja California, Sonora, and Chihuahua to Durango.

Muhlenbergia pauciflora Buckl. Proc. Acad. Nat. Sci. Phila. **1862:** 91 (1863).

COAHUILA: Sierra Mojada, Cañon San Salvador, abundant on slopes, *Muller 3312.*

Trans-Pecos Texas to Arizona and south in the mountains of Baja California, Sonora, and Chihuahua. The type of the species (*Wright 732*) was collected "in declivities in the mountains near El Paso, Sept. 12, 1849."

Muhlenbergia monticola Buckl. Proc. Acad. Nat. Sci. Phila. **1862:** 91 (1863).

COAHUILA: Camp near Mt. Carmel canyon, Oct. 1852, *Parry;* Sierra del Carmen, Sept. 1, 1936, *Marsh 872;* limestone hill near Santo Domingo, *Wynd & Mueller 453;* Muzquiz, *Marsh 549;* Sierra Madera, Cañon del Agua, among rocks in oak-pinyon belt, in lower canyon, *Muller 3258, 3259;* Cuatro Cienegas, *Marsh 2053;* Puerto San Lazaro, rock crevices on dry open slope, *Muller 3071;* Picachos Colorados, base of cliffs, *Johnston & Muller 143;* Sierra Cruces, eastern foothills near Santa Elena, among bushes along arroyo, *Johnston & Muller 238;* Sierra Cruces, Cañon Tinaja Blanca, about rock ledges on crest at head of canyon, *Johnston & Muller 298;* Sierra Mojada, Cañon San Salvador, abundant on slopes, *Muller 3312.* CHIHUAHUA: Sierra San Carlos, base of limestone cliffs, *Johnston & Muller 46;* near Rancho Madera, southwestern base of Sierra Rica, confined to small gypsum outcrop on slope, *Stewart 2434;* volcanic neck east of El Coyote, base of cliff, *Johnston & Muller 1411;* Sierra Almagre, among rocks in deep shaded canyon, *Johnston & Muller 1177;* Sierra de los Organos, 1937, *LeSueur;* Sierra Santa Eulalia, 2 km. north of San Antonio, *Harvey 1513;* Sierra Santa Eulalia, dry limestone ledges, Aug. 1885, *Pringle 396.*

Trans-Pecos Texas to Arizona and south into northern Mexico. In its extreme form, typical *M. monticola* is separated from typical *M. tenuifolia,* of central Mexico, by having narrow inflorescences with strict branches, strict spikelets, and green acute lanceolate glumes. *Muhlenbergia tenuifolia* has purple inflorescences, which have spreading or ascending branches on which the spikelets are divaricate or even reflexed. Its glumes are deep purple, smaller than in *M. monticola,* and commonly denticulate and obtusish and abruptly apiculate at the apex. In our area, the ranges of *M. monticola* and *M. tenuifolia* meet and the species intergrade very badly. I have arbitrarily referred to *M. monticola* those plants with narrow green or weakly purplish inflorescences (i.e., those with strict panicle-branches and strict spikelets), and to *M. tenuifolia* those plants having a usually darkly colored panicle with spreading branches and spikelets.

The type of *M. monticola* (*Wright 731*) was collected in Limpia Canyon in the Davis Mts., Texas. This typical form has been illustrated by Hitchcock, Man. Grasses U. S. *fig. 788* (1935). Very similar plants have been collected elsewhere in trans-Pecos Texas. Material from Arizona, however, differs in having a distinctly looser panicle. Vasey, U. S. Dept. Agric., Div. Bot. Bull. **13**[1]: *t. 19* (1892), has an illustration (sub *M. calamagrostidea*) of the Arizonan form. From Arizona this aberrant form extends south into the Sierra Madre of Sonora and Chihuahua, where the inflorescence becomes larger and more open and the spikelets divaricate or even reflexed. These large plants, except for the green, not purple, panicles, are remarkably similar in gross aspect to some forms of *M. tenuifolia* from about Mexico City, the type locality of that species. It is clear that the two species, *M. monticola* and *M. tenuifolia,* intergrade in the northern states of Mexico and that, if they are both to be recognized, this can be justified only for convenience and performed in an arbitrary manner.

Muhlenbergia tenuifolia (H.B.K.) Kunth, Rév. Gram. **1:** 63 (1829).

VERNACULAR NAME: Zacate espumilla.

COAHUILA: Mouth of Cañon La Cruz, 20 km. south of Ocampo, gravelly bed of large arroyo, *Johnston 9187;* Cañon Bocatoche, open arroyo, *Muller 3119;* La Rosita, *Shreve & Tinkham 9591;* 2 mi. west of Saltillo, *Harvey 1097;* Saltillo, edge of garden under trees, 1898, *Palmer 393;* Sierra Cruces, near Santa Elena, hillsides, *Stewart 284;* San Antonio de los Alamos, gravelly flat above tuff cliffs, *Johnston 8255;* Parras, 1880, *Palmer 1348;* Sierra Parras, Oct. 1910, *Purpus 5007;* Sierra Negras, 9 km. south of Parras, *Stanford et al. 165.* CHIHUAHUA: Rocky hills near Chihuahua, May 28, 1885, *Pringle 428;* hills and plains near Chihuahua, Oct. 23, 1885, *Pringle 397.* ZACATECAS: Valley 15 km. west of Concepcion del Oro, *Stanford et al. 506.*

Ranging from central and southern Mexico north into our area. Over most of its range a well marked and readily recognized species, but in our area completely intergrading with the more northern *M. monticola.* The species is a weak perennial and, like *M. monticola,* favors sheltered places at bases of cliffs, along rocky arroyo banks, or on slopes in deep canyons.

Muhlenbergia elongata Scribn. in Beal, Grasses No. Am. **2:** 251 (1896).

CHIHUAHUA: Rocky hills east of Chihuahua, ledges, 1885, *Pringle 398* (ISOTYPE).

Known only from near Chihuahua and from extreme southwestern parts of the state (*Palmer 159*).

Muhlenbergia Marshii sp. nov.

Planta perennis; culmis ca. 1 m. altis erectis teretibus glabris dense caespitosis simplicibus, basi ad 3 mm. crassis, internodiis 1–1.5 dm. longis; vaginis internodia 3–5 cm. longe superantibus scabridulis; ligulis 1–1.5 mm. longis truncatis glabris; laminis 15–40 cm. longis 2–4 mm. latis involutis rigidulis utrinque scabridulis; panicula spiciformi 2.5–4 dm. longa 3–6 mm. crassa, haud vel vix interrupta, basi e vagina superiore saepe haud exserta, ramis infra medium paniculae 2–4 cm. longis strictis multifloris; spiculis strictis 0–0.5 mm. longe pedicellatis (aristis glumarum exclusis) ca. 4 mm. longis; glumis subaequalibus 3 mm. longis pallidis subhyalinis obscure medio-nervatis (nervis prominentulis scabridis) lanceolatis, paullo supra basim latioribus deinde sursum in aristam rectam 0.3–0.7 mm. longam gradatim contractis, vel non raro summum ad apicem basim aristae minutissime obscurissimeque truncatis vel emarginatis et lacerato-denticulatis; lemmatibus (aristis rectis ad 0.5 mm. longis exclusis) ad 4 mm. longis glumas evidenter superantibus brunnescentibus supra medium 0.4–0.6 mm. latis deinde sursum gradatim attenuatis, sparse minutissime strigosis sublevibus 3-nervatis basi breviter perinconspicueque adpresseque villosis.

COAHUILA: Sierra del Carmen, Sept. 8, 1936, *E. G. Marsh Jr. 746* (TYPE, Gray Herb.). TEXAS: Davis Mts., H. O. Canyon above Sawtooth, soil in cracks of rocks in stream-bed, tough tightly rooted clumps, July 1936, *Hinckley*.

A member of the species-complex passing as *M. rigens,* among the members of which it is readily distinguished by its short-awned glumes and lemmas and extreme eastern occurrence. The basal portion of the inflorescence bears elongate strict branches and is not exserted from the uppermost leaf-sheaths. In these characters it agrees with true *M. rigens* of central California and closely related forms from southern California and southern Arizona and adjacent Mexico. True *M. rigens* has a somewhat interrupted inflorescence composed of rather elongate strict branchlets, and it appears to be confined to western middle California.

Muhlenbergia mundula sp. nov.

Planta perennis; culmis ca. 1 m. altis erectis teretibus glabris dense caespitosis simplicibus basi ad 3 mm. crassis, internodiis 1–1.5 dm. longis; vaginis saepe scabridulis quam internodiis saepe 1–5 cm. longioribus; ligulis 1–1.5 mm. longis truncatis vel rotundatis; laminis 8–30 cm. longis 2–4 mm. latis involutis rigidulis; panicula spiciformi 15–30 cm. longa densa 4–9 mm. crassa haud interrupta, e vaginis superioribus evidenter exserta, ramulis inferioribus brevibus 5–15 mm. longis strictis multifloris; spiculis strictis 0–5 mm. longe pedicellatis; glumis 2–3 mm. longis pallidis vel plumbeis subhyalinis obscure medio-nervatis, oblongis vel lanceolatis, apice acutis vel obtusis vel erosis raro attenuatis; lemmatibus 3–4 mm. longis 3-nervatis non raro scabridulis, supra basim latioribus deinde apicem versus gradatim attenuatis muticis.

COAHUILA: Sierra Hechiceros, Cañon Indio Felipe, side of dry arroyo, common, *Stewart 174*. CHIHUAHUA: Rancho El Pino, 10 km. southeast of Sierra Rica, rocky slope, frequent, *Stewart 2407;* by streams near Chihuahua, Oct. 13, 1885, *Pringle 417* (TYPE, Gray Herb.); Quicorichi, Rio Mayo, *Gentry 1931;* southwestern Chihuahua, 1885, *Palmer 21*. SONORA: Cañon Bellota, Sierra Cabellera, Bavispe Area, *Santos 2096*. NEW MEXICO: Berendo Creek, Black Range, Sierra Co., *Metcalfe 1391*. ARIZONA: Chiricahua Mts., Rigg's Ranch, *Blumer 1491;* Pinal Creek, Miami, *Harrison &*

Kearney 6342; Mule Mts., *Goodding 907;* Rincon Mts., Manning Camp, *Blumer 3397;* White Mts., *Griffiths 5445.*

This species includes most of the plants of Arizona, New Mexico, and northern Mexico which have passed as *M. rigens*. The plant illustrated by Hitchcock, Man. Grasses U. S., as *M. rigens* belongs to *M. mundula*. It is readily distinguished from true *M. rigens* of central California, and from closely related unnamed forms from southern California and southern Arizona, by having the spike well exserted from the upper leaf-sheaths and by having the lower branches of the panicle only 5–15 mm. rather than 20–30 mm. long. In appearance the species much resembles *M. leptoura,* of northwestern Chihuahua, but it differs from that species in having the glumes distinctly shorter than rather than equalling or surpassing the lemma.

Blepharoneuron tricholepis (Torr.) Nash, Bull. Torr. Bot. Cl. **25:** 88 (1898).

CHIHUAHUA: Mapula Mts., thin soil on summits, Oct. 26, 1886, *Pringle 822.*

Colorado and Utah south through Arizona, New Mexico, and trans-Pecos Texas into the mountains of northern Mexico. The species is known from the Davis, Chinati, and Chisos Mountains of Texas and is, accordingly, to be expected in the mountains of northern Coahuila and northeastern Chihuahua.

Sporobolus microspermus (Lag.) Hitchc. Jour. Wash. Acad. **23:** 453 (1933).

COAHUILA: San Antonio de los Alamos, colony in loose gravelly soil on flats above tuff cliffs, *Johnston 8244.* CHIHUAHUA: Near Rancho El Pino, 10 km. southeast of Sierra Rica, rocky slope, *Stewart 2411;* Los Medanos, 1935, *LeSueur 74.*

As currently accepted, this species ranges in western United States and south to Costa Rica. A critical study will probably show it to be an aggregate of several well-marked species of limited distribution. Hitchcock, Contr. U. S. Nat. Herb. **17:** 308 (1913), sub *S. ramulosus,* reports the plant from the Sierra Santa Eulalia and from near Chihuahua.

Sporobolus pyramidatus (Lam.) Hitchc. U. S. Dept. Agric., Misc. Pub. **243:** 84 (1936).

Sporobolus pulvinatus Swallen, Jour. Wash. Acad. **31:** 351 (1941).

COAHUILA: South of Laguna de Leche, saline and perhaps gypseous silt in mogote, *Johnston 8626;* Saltillo, along ditch, *Hitchcock 5580* (US). CHIHUAHUA: 5½ mi. south of Ojinaga, outwash from saline and gypseous shales, *Johnston 8005;* sandy plains near Chihuahua, Sept. 22, 1886, *Pringle 816.* DURANGO: Flats on plains 3 mi. northeast of Bermejillo, *Johnston 7787.*

Texas and Oklahoma to Arizona and south into Mexico; South America.

Sporobolus airoides Torr. Pac. R. R. Rep. **7**^{3}**:** 21 (1858).

COAHUILA: 4 mi. west of Cuatro Cienegas, coarse tufted grass on alkaline flat, *Johnston 7133;* Laguna de Jaco, saline meadow south of the lake, abundant, coarse tufts, *Johnston & Muller 1102.* CHIHUAHUA: Villa Ahumada flat, 1935, *LeSueur 71.*

Widely distributed in saline soils in western United States and extending south into northern Mexico.

Sporobolus regis sp. nov.

Planta robusta ca. 12 dm. alta e rhizomate elongato nodoso (internodiis 10–12 mm. longis) 3–4 mm. crasso oriens; culmis simplicibus erectis confertis foliosis; vaginis quam internodiis saepe subaequilongis vel usque ad 1 cm. brevioribus, extus pilis numerosis gracilibus 1–2 mm. longis adpressis pallide flavescentibus donatis, vetustioribus glabrescentibus; ligula subnulla 0.3 mm. longa vel breviore fimbriata vel dense et minute ciliolata; laminis 1–3 dm. longis 3–4 mm. latis saepe laxe involutis, subtus levibus, supra pallidioribus minute scabridis; paniculis apertis 3–4 dm. longis ad 15 cm. crassis, basi e vagina superiore haud exsertis, ramis alternis 2–12 mm. distantibus ramulosis adscendentibus vel laxe adscendentibus 5–10 cm. longis, axillis villosis, ramulis laxe adscendentibus saepe purpureis; spiculis 2–2.5 mm. longis glaberrimis unifloris, pedicellis strictis 1–5 mm. longis; gluma exteriore 1.2–1.5 mm. longa hyalina late lanceolata acuta, supra basim in medio purpurea; gluma interiore 1.5–1.8 mm. longa hyalina lanceolata enervata acuta; lemmate hyalino lanceolato-elliptico obscure uninervato, apice late acuto, longitudinem paleae aequante.

COAHUILA: Salt flat 4 km. southeast of Laguna del Rey, abundant, Sept. 18, 1942, *Stewart 2653* (TYPE, Gray Herb.).

A very well marked species, probably most closely related to *S. airoides* Torr. and *S. Wrightii* Munro. From these and most other members of the genus, *S. regis* differs in the very hairy leaf-sheaths, the tufts of hairs in the axils of the panicle-branches, and the very coarse rhizomes. The bases of the culms and the younger nodes of the rhizomes bear shredded remnants of old leaves.

Sporobolus Wrightii Munro ex Scribn. Bull. Torr. Bot. Cl. **9**: 103 (1882).

VERNACULAR NAME: Zacaton.

COAHUILA: 5 mi. north of Allende, oak thicket on plain, coarse tufts, culms 3–6 ft. tall, *Johnston 7010;* open country between Santo Domingo and Piedra Blanca, *Wynd & Mueller 497;* 20 mi. northwest of La Babia, open valley floor, *Wynd & Mueller 449;* Santa Anna Canyon, *Marsh 495;* trail from southern extremity of Hillcoat Mesa to Buena Vista headquarters, July 27, 1938, *Marsh 1512;* vicinity of Encantada Ranch headquarters and eastward, July 28, 1938, *Marsh 1520;* Cuatro Cienegas, *Marsh 2038, 2081;* Cuatro Cienegas, Puerto del Norte, *Harvey 1220;* Saltillo, in large bunches, dry alkaline clay soil, scarce, 1898, *Palmer 1;* Llano de Guaje near Tanque La India, the common grass about the bare flats, *Johnston & Muller 778;* Sierra del Pino, La Noria, large clumps in arroyo, *Johnston & Muller 666;* between Palos Blancos and San Pedro, road to Cuesta Zozaya, common in grassy valley on tableland, *Johnston 9272;* Laguna de Leche, the common grass about the margin of the dry lake, *Johnston 8601;* south of Laguna de Leche, saline soils below outcrops of Upper Cretaceous beds, *Johnston 8624;* east of Laguna de Jaco, about gypsum beds, 6–10 dm. tall, *Stewart & Johnston 1959;* Laguna de Jaco, saline soil at south end of lake, *Johnston & Muller 1091;* 11 km. northeast of Jimulco, *Stanford et al. 72.* CHIHUAHUA: Presidio del Norte, 6–8 ft. tall, *Parry;* 11 mi. south of Ojinaga, along small arroyo in low hills, 3–5 ft. tall, *Johnston 8034;* Pirámide, low ground, heavy soil at edge of cornfield, 3–6 ft. tall, *Johnston 8139;* Carrizal, Aug. 18 or 19, 1846, *Wislizenus 103;* Meoqui, 1938, *LeSueur 34;* 20 km. south of Camargo, *Harvey 1396.* ZACATECAS: 15 km. west of Concepcion del Oro, *Stanford et al. 528;* 7 mi. north of San Tiburcio, heavy, probably alkaline soil among mesquites, *Johnston 7362.*

Trans-Pecos Texas to southern California and south to central Mexico. Hitchcock, Contr. U. S. Nat. Herb. **17**: 309 (1913), reports the species from Chihuahua, Torreon, and Saltillo. It appears to be present in most parts of our area. Although I have accepted this species in the broad traditional sense, I suspect that it is an aggregate of several critical species.

The plants I have included in *S. Wrightii* vary greatly in size, appearance, and selection of habitats. The leaves are broad to narrow, dark or pale green, flat to involute. The plants may form large very coarse tussocks over a meter broad, and with culms nearly 2 m. tall, or low clumps 1–2 dm. tall, with the culms much less than a meter in height. The larger plants are mostly from permanently wet soils; the small plants come from the plains where water stands and evaporates after storms. The soils supporting the plant vary from those with no appreciable amount of salt to those with large amounts of alkali and even gypsum.

Sporobolus cryptandrus (Torr.) Gray, Man. 576 (1848).

COAHUILA: Saltillo, sandy field, *Hitchcock 5625* (US); Tanque Colorado, among bushes on red dunes, *Johnston 8663;* Los Medanos, 1935, *LeSueur 60, 80;* valley near Chihuahua, Oct. 4, 1885, *Pringle 419.*

Widely distributed in sandy places over the United States and south into northern Mexico. The two following species are probably no more than varieties.

Sporobolus flexuosus (Thurb.) Rydb. Bull. Torr. Bot. Cl. **32:** 601 (1905).

Sporobolus cryptandrus var. *flexuosus* Thurb. in Wats. Bot. Calif. **2:** 269 (1880).

CHIHUAHUA: Los Medanos, 1935, *LeSueur 80a;* between Los Medanos and Samalayuca, sand hills, Sept. 1886, *Pringle 815;* Colonia Diaz, 1899, *Nelson 6458.*

Southwestern United States and northern Chihuahua. Differing from *S. cryptandrus* only in having a more open panicle, with the spikelets and ultimate branchlets spreading rather than appressed along the primary branches of the panicle.

Sporobolus giganteus Nash, Bull. Torr. Bot. Cl. **25:** 88 (1898).

Sporobolus cryptandrus var. *strictus* Scribn. Bull. Torr. Bot. Cl. **9:** 103 (1882).

Sporobolus contractus Hitchc. Am. Jour. Bot. **2:** 303 (1915).

COAHUILA: North end of Cañada Oscuro, gravelly slopes among brush, common, *Johnston 8460;* south of Laguna de Leche, shaly bank among brush, frequent, *Johnston 8625;* Sierra Cruces, 8 mi. north of Santa Elena, stony flat among bushes, *Johnston & Muller 1027.* CHIHUAHUA: Los Medanos, 1935, *LeSueur 13, 58;* 20 km. south of Camargo, *Harvey 1397.*

Southwestern United States and northern Mexico. Probably only a phase of *S. cryptandrus,* with the inflorescence bearing short strict crowded branches and branchlets and accordingly spike-like in form. Hitchcock has distinguished the robust plants of this form as *S. giganteus* and the more slender forms as *S. contractus.*

Sporobolus Nealleyi Vasey, Contr. U. S. Nat. Herb. **1:** 57 (1890); Johnston, Jour. Arnold Arb. **22:** 155 (1941).

COAHUILA: Castillon, confined to gypsum flat, infrequent, *Johnston & Muller 1268;* east of Laguna de Jaco, frequent, confined to gypsum, *Johnston & Muller 1073, Stewart & Johnston 1954;* Sierra Cruces, gypsum flats near Santa Elena, *Johnston & Muller 247;* gypsum bed west of Buena Vista, along road between San Antonio de los Alamos and Puerto Caballo, rare, *Johnston 8314.*

Western Texas and eastern New Mexico and south into Coahuila. Apparently confined to gypsum. The type-collection of the species was originally given as collected at "Brazos Santiago, Texas," that is, near the mouth of the Rio Grande, where the species is neither known nor to be expected. This is apparently the result of a clerical error. Nealley's specimens came from Screw Bean, a locality near the Pecos River, in Reeves County, Texas, where a large variety of gypsophiles has been collected.

Sporobolus spiciformis Swallen, Proc. Biol. Soc. Wash. **56:** 78 (1943).

COAHUILA: Puerto del Norte, Cuatro Cienegas, July 1939, *Harvey 1225* (TYPE, US.); 4 mi. west of Cuatro Cienegas, common and conspicuous on saline and gypseous flats, 1938, *Johnston 7132;* 4 km. southeast of Laguna del Rey, abundant on salt flats, 1942, *Stewart 2654;* Noria de San Juan, southeast of Laguna del Rey, common on saline plain, 1942, *Stewart 3008.*

Endemic to our area, and apparently confined to saline gypseous soils. The species is most closely related to *S. phleoides* Hack., of saline soils in the deserts of western and northern Argentina. It differs from the southern plant in its paler color, involute leaves, more rigid tighter leaf-sheaths, broader erose or dentate glumes, non-rostrate palea, and much larger anthers.

Oryzopsis hymenoides (R. & S.) Ricker ex Piper, Contr. U. S. Nat. Herb. **11:** 109 (1906).

A widely distributed species of sandy soils in western United States. Hitchcock, Contr. U. S. Nat. Herb. **17:** 285 (1913), reports a collection from "sandhills near Paso del Norte, *Pringle 1053.*"

Piptochaetium fimbriatum (H.B.K.) Hitchc. var. **confine** var. nov.

A forma typica austro-Mexicana glumis viridibus evidenter nervatis haud purpureis differt.

COAHUILA: Sierra del Carmen, Cañon Sentenela, *Wynd & Mueller 643;* Hillcoat Canyon, west of Buena Vista Ranch, July 13, 1938, *Marsh 1284;* Sierra Madera, Cañon Charretera, in shade in oak thickets, *Johnston 9077;* Sierra del Pino, La Noria, in thickets on arroyo-bank, *Johnston & Muller 486* (TYPE, Gray Herb.).

Ranging in the mountains along the Mexican Boundary, from trans-Pecos Texas (Chisos and Davis Mts.) west to Arizona, and from Coahuila and northern Nuevo Leon to northeastern Sonora. Typical *P. fimbriatum* comes from central Mexico and differs from our northern plant in having firmer obscurely veined purple glumes and usually less slender and flaccid leaves. Where I have seen the var. *confine* in Coahuila, it has always grown in very sheltered shaded places, usually under bushes in dense oak thickets, and it is seldom common.

Stipa neomexicana (Thurb.) Scribn. U. S. Dept. Agric., Div. Agrost. Bull. **17:** 132 (1899).

COAHUILA: Along trail from southern extremity of Hillcoat Mesa to Buena Vista Ranch headquarters, July 27, 1938, *Marsh 1492;* tableland north of Cañon del Cuervo Chico, basal slopes of low rounded limestone hills, *Johnston 8564;* north end of Carneros Pass, conspicuous grass among low shrubbery, *Johnston 7297.*

Western Texas and Colorado to Utah and Arizona and south through Coahuila to the mountains of Nuevo Leon.

Stipa leucotricha Trin. & Rupr. Mém. Acad. St. Pétersb. VI. Sci. Nat. **5**[1]**:** 54 (1842).

COAHUILA: Rio Grande Valley near Piedras Negras, April 17, 1900, *Pringle 8292;* Muzquiz, Dec. 5, 1936, *Marsh 1077;* Monclova, *Marsh 1691, 1718.*

Oklahoma south through central Texas into northeastern Coahuila. The species appears to differ from *S. mucronata* H.B.K., of central and eastern Mexico, only in the large size of the spikelet and fruit and in the usually green rather than purpurescent glumes. The material from Coahuila and adjacent Texas is distinctly smaller than the typical form of *S. leucotricha,* and some of the specimens have colored glumes.

Stipa eminens Cav. Icon. Pl. **5**: *42. t. 467* (1799).

COAHUILA: Limestone hill near Santo Domingo, *Wynd & Mueller 460;* Hillcoat Mesa, west of Encantada Ranch, July 25, 1938, *Marsh 1460;* Sierra Madera, lower part of Cañon Charretera, open flat, *Johnston 9161;* near Santa Rosa, limestone hills, *Shreve & Tinkham 9576;* north end of Carneros Pass, *Johnston 7298;* Sierra del Pino, La Noria, common grass on flats and meadows, *Johnston & Muller 454, 663, Stewart 1207;* tableland north of Cañon del Cuervo Chico, gravelly places on low limestone hills, *Johnston 8562;* Sierra Parras, April 1905, *Purpus 1125* in pt.; Sierra Cruces, limestone foothills 8 mi. north of Santa Elena, *Johnston & Muller 1026;* Sierra Cruces, about volcanic ledges on ridge at head of Cañon Tinaja Blanca, *Johnston & Muller 305.* CHIHUAHUA: Sierra Santa Eulalia, Aug. 12, 1885, *Pringle 384.*

Trans-Pecos Texas to Arizona and south to central Mexico. Hitchcock, Contr. U. S. Nat. Herb. **24**: 238 (1925), reports the species from Cedros, Zacatecas.

Stipa angustifolia Hitchc. Contr. U. S. Nat. Herb. **24**: 246 (1925).

COAHUILA: Saltillo, July 25, 1905, *Palmer 626.*

This species was based upon a specimen collected by Palmer July 25, 1905, "among rocks on summit of Sierra de la Puebla, near Saltillo." The collection number is given as *"Palmer 726."* The specimen in the Gray Herbarium, agreeing with the original description, and collected near Saltillo on the same date as the type, bears the number *Palmer 626.* This species has very slender involute leaves. It has been collected in Nuevo Leon (near Pablillo, *Mueller 522*) and in southern Tamaulipas (Miquihuana, *Stanford et al. 645a*).

Stipa clandestina Hackel, Rep. Sp. Nov. **8**: 516 (1910).

COAHUILA: Saltillo, alt. 1650 m., March 1908, *Arsène 3441* (ISOTYPE); Saltillo, alt. 1600 m., March 1908, *Arsène 3467;* Saltillo, in large bunches, banks of irrigation ditches, 1898, *Palmer 3;* Saltillo, dry ground, 1910, *Hitchcock 815.* ZACATECAS: Valley 15 km. west of Concepcion del Oro, valley floor, 18 in. tall, *Stanford et al. 553.*

Known only from our area.

Stipa editorum Fourn. Mex. Pl. **2**: 75 (1886).

COAHUILA: 10 mi. east of Fraile, abundant and most conspicuous species on silty floor of valley, local, *Johnston 7303.* ZACATECAS: 7 mi. north of San Tiburcio, heavy soil among mesquites, *Johnston 7361.*

Known from Coahuila, Zacatecas, Nuevo Leon, southern Tamaulipas, and Puebla. The species may possibly be gypsophilous.

Stipa multinodis Scribn. ex Beal, Grasses No. Am. **2**: *222* (1896).

CHIHUAHUA: Sierra Santa Eulalia, Aug. 1885, *Pringle 385* (ISOTYPE).

Closely related to *S. editorum,* with which it agrees in the many-noded strict culms 7–12 dm. tall and somewhat fruticulose at the base. It differs in a slightly smaller lemma and nearly absent ligule. The species is known only from the type collection.

Stipa robusta (Vasey) Scribn. U. S. Dept. Agric., Div. Agron. Bull. **5**: 23 (1897).

COAHUILA: Sierra Madera, Cañon Charretera, common in rocky bed of arroyo in oak belt, becoming 4 ft. tall, *Johnston 9073;* Saltillo, 1902, *Palmer 317;* Lirios, 1880, *Palmer 1249;* San Antonio de las Alanzanas, near mountain border, 3 ft. tall, Aug. 31, 1848, *Gregg 349.*

Colorado to Arizona and trans-Pecos Texas, and south through Coahuila to the mountains of Nuevo Leon. A large coarse grass apparently restricted to the oak and lower pine belts. The type came from the Chinati Mts., Texas, and accordingly the species is to be expected in the mountains of northeastern Chihuahua. In the United States this species has been reported to have narcotic effects on animals eating it. In the notes accompanying his collections from the mountains of southeastern Coahuila, cited above, Gregg states that the grass is "very injurious to animals, intoxicating and often killing them. Animals acquainted with it will not eat it."

Stipa tenuissima Trin. Mém. Acad. St. Pétersb. VI. Sci. Nat. **2**[1]: 36 (1836).

COAHUILA: Sierra del Carmen, Sept. 1, 1936, *Marsh 878;* Sierra del Carmen, Cañon Sentenela, *Wynd & Mueller 538;* Hillcoat Canyon, west of Buena Vista Ranch, July 13, 1938, *Marsh 1314;* Saltillo, bunches on shady slope of hill, 1904, *Palmer 455;* Saltillo, 1909, rare, *Arsène 3469;* Chojo Grande, 27 mi. southeast of Saltillo, 1904, *Palmer 341;* north end of Carneros Pass, among low bushes, *Johnston 7296;* Carneros Pass, limestone hills, Sept. 20, 1890, *Pringle 3274.*

New Mexico and trans-Pecos Texas south through Coahuila and Nuevo Leon to Puebla; Argentina.

Aristida adscensionis L. Sp. Pl. 82 (1753).

COAHUILA: Sierra del Carmen, July 29, 1936, *Marsh 675;* 21 mi. south of Sabinas, heavy soil, *Johnston 7043;* Santa Anna Canyon, *Marsh 433;* Cuatro Cienegas, *Marsh 2059* in pt.; Saltillo, 1898, *Palmer 388;* Chojo Grande, 27 mi. southeast of Saltillo, in ravine, 1904, *Palmer 333;* 42 mi. west of Saltillo, *Shreve & Tinkham 9839;* west base of Picacho del Fuste, cemented gravels, *Johnston 8415;* San Antonio de los Alamos, on canyon-wall and on gravelly flats at top of cliffs, *Johnston & Muller 874, Johnston 8252;* Las Uvas, east side of Valle Acatita, gypsum in arroyo, *Stewart 2696;* Parras, 1880, *Palmer 1352;* Torreon, 1898, *Palmer 512.* CHIHUAHUA: Los Medanos, 1935, *LeSueur 36;* Chihuahua, 1935, *LeSueur 3;* rocky hills near Chihuahua, Aug. 1885, *Pringle 390;* Sierra Organos, 1937, *LeSueur 191;* 60 km. north of Escalon, *Harvey 1306.*

A variable annual species widely distributed in the warmer parts of America and the Old World. This species has been consistently described as always having the lemma with three awns. Three of the collections cited above (*Pringle 390, Johnston 8252* and *8415*) have the lateral awns minute or nearly wanting, but otherwise they agree closely with the specimens associated with them.

Aristida ternipes Cav. Icon. Pl. **5**: 46 (1799).

CHIHUAHUA: Rocky hills northeast of Chihuahua, Aug. 13, 1885, *Pringle 387;* Meoqui, 1936, *LeSueur 120* in pt.; Meoqui, 1935, *LeSueur 38.*

Ranging from trans-Pecos Texas to Arizona and south through Sonora and Chihuahua; reaching northern South America.

Aristida Schiedeana Trin. & Rupr. Mém. Acad. St. Pétersb. VI. Sci. Nat. **5**[1]: 120 (1842).

Aristida Orcuttiana Vasey, Bull. Torr. Bot. Cl. **13**: 27 (1886).

COAHUILA: Sierra del Carmen, Cañon Sentenela, *Wynd & Mueller 607.* CHIHUAHUA: Sierra Santa Eulalia, Sept. 10, 1885, *Pringle 386.*

Trans-Pecos Texas to southern California and south to Guatemala. Very closely related to *A. ternipes* and differing from that species chiefly in having the neck of the fruit twisted and bent. Our plants represent the northern phase of the species (*A. Orcuttiana*), which is weakly distinguished from the typical southern phase by usually having glabrous and somewhat firmer, paler glumes.

Aristida divaricata H. & B. ex Willd. Enum. Pl. **1:** 99 (1809).

CHIHUAHUA: On the Coahuila boundary 1 mi. east of Poza de Villa, silty plain, *Johnston 8177;* Rancho El Pino, 10 km. southeast of Sierra Rica, rocky slope, *Stewart 2394;* 7 mi. south of Pirámide, silty flat, *Johnston 8108;* 4 mi. southeast of Organos, flats at base of grassy slope, *Stewart & Johnston 2041.*

Western Kansas and western Texas to California and south through Chihuahua and Sonora, reaching Guatemala. Much resembling the two previous species and having a similar very lax panicle with long slender abruptly and widely spreading branches, but differing in having three well-developed awns on the lemma. The collection from near Pirámide has the fruiting lemma with a stout untwisted neck and accordingly belongs to the form distinguished as *A. hamulosa* Henr.

Aristida longiseta Steud. Syn. Pl. Glum. **1:** 420 (1855).

COAHUILA: Dry mesas near Piedras Negras, Apr. 23, 1900, *Pringle 9037;* Sierra del Carmen, Aug. 14, 1936, *Marsh 665;* 20 mi. northwest of Hac. La Babia, open valley floor, *Wynd & Mueller 445.* CHIHUAHUA: Los Medanos, 1935, *LeSueur 57.*

Widely distributed in the western United States and extending south into our area. The Coahuilan collections, representing the var. *rariflora* Hitchc., have smooth lemmas with a stout neck. LeSueur's collection has more attenuate minutely tuberculate lemmas. Hitchcock, Contr. U. S. Nat. Herb. **22:** 563 (1924), reports a collection of the species (*Pringle 473*) from near Chihuahua.

Aristida Roemeriana Scheele, Linnaea **32:** 343 (1849).

Aristida purpurea var. *micrantha* Vasey, Contr. U. S. Nat. Herb. **3:** 47 (1892).

COAHUILA: Allende, *Marsh 1799;* igneous hill near Santo Domingo, *Wynd & Mueller 468;* Zacate, July 14, 1936, *Marsh 501;* Yerda Spring, July 6, 1936, *Marsh 293;* Hermanas, *Marsh 1586, 1617;* Monclova, *Marsh 1694;* Cañon Bocatoche, grassy valley floor, *Muller 3111;* near Rancho Santa Teresa, *Wynd & Mueller 173, 202, 206;* La Rosita, *Shreve & Tinkham 9593;* east of Hac. La Rosa, mountain slope, *Wynd & Mueller 44;* mountains west of Saltillo, 1880, *Palmer 1351;* Saltillo, stony hills, 1898, *Palmer 392;* Sierra Madera, Cañon Charretera, lower canyon, open flat, *Johnston 9160;* mouth of Cañon La Cruz, 20 km. south of Ocampo, base of mountains, *Johnston 9176, 9178;* Cuatro Cienegas, 1939, *Marsh 2059* in pt.; Sierra Cruces, 8 km. north of Santa Elena, stony flat, *Johnston & Muller 1015.*

A variable and ill-defined species ranging from Texas south through northeastern Mexico to Hidalgo. It is a plant with small spikelets with strongly unequal, usually purpurescent, glumes in a rather loose panicle with more or less nodding branches. It intergrades completely with *A. purpurea, A. longiseta, A. Reverchoni, A. curvifolia, A. dissita,* and *A. glauca,* all intergrading and variable species, and like them incapable of precise definition. The condition is probably the result of free and much repeated interspecific hybridization and subsequent segregation and recombination of characters. Since technical characters of the spikelet are as variable and erratic as those found in the form of inflorescence and the gross aspect of the plant, I have preferred to use these latter in defining the "species" in this most difficult genus of grasses.

Aristida Reverchoni Vasey, Bull. Torr. Bot. Cl. **13:** 52 (1886).
Aristida Nealleyi Vasey, Contr. U. S. Nat. Herb. **3:** 45 (1892).

CHIHUAHUA: Sierra Santa Eulalia, dry ledges, Sept. 8, 1885, *Pringle 389*.

Texas to southern California and south into Chihuahua. A plant with very strict subsessile clusters of spikelets forming a spike about 15 cm. long. The awns are rather slender and usually pinkish. The plant intergrades with *A. Roemeriana, A. curvifolia, A. longiseta, A. dissita,* and *A. glauca*. Hitchcock and Henrard treated this plant as a synonym of *A. glauca,* but that is a plant of eastern Mexico with looser spikelet-clusters and a more interrupted spike, more suggestive of a slender form of *A. curvifolia* than of the present species.

Aristida curvifolia Fourn. Mex. Pl. **2:** 78 (1886).
Aristida Wrightii Nash in Small, Fl. S. E. U. S. 116, 1327 (1903).

COAHUILA: Sierra del Carmen, Sept. 12, 1936, *Marsh 841;* Rancho Agua Dulce, lower slopes of Sierra San Manuel, *Wynd & Mueller 328;* limestone hill near Santo Domingo, *Wynd & Mueller 452;* Santa Anna Canyon, *Marsh 498;* Palm Canyon, near Muzquiz, *Marsh 322;* Flores Pasture, near Muzquiz, *Marsh 315;* Hillcoat Canyon, west of Buena Vista Ranch, July 13, 1938, *Marsh 1330;* Hillcoat Mesa, west of Encantada Ranch, July 25, 1938, *Marsh 1437;* Sierra del Pino, La Noria, flats, *Johnston & Muller 452, 695, 696;* Sierra Madera, Cañon Charretera, bed of arroyo in oak belt, *Johnston 9068;* south of Laguna Leche, slightly saline and gypseous soil near mogote, *Johnston 8621*.

Ranging from Texas to Arizona and south to southern Mexico. A rather coarse and stiff plant with strict subsessile clusters of spikelets forming a stiff interrupted spike 15–30 cm. long. Differing from *A. Reverchoni,* with which it intergrades, in the stiffer brownish awns, firmer non-purpurescent glumes, somewhat interrupted longer spike, and frequently loosely appressed spikelet-clusters. It intergrades with *A. pansa, A. arizonica, A. Reverchoni,* and *A. Roemeriana*.

To this species I have referred most of the larger plants of Texas and northeastern Mexico which Hitchcock placed in *A. Wrightii* and in *A. glauca*. Hitchcock attempted to distinguish *A. glauca* and *A. Wrightii* by attributing to the former a more slender and elongate, usually somewhat twisted, beak to the lemma, but I find these characters too indefinite and variable to be of any use, if not actually illusionary. Henrard placed great emphasis on the obtuse somewhat dentate tips of the glumes found in the type of *A. curvifolia,* but this character is variable and, furthermore, appears sporadically in various species of northern Mexico and the western United States. Otherwise the species seems nearly the same as the Texan plant described as *A. Wrightii*.

Aristida pansa Woot. & Standl. Contr. U. S. Nat. Herb. **16:** 112 (1913).

COAHUILA: Along trail between southern end of Hillcoat Mesa and Buena Vista headquarters, July 27, 1938, *Marsh 1493;* western base of Picacho del Fuste, gypsum beds on north-facing mountain side, *Johnston 8399;* western base of Picacho del

Fuste, rocky flats, *Johnston 8419;* tableland north of Cañon del Cuervo Chico, base of low limestone hill, *Johnston 8563;* Aguaje Pajarito, west end of Sierra Fragua, rocky flats, *Johnston 8714;* north of La Ventura, on gypsum beds, *Shreve & Tinkham 9608;* Picacho de San José, about ledges on high northwestern slope, *Johnston 8209.*

Western Texas and New Mexico south into our area. A plant with branched inflorescence, the branches short, stiffly ascending, and bearing crowded appressed spikelets in dense spicate clusters. The species intergrades with *A. divaricata, A. dissita,* and *A. curvifolia.* Typically it has three subequal awns. Among the collections above cited, however, *Johnston 8209, 8399,* and *8414* are plants otherwise agreeing with *A. pansa* but having only a well-developed middle awn, the lateral ones being reduced and nearly wanting. Another collection, *Johnston 8419,* consists of plants with three subequal awns and was mixed with plants, otherwise similar, having the lateral awns reduced and nearly wanting. The plants with single awns suggest *A. Schiedeana,* but they are obviously variations of *A. pansa.* Curiously they come from the same area in Coahuila where I found a homologous form of *A. adscensionis.*

Aristida dissita sp. nov.

Planta perennis caespitosa 3–7 dm. alta perinconspicue minuteque pubescens et scabridula; culmis numerosis confertis simplicibus teretibus inconspicue striatis; vaginis striatis quam internodiis longioribus, margine ad apicem villosis; ligula subnulla dense breviterque villoso-ciliata; laminis 1–2 dm. longis rigidulis rectis vel saepe plus minusve curvatis glauco-viridibus, saepe involutis et 0.5–1 mm. crassis, raro subplanis et ad 1.5 mm. latis, supra minute hispidulis et scabridulis, subtus sublevibus; panicula exserta elongata 1–3 dm. longa saepe 6–8 cm. crassa aperta dissitiflora adscendente ramosa; rhachi tereti superne subangulata, ramis in nodis solitariis vel binis vel raro trinis gracilibus angulo ca. 45° ab rhachi divergentibus, infra medium paniculae 3–5 cm. distantibus, supra medium 1–3 cm. distantibus; spiculis 0–5 (raro ad 10) mm. longe pedicellatis angulo ca 45° a ramis divergentibus, supra medium ramis 2–8 laxe dispositis; glumis violaceis vel purpureo-viridibus angustis acuminatis, non raro in arista inconspicua gracili terminatis, glabris uninervatis carinatis, gluma exteriore (7–)8–9 mm. longa; gluma interiore (8–)9–10 mm. longa, quam exteriore 1–2 mm. longiore; fructibus angustissimis graciliter attenuatis nigrescentibus non tortis praesertim supra medium non raro minutissime scabridis; aristis subaequalibus 12–18 mm. longis rectis tenuibus; callo ca. 0.9 mm. longo acuto barbato.

Coahuila: Several miles west of Buena Vista, along road from San Antonio de los Alamos, banks of gypsiferous shales, *Johnston 8302;* 3 mi. east of San José, silty flat, openings in mogote, *Johnston 8218.* Chihuahua: 4 mi. southeast of Mesteñas, grassy rocky slope, *Stewart & Johnston 2016;* Chihuahua, 1935, *LeSueur 19;* near Chihuahua, hills and plains, Oct. 13, 1885, *Pringle 388* (type, Gray Herb.); 13 km. south of Jimenez, *Harvey 1344.* Texas: El Paso, mesa, base of hill, 1915, *Hitchcock 774;* Sierra Prieta, Hudspeth Co., 1928, *Cory 1049;* Eagle Mt. mine, Hudspeth Co., 1928, *Cory 1048;* 9 mi. east of Van Horne, Culberson Co., probably gypsiferous soil, *Waterfall 4161;* Nichols Ranch, Glass Mts., Brewster Co., *Warnock T532.* New Mexico: 15 mi. west of Las Lunas, Valencio Co., sandy alluvium, *Bacigalupi 572.*

This species keys to *A. pansa* in Hitchcock's treatment of the genus in the Manual of the Grasses of the United States, 440 (1935), and in North

American Flora, **17**: 376 (1935), and is probably closely related to that species. It agrees with *A. pansa* in having an inflorescence with moderately elongate ascending branches, but it differs in having the spikelets spreading from the branch and hence very loosely disposed, rather than closely appressed to the branch and forming a spicate cluster. The proposed species frequently suggests *A. barbata,* but that plant has a proportionately broader panicle with longer and more widely spreading branches, as well as larger and more widely spreading spikelets on more elongate pedicels. Some of the cited material of *A. dissita* has been identified as *A. hamulosa,* but that species is readily distinguished by its elongate widely spreading or even reflexed panicle-branches and its larger very strict spikelets in spicate clusters. The same characters readily separate it from *A. divaricata,* the species to which the type collection was referred by Hitchcock, Contr. U. S. Nat. Herb. **22**: 549 (1924). In trans-Pecos Texas the panicle-branches of *A. dissita* shorten and become more strict and it passes into *A. Reverchoni, A. pansa, A. Roemeriana,* and even *A. curvifolia.* The loose inflorescence of *A. dissita,* with its ascending panicle-branches, up to 7 cm. long, and loosely disposed ascending spikelets, gives the species a distinctive aspect and permits its ready recognition. It is difficult to understand why the plant should have remained so long without a name.

Tragus Berteronianus Schult. Mant. **2**: 205 (1824).

COAHUILA: Palm Canyon, near Muzquiz, *Marsh 1000;* Saltillo, 1898, *Palmer 396;* north end of Sierra Cruces, sabaneta west of San Rafael, *Johnston & Muller 1035.* CHIHUAHUA: Presidio del Norte, *Bigelow;* Rancho El Pino, 10 km. southeast of Sierra Rica, *Stewart 2403;* 10 mi. southeast of Organos, under bushes at foot of grassy slope, local, *Stewart & Johnston 2036;* hills and plains near Chihuahua, Aug. 1885, *Pringle 421;* Meoqui, 1935, *LeSueur 33.* ZACATECAS: Near Concepcion del Oro, many plants together among bushes and rocks on stony mesas, 1904, *Palmer 279.*

Texas to Arizona and south to South America and in the warmer parts of the Old World. Although stated by some authors to be introduced into our area, it behaves like an indigenous species. It associates with indubitably native species in scattered localities far from human habitations, and it was collected in Texas, New Mexico, and Arizona far from settlements by the early botanists exploring that then frontier area a hundred years ago. Hitchcock, Contr. U. S. Nat. Herb. **17**: 216 (1913), reports collections of the species from Tlahualilo, Durango, and from Sabinas and Soledad, Coahuila.

Hilaria mutica (Buckl.) Benth. Jour. Linn. Soc. Bot. **19**: 62 (1881).

VERNACULAR NAME: Tobosa.

COAHUILA: Sierra del Carmen, Sept. 6, 1936, *Marsh 853;* Rancho Agua Dulce, eastern slope of Sierra San Manuel, *Wynd & Mueller 481;* Hillcoat Mesa, west of Encantada Ranch, July 25, 1938, *Marsh 1434;* El Berrendo, *Harvey 1175;* near La Rosa, *Shreve & Tinkham 9905;* between Hac. La Rosa and Hac. Lechuguilla, dry desert, *Wynd & Mueller 61;* 6 mi. north of Castillon, dominant on large flat, *Johnston & Muller 191;* northeastern foothills of Sierra Cruces, 5 mi. south of San Rafael, silty flat in arroyo, *Johnston & Muller 1031;* 7 mi. south of Jaco, small flat among mesquites, *Johnston & Muller 1115.* CHIHUAHUA: Chihuahua, plains, *Pringle 485;* Meoqui, 1935, *LeSueur 40;* 10 km. east of Jimenez, *Harvey 1348;* 5 mi. east of Carrillo, extensive clumps on lower slopes of dunes, *Muller 3321.* DURANGO: 3 mi. northeast of Bermejillo, flats among mesquites, *Johnston 7788;* Torreon, 3–4 ft. tall, protection of mesquites, 1898, *Palmer 506.*

Ranging from western Oklahoma and central Texas west to Arizona and south into our area. A common and widespread grass characteristic of flats where water collects after storms and stands for some time before evaporating. The tobosa flats are most common on the clay soils of the calcareous areas, where they vary from a few square meters in extent up to considerable size. In the igneous areas in eastern Chihuahua, tobosa flats are found chiefly on the bottoms of the larger basins. In Coahuila, in calcareous clays, tobosa flats may be encountered in varying abundance from the bottom of the broad valleys up the long slopes to the bases of the mountains and even on flat places in open canyons in the foothills. The soils of tobosa flats may be moderately gypsiferous, but they seldom if ever are saline. Tobosa growing in favorable situations with continually renewed soil-moisture is considered a good feed for stock. The tobosa developing on flats where it is subjected to irregular wettings and long periods of drought is said to become excessively siliceous and rapidly wears down the teeth of stock subsisting on it. Because of this fact, stock-men distinguish the ecological forms of tobosa and have various names for them. As a botanist I have even been severely criticized for insisting they were all one species.

Hilaria Belangeri (Steud.) Nash, No. Am. Fl. **17:** 135 (1912).

COAHUILA: Base of the mountains 3 mi. southeast of Saltillo, *Johnston 7251.* CHIHUAHUA: Chihuahua, *LeSueur 18;* Chihuahua, hills and plains, *Pringle 493;* Parral-Chihuahua road, 19 mi. north of Rio San Pedro, *Harvey 1432.*

Texas to Arizona and south into northern Mexico. The present northern plant is very closely related to *H. cenchroides* H.B.K., of central Mexico, and is perhaps not specifically distinct.

Aegopogon cenchroides H. & B. ex Willd. Sp. Pl. **4:** 899 (1806).

CHIHUAHUA: Mapula Mts., thin soil on ledges, Oct. 25, 1886, *Pringle 823.*

Ranging along the western Sierra Madre, from northwestern Chihuahua and adjacent Sonora south to South America.

Microchloa Kunthii Desv. Opusc. 75 (1831).

CHIHUAHUA: Pirámide, sheltered places about the bases of large rock masses, *Johnston 8120;* dry gravelly soil on mesa west of Chihuahua, Aug. 6, 1885, *Pringle 425.*

Baja California and northern Chihuahua south to Argentina.

Leptochloa dubia (H.B.K.) Nees, Syll. Pl. Ratisb. **1:** 4 (1824).

COAHUILA: Sierra del Carmen, Sept. 8, 1936, *Marsh 723;* Jardin del Sur, Sept. 3, 1936, *Marsh 767;* Hillcoat Mesa, west of Encantada Ranch, July 24, 1938, *Marsh 1449;* Sierra Guajes, Cañon Madera, hillsides, *Stewart 1506;* Sierra Madera, Cañon Charretera, ledges among bushes on sunny hillside in oak belt, *Johnston 9103;* Saltillo, sandy bottomland, *Hitchcock 677;* Saltillo, 1898, *Palmer 381, 382;* 2 mi. west of Saltillo, *Harvey 1092A;* Sierra del Pino, La Noria, arroyo banks in oak belt, *Johnston & Muller 493, Stewart 1201;* Sierra Cruces, 8 mi. north of Santa Elena, thickets along arroyo, *Johnston & Muller 1029;* Sierra Negras, 9 km. south of Parras, *Stanford et al. 189.* CHIHUAHUA: Ojo Almagre, Sierra Almagre, wet sand, *Johnston & Muller 1212;* hills and plains near Chihuahua, *Pringle 422.* ZACATECAS: Concepcion del Oro, 1904, *Palmer 268.*

Texas and Oklahoma to Arizona and southward through Mexico; Argentina. Hitchcock, Contr. U. S. Nat. Herb. **17:** 350 (1913), reports the species from Cedros and Pico de Tiera, Zacatecas. A perennial species usually growing among brush on rocky hillsides and flats.

Leptochloa filiformis (Lam.) Beauv. Ess. Agrost. 71, 166 (1812).

COAHUILA: Monclova, 1880, *Palmer 1364;* Monclova, 1939, *Marsh 1843.*

A weedy plant, widely distributed in the warmer parts of America. Hitchcock, Contr. U. S. Nat. Herb. **17:** 349 (1913), reports a collection by Pringle (no. *1161*) from "Paso del Norte," Chihuahua.

Leptochloa viscida (Scribn.) Beal, Grasses No. Am. **2:** 434 (1896).

CHIHUAHUA: Plains near Chihuahua, wet places, 1886, *Pringle 814.*

Wet places, Texas to California and northern Mexico.

Leptochloa fascicularis (Lam.) Gray, Man. 588 (1848).

COAHUILA: Road to Don Martin Dam, *Harvey 947.* CHIHUAHUA: Plains near Chihuahua, shallow water, 1886, *Pringle 813;* Camargo, along the Rio Conchos, *Harvey 1403.* DURANGO: Torreon, in soft mud in overflowed land, 1898, *Palmer 503.*

Wet, frequently brackish soils. Widely distributed in the warmer parts of America.

Leptochloa uninervia (Presl) Hitchc. & Chase, Contr. U. S. Nat. Herb. **18:** 383 (1917).

Collected on the Texas bank of the river (Boquillas, Mariscal Canyon, and mouth of Tornillo Creek) in the Big Bend of the Rio Grande and presumably on the Coahuilan bank of the river also. Widely distributed in wet places in the warmer parts of America.

Eleusine indica (L.) Gaertn. Fruct. et Sem. **1:** 8 (1788).

COAHUILA: Monclova, 1939, *Marsh 1840.* CHIHUAHUA: Presa de Chihuahua, 1936, *LeSueur 129.*

Widely distributed weedy plant, introduced from the Old World.

Cynodon Dactylon (L.) Pers. Syn. **1:** 85 (1805).

COAHUILA: Sierra del Carmen, Sept. 8, 1936, *Marsh 740;* Yerda Spring, *Marsh 265;* Hermanas, *Marsh 1611;* Monclova, *Marsh 1697, Harvey 1131;* Saltillo, 1898, *Palmer 254;* Parras, Nov. 1910, *Purpus 5087;* 11 km. northeast of Jimulco, *Stanford et al. 3.* CHIHUAHUA: Rancho El Pino, southeast of Sierra Rica, sandy arroyo, *Stewart 2404;* 5 km. west of Camargo, *Harvey 1410.* DURANGO: Torreon, low places, 1898, *Palmer 814.*

Introduced from the Old World, now widely distributed in the warmer parts of America. A common plant in moist soils, along river bottoms, about fenced tanques, along irrigation ditches, and frequently a tenacious weed in cultivated soils.

Spartina Spartinae (Trin.) Merrill ex Hitchc. Contr. U. S. Nat. Herb. **17:** 329 (1913).

COAHUILA: Cuatro Cienegas, 1939, *Marsh 2037, 2039;* Viesca, 1938, *Shreve 8772.*

Wet saline soils from Florida to Texas and south to Central America; Argentina. In eastern Mexico it has been collected inland in Coahuila and about Hacienda Angostura, east of San Luis Potosi.

Chloris virgata Sw. Fl. Ind. Occ. 203 (1797).

COAHUILA: Sierra del Carmen, Sept. 8, 1936, *Marsh 749;* 20 mi. northwest of La Babia, open valley floor, *Wynd & Mueller 443;* Santa Anna Canyon, *Marsh 429;* Monclova, *Marsh 1848;* west of Puerto de las Monjas, 1–4 ft. tall, low ground, *Johnston 8640;* Parras, along arroyo in thickets, 1898, *Palmer 448;* Parras, 1880, *Palmer;* 7 mi. south of Jaco, about mogote, *Johnston & Muller 1105;* meadow about charco southeast of Almagre, *Johnston & Muller 1226.* CHIHUAHUA: Rancho El Pino, southeast of Sierra Rica, *Stewart 2397;* Los Medanos, 1935, *LeSueur 63;* Meoqui, 1935, *LeSueur 31;* Jimenez, banks of the Rio Florido, *Harvey 1318.*

Texas to southern California, and south to Argentina. Hitchcock, Contr. U. S. Nat. Herb. **17:** 332–333 (1913), reports specimens from Chihuahua City, Torreon, Tlahualilo, and Saltillo. This annual grass is most commonly found in and about mogotes, growing through low bushes on bajillos, in fenced areas about tanques, or in other areas where silty soil is frequently well moistened. In well watered situations it may grow over a meter high. In some unfavored places depauperate plants less than a decimeter high may be found.

Chloris submutica H.B.K. Nov. Gen. et Sp. **1:** 167 (1816).

COAHUILA: Saltillo, along ditch at edge of corn field, 1898, *Palmer 390.* CHIHUAHUA: Northeast of Chihuahua, valley near Nombre de Dios, Aug. 20, 1885, *Pringle 424.* ZACATECAS: 15 km. west of Concepcion del Oro, valley floor, *Stanford et al. 558.*

From our area south to central Mexico.

Chloris latisquamea Nash, Bull. Torr. Bot. Cl. **25:** 439 (1898).

COAHUILA: 11 mi. south of Allende, along tree-lined arroyo, *Johnston 7018;* Sabinas River, Muzquiz, *Marsh 399.*

Texas and northeastern Coahuila.

Chloris aristata (Cav.) Swallen, No. Am. Fl. **17:** 596 (1939).

COAHUILA: Parras, among weeds on bank of ditch, 1898, *Palmer 450.*

From our area south to Costa Rica.

Chloris andropogonoides Fourn. Pl. Mex. **2:** 143 (1886).

COAHUILA: Palm Canyon, near Muzquiz, *Marsh 984.*

Texas and northeastern Mexico.

Trichloris mendocina (Phil.) Kurtz, Mem. Fac. Cien. Univ. Córdoba **1896:** 37 (1897).

COAHUILA: Perros Bravos, Sept. 20, 1848, *Gregg 473*; near Horizonte, 1937, *Wynd 774;* valley of the Nazas, May 10, 1847, *Gregg 611.* CHIHUAHUA: Near El Carmen, 1935, *LeSueur 70;* valley near Chihuahua, 1885, *Pringle 475.* DURANGO: Torreon, along dry ditch among shrubs and cacti, *Hitchcock 658.*

Arizona to trans-Pecos Texas, along the Rio Grande Valley to Laredo, and south into our area; southern South America.

Trichloris pluriflora Fourn. Mex. Pl. **2:** 142 (1886).

Hitchcock, Contr. U. S. Nat. Herb. **17:** 335 (1913), reports a collection (*Nelson 6827*) from Sabinas, Coahuila. Southern Texas, west to Val Verde County, and south in eastern Mexico; also in Andean South America.

Bouteloua simplex Lag. Var. Cien. **4:** 141 (1805).

COAHUILA: Saltillo, corn field, 1898, *Palmer 397, 398;* Chojo Grande, 27 mi. southeast of Saltillo, appearing after rains in level places near water-course, 1904, *Palmer 332*.

Western Texas and Colorado to Arizona, south to central Mexico.

Bouteloua Parryi (Fourn.) Griffiths, Contr. U. S. Nat. Herb. **14**: 381 (1912).
Bouteloua polystachya var. *vestita* Wats. Proc. Am. Acad. **18**: 177 (1883).

COAHUILA: Carneros Pass area, 1880, *Palmer 1357* (type of var. *vestita*). CHIHUAHUA: Pirámide, gravelly plain near rock masses, *Johnston 8132;* center of large grassy plain 7 mi. northeast of La Morita, common, *Johnston 7971;* base of Sierra Santa Eulalia, sandy alluvium of streams in rocky hills, *Pringle 413*.

New Mexico to Arizona and south to San Luis Potosi.

Bouteloua barbata Lag. Var. Cien. **4**: 141 (1805).

VERNACULAR NAME: Pata del Cuervo.

COAHUILA: Sacramento, gravelly arroyo, *Johnston 7086;* Cuatro Cienegas, *Marsh 2065;* 4 mi. east of Cuatro Cienegas, ditch by road, *Johnston 7117;* near Rosario, about edge of mogote, stems spreading, *Johnston 8824;* 20 km. north of junction of Monclova and Torreon roads, *Harvey 1109;* 42 mi. east of Saltillo, *Shreve & Tinkham 9837;* Saltillo, near ditch, prostrate, 1898, *Palmer 400, 401;* south base of Picacho San José, gravelly flat, erect, *Johnston & Muller 804;* 3 mi. east of San José, silty plain, ascending, *Johnston 8216;* 7 mi. south of Jaco, about mogote, decumbent, *Johnston & Muller 1106;* Torreon, bank of Rio Nazas in railroad cut, 1898, *Palmer 514;* plains near Jimulco, 1902–1905, *Pringle 11216, 13626*. CHIHUAHUA: Presidio del Norte, *Bigelow, Parry;* 5½ mi. south of Ojinaga, outwash from saline shales, *Johnston 8006;* 4½ mi. northwest of San Francisco, grassy flat, ascending, *Stewart & Johnston 2010;* Los Medanos, *LeSueur 59;* Villa Ahumada, flats, *LeSueur 65;* Chihuahua, hills and plains, *Pringle 490*.

Texas to southern California and south to southern Mexico. This small rapidly growing annual grass is widely distributed in our area, especially about mogotes, ditches, and similar sites where run-off collects after storms and the soil is moistened at frequent intervals during the summer.

Bouteloua hirsuta Lag. Var. Cien. **4**: 141 (1805).

VERNACULAR NAMES: Grama; Navajitas.

COAHUILA: Sierra del Carmen, Aug. 14, 1936 and Sept. 1, 1936, *Marsh 657, 887;* trail from Encantada Mesa to Fresno Mesa, July 14, 1938, *Marsh 1397;* 3 mi. southeast of Saltillo, common on slopes at base of mountains, *Johnston 7249;* Sierra del Pino, La Noria, common on gravelly flats, *Johnston & Muller 451, Stewart 1204;* west base of Picacho del Fuste, rocky flats, *Johnston 8425;* Sierra Madera, Cañon Charretera, openings in brush on rocky flats, *Johnston 9058;* eastern foothills of Sierra Cruces near Santa Elena, rocky flats and slopes, *Johnston & Muller 217, 1385, Stewart 831*. CHIHUAHUA: Sierra Virulento, east of Rancho Virulento, rocky terrace, *Johnston 9084;* Sierra Organos, 1937, *LeSueur 165;* hills and plains near Chihuahua, *Pringle 409*.

Widely distributed in the western United States and south to Guatemala. Well-drained soils on plains and hillsides. Usually growing with the more common *B. gracilis*.

Bouteloua scorpioides Lag. Gen. et Sp. Nov. 5 (1816).

Reported by Griffiths and Hitchcock from Cedros, Zacatecas (*Lloyd 105*), where it is said to make turf on the plains. Otherwise the species is known only from central Mexico, from San Luis Potosi to Puebla.

Bouteloua ramosa Scribn. ex Vasey, U. S. Dept. Agric., Div. Bot. Bull. **12**[1]: *t. 44* (1890).

VERNACULAR NAMES: Chino; Zacate Chino.

COAHUILA: 20 km. south of Ocampo, gravelly flats at base of mountains, *Johnston*

9177; Monclova, 1880, *Palmer 1358;* Cuatro Cienegas, Puerto del Norte, *Harvey 1207;* Cuatro Cienegas, *Marsh 2054;* near Rancho Santa Teresa, south of Castaños, *Wynd & Mueller 172;* 25 mi. south of Monclova, limy hillside, *Johnston 7200;* hills 20 mi. west of Saltillo, *Shreve & Tinkham 9826;* Saltillo, rough stony mountain-side, 1898, *Palmer 404;* west base of Picacho del Fuste, rocky flats, *Johnston 8418;* west end of Sierra Fragua, near Aguaje Pajarito, rocky flat, *Johnston 8793;* desert 55 mi. west of Saltillo, rocky sandstone slope, *Johnston 7697;* Picachos Colorados, rocky slope at base of cliffs, *Johnston & Muller 117;* Sierra Cruces near Santa Elena, rocky flats among brush, *Johnston & Muller 1022, 1383;* San Antonio de los Alamos, gravelly flat at head of cliffs, *Johnston 8249;* near Bufido, limestone hillside, *Johnston & Muller 850.* CHIHUAHUA: Sierra Santa Eulalia, dry calcareous banks, Aug. 14, 1885, *Pringle 414;* 13 mi. south of Jimenez, *Harvey 1339;* 31 mi. southeast of Jimenez, *Muller 3329.* ZACATECAS: Mountains back of Apizalaya, Hac. Cedros, *Lloyd 254* (US).

Southern trans-Pecos Texas south into our area. A common and characteristic grass on stony slopes and flats along the base and in the foothills of the limestone mountains of Coahuila, particularly in the Palma Belt, where it is usually abundant and a major forage grass.

In recent treatments of *Bouteloua,* the present species, *B. ramosa,* has been treated as a synonym of *B. breviseta* Vasey. These two species, however, although obviously closely related, differ in distribution, soil preference, habit of growth, and in some minor morphological characters. *Bouteloua breviseta* is a plant of highly gypsiferous soils in the northern half of trans-Pecos Texas and in southeastern New Mexico. Its leaves are strongly involute and its spikes are pale and erect or stiffly ascending. *Bouteloua ramosa,* ranging south of *B. breviseta,* is a plant of stony, prevailingly limestone, flats and slopes. Its leaf-blades are usually nearly flat, with the upper surface much less hairy than in *B. breviseta.* The dark-colored spikes are stouter and much more spreading. The stems become more fruticulose, are strictly erect, and form denser tufts.

Bouteloua gracilis (H.B.K.) Lag. ex Steud. Nom. Bot. ed. 2, **1:** 219 (1840).

VERNACULAR NAMES: Grama; Navajitas.

COAHUILA: Sierra del Carmen, Aug. 21 and 29, 1936, *Marsh 570, 693;* 20 mi. northwest of Hac. La Babia, open valley floor, *Wynd & Mueller 435;* trail from southern end of Hillcoat Mesa to Buena Vista headquarters, July 27, 1938, *Marsh 1506;* Mesa Grande, 40 km. northwest of Hac. Encantada, meadows, abundant, *Stewart 1632;* Saltillo, stony mountain-side, 1898, *Palmer 399, 406;* Saltillo, along ditches, 1898, *Palmer 403;* 3 km. southwest of Fraile, *Stanford et al. 332;* San Antonio de las Alanzanas, frequent, Aug. 3, 1848, *Gregg 370;* Sierra del Pino, La Noria, meadows, *Johnston & Muller 701, Stewart 1209;* west base of Picacho del Fuste, gravelly soil, 2–3½ ft. tall, *Johnston 8424;* Sierra Madera, Cañon Charretera, open rocky canyon floor, 2–3 ft. tall, *Johnston 9159;* tableland north of Cañon del Cuervo Chico, rocky slopes of low limestone hills, *Johnston 8560;* between Palos Blancos and San Pedro, east of Cuesta Zozaya, high grassy valley, *Johnston 9274;* Sierra Cruces, near Santa Elena, stony flats among bushes, *Johnston & Muller 1028;* gypsum ridge east of Laguna Jaco, common, *Stewart & Johnston 1964, 1966.* CHIHUAHUA: Rancho El Pino, southeast of Sierra Rica, rocky slopes, *Stewart 2408;* Sierra Virulento, rocky terrace, *Johnston 9082;* 2 mi. west of Pozo de Villa, sabaneta under low bushes, *Johnston 8165;* 4½ mi. northwest of San Francisco, grassy flat, *Stewart & Johnston 2011;* Sierra Organos, 1937, *LeSueur 166;* White Water, 1893, *Mearns 2301;* Villa Ahumada, flats, *LeSueur 66;* near Chihuahua, *Pringle 407;* 6 mi. west of Piloncillo, with tobosa in grassland, *Johnston 7878.* ZACATECAS: Valley 15 km. west of Concepcion del Oro, *Stanford et al. 522;* Pico de Teira, *Lloyd 242* (US).

Widely distributed in the western United States and south to central Mexico. A generally distributed grass in our area. It is abundant in some of the larger valleys and on the igneous oak-clad hills of eastern Chihuahua, where it may become the dominant plant over large areas. In the limestone areas of Coahuila it is rather common on the tablelands and larger valleys in the oak and lower pine belts. On the lower slopes of the limestone mountains it is frequent with other grasses among the bushes on rocky flats and slopes in the Palma Belt. It avoids clay, and along the foot of limestone mountains it is found only where the soil is stony.

Bouteloua eriopoda Torr. Pac. R. R. Rep. **4**: 155 (1857).

COAHUILA: Sierra del Carmen, Sept. 13, 1936, *Marsh 896;* west base of Picacho del Fuste, cemented gravels on flats, not common, stems pallid, sprawling, *Johnston 8420;* San Antonio de los Alamos, summit of high tuff cliffs, gravelly flat, *Johnston 8251, 8257;* west end of Sierra Fragua, Aguaje Pajarito, frequent on rocky flats, stems grayish, erect or ascending, *Johnston 8718;* eastern foothills of Sierra Cruces near Santa Elena, gypsum flat, *Johnston & Muller 245;* Sierra Cruces, 8 mi. north of Santa Elena, stony flat among bushes, stems laxly ascending, *Johnston & Muller 1021, 1025;* south base of Picacho San José, rocky slope, stems wiry, ascending, *Johnston & Muller 802.* CHIHUAHUA: 1 mi. east of Pozo de Villa, silty plain, among bushes, *Johnston 8176;* Presidio del Norte, Sept. 1, 1852, *Bigelow;* east base of Sierra Virulento, rocky bench, *Johnston 8085;* 4½ mi. northwest of San Francisco, fairly abundant on grassy flat, *Stewart & Johnston 2012;* Sierra Organos, 1937, *LeSueur 162;* Sierra Santa Eulalia, Aug. 31, 1885, *Pringle 411;* south of San Fernando, silty soil on plain, common, *Johnston 7937;* 6 mi. west of Piloncillo, lava slope, *Johnston 7875.*

Western Texas to Arizona and northern Mexico. A generally distributed but not abundant grass in northern Coahuila and eastern Chihuahua. Its pallid lax loosely ascending frequently somewhat sprawling stems and woolly leaf-sheaths give the plant a very distinctive appearance.

Bouteloua Karwinskii (Fourn.) Griffiths, Contr. U. S. Nat. Herb. **14**: 394 (1912).

COAHUILA: Valley floor 3–4 km. east of Puerto Caballo, with tobosa, common, *Johnston 8319;* south of Laguna de Leche, flats formed by planed-off Upper Cretaceous beds, slightly saline and gypsiferous soil, *Johnston 8618;* 1–2 mi. west of Matrimonio Viejo, about mogote at base of slightly saline and gypsiferous slope, *Johnston 9370.* ZACATECAS: Cedros, *Lloyd 170, 183* (US); 7 mi. north of San Tiburcio, heavy slightly saline soil on flats with mesquites, abundant, *Johnston 7358.*

Ranging from our area south and east to southern Tamaulipas (Cañon de las Minas et Victoria, *Karwinski 1479,* type) and San Luis Potosi. Griffiths, l.c., collected the species at Alonzo, east of San Luis Potosi, and gives an illustration, *pl. 76,* of the habitat. The species appears to be confined to slightly saline and gypsiferous clays. In habit it suggests small slender plants of *B. gracilis,* but it has smaller pale spikes.

Bouteloua trifida Thurb. in Wats. Proc. Am. Acad. **18**: 177 (1883).

COAHUILA: Road to Don Martin Dam, 9 km. from Nuevo Leon border, *Harvey 925;* Allende, *Marsh 1788;* Palm Canyon, near Muzquiz, *Marsh 977;* Yerda Spring, *Marsh 290;* Santa Anna Canyon, *Marsh 467;* Zacate, *Marsh 503;* Hermanas, *Marsh 1620;* 2 mi. northwest of Fronteras, road to Natadores, silty desert plain, *Johnston 7171;* Monclova, 1880, *Palmer 1355* (TYPE); Cañon Bocatoche, dominant grass of drier valley-floor, clumps 3 in. in diameter, *Muller 3110;* on desert near Rancho Santa Teresa, south of Castaños, *Wynd & Mueller 205;* dry desert between Hac. La Rosa and Hac. Lechuguilla, *Wynd & Mueller 65;* Saltillo, summit of stony treeless mountain, 1898, *Palmer 402;* Saltillo, 1905, *Palmer 522;* base of mountains 20 km. south of

Ocampo, one plant in mogote, *Johnston 9179;* south of Laguna de Leche, slightly saline and gypseous silty flat, *Johnston 8619;* Sierra Cruces, north of Santa Elena, rocky flat among bushes, *Johnston & Muller 1020, 1379.* CHIHUAHUA: Base of Sierra Santa Eulalia, dry gravelly soil, *Pringle 412.*

Western Texas to southern Nevada and Arizona, south to San Luis Potosi.

Bouteloua aristidoides (H.B.K.) Griseb. Fl. Brit. W. Ind. 537 (1864).

COAHUILA: Soledad, 1880, *Palmer 1354;* Monclova, 1880, *Palmer 1353;* Torreon, abundant in deep cut along railroad, 1898, *Palmer 513.* CHIHUAHUA: Rancho El Pino, southeast of Sierra Rica, rocky slope, *Stewart 2393;* Pirámide, gravelly flats under large oaks, *Johnston 8117;* low ridge southwest of Mesteñas, rocky slope, ascending, *Stewart & Johnston 2022;* Sierra Organos, 1937, *LeSueur 39;* 11 mi. northeast of Camargo, gravelly benches, common, *Johnston 7904;* Jimenez, banks of Rio Florido, *Harvey 1323;* Cañon La Renga, 15 km. northwest of Santa Fe, dry arroyos, ascending, *Stewart 2620.*

Western Texas to southern California and south to central Mexico; South America.

Bouteloua chondrosioides (H.B.K.) Benth. ex Wats. Proc. Am. Acad. **18:** 179 (1883).

CHIHUAHUA: Volcanic hills 20 km. north of Chihuahua, locally common along base of rocky slope, *Stewart & Johnston 2129;* rocky hills northeast of Chihuahua, forming close sod on small patches, *Pringle 410.*

Trans-Pecos Texas to Arizona and south to southern Mexico. Apparently favoring igneous rocks.

Bouteloua rigidiseta (Steud.) Hitchc. Jour. Wash. Acad. **23:** 453 (1933).

COAHUILA: Calcareous mesa near Piedras Negras, April 20, 1900, *Pringle 8018.*

Oklahoma south through central and eastern Texas into adjacent Mexico.

Bouteloua radicosa (Fourn.) Griffiths, Contr. U. S. Nat. Herb. **14:** 411 (1912).

COAHUILA: Don Martin Dam, *Harvey 934;* Caracol Mts., 1880, *Palmer 1354;* Puerto San Lazaro, common on rocky arroyo banks, *Muller 3051.*

Coahuila to Arizona and south to southern Mexico.

Bouteloua Johnstoni Swallen, Proc. Biol. Soc. Wash. **56:** 79 (1943).

COAHUILA: South end of Cañada Oscuro, confined to gypsum beds on the escarpment near Tanque La Luz, locally very common, *Johnston 8491* (ISOTYPE); high west end of the Sierra Fragua, north of Puerto Colorado, one large colony on east slope just below high crest, *Johnston 8751;* 1 km. northeast of Parritas, east side of Valle Acatita, common on gypsum mesas, *Stewart 2763.*

A very distinct species, of which only the three collections cited above are known. Near Tanque La Luz in Cañada Oscuro, and a mile or so to the southeast, on the steep north-facing slopes at the mouth of Cañon del Cuervo Chico, the grass was common on all the gypsum beds exposed on the escarpment. Its behavior was that of a marked gypsophile. On the steep west-facing slope up which I climbed from near Aguaje Pajarito to the high western crest of the Sierra Fragua, I found the grass again common. Here it was confined to a sharply delimited belt over a hundred feet wide. It was associated with some gypsum indicators, but the soil on which it grew was not pure gypsum, only very moderately gypseous at most. My collection no. *8751* came from a small colony near the ridge crest, and the only one observed away from the belt of the plant just mentioned. The soil gave no indications of being gypsiferous and no recognized gypsophiles were growing with it. Mr. Stewart's collection from near Rancho Parritas came from gypsum.

The plant has a very distinctive habit of growth. The stems, 15–45 cm. long, are ascending or decumbent. The clump appears to die in the middle and soon forms loose spongy rings of growth 5–10 dm. in diameter.

Bouteloua curtipendula (Michx.) Torr. in Emory, Notes Mil. Recon. 154 (1848).

COAHUILA: Desert 25 mi. southwest of Sabinas, *Wynd & Mueller 217;* Sierra del Carmen, Aug. 12, 1936, *Marsh 642;* Sierra del Carmen, Cañon Sentenela, *Wynd & Mueller 642;* Yerda Spring, *Marsh 252, 264;* Palm Canyon, *Marsh 980;* Santa Anna Canyon, *Marsh 546;* trail from south end of Hillcoat Mesa to Buena Vista headquarters, July 27, 1938, *Marsh 1507;* Monclova, *Harvey 1151;* Sierra Gloria, *Marsh 1946;* La Rosita, *Shreve & Tinkham 9592;* Saltillo, 1898, *Palmer 407;* Buena Vista, frequent, July 24, 1848, *Gregg 301;* Chojo Grande, 27 mi. southeast of Saltillo, 1904, *Palmer 371;* 3 km. southwest of Fraile, *Stanford et al. 327;* Sierra Cruces, near Santa Elena, abundant on open hillsides, up to 10 dm. tall, *Stewart 832;* San Antonio de los Alamos, gravelly flat on top of cliffs, *Johnston 8254;* west end of Sierra Fragua near Aguaje Pajarito, rocky flats, *Johnston 8792;* Sierra Negras, 9 km. south of Parras, *Stanford et al. 195;* 11 km. northeast of Jimulco, *Stanford et al. 51.* CHIHUAHUA: Rancho El Pino, southeast of Sierra Rica, rocky slopes, *Stewart 2406;* Chihuahua, rocky hillsides, 1908, *Palmer 114;* Chihuahua, hills and plains near Chihuahua, Aug. 27, 1885, *Pringle 408.* ZACATECAS: Concepcion del Oro, 1904, *Palmer 264;* Cedros, footslopes, 1908, *Lloyd 201.*

Widely distributed in central and eastern United States and south to Central America; South America. A common and widely distributed grass in our area, frequent in the grasslands of eastern Chihuahua. In the limestone mountains of Coahuila, with *B. ramosa,* forming the best pasturage for horses and cattle on the rocky slopes and flats in the foothills, and with *B. gracilis* the good pasturage on the tablelands and mountain valleys. In the eastern parts of our area the plants tend to have few spikelets in each spike and to intergrade with *B. uniflora.*

Bouteloua uniflora Vasey, Bot. Gaz. **16**: 26 (1891).

COAHUILA: Trail from Encantada Mesa to Fresno Mesa, July 20, 1938, *Marsh 1376;* Sierra del Pino, La Noria, meadow at lower edge of pine belt, *Johnston & Muller 450, Stewart 1217;* Sierra Madera, Cañon Charretera, openings in oak thickets on rocky flat, *Johnston 9060;* Saltillo, 1906, *Griffiths 8408;* Carneros Pass, tufts among bushes, *Johnston 7299.* ZACATECAS: Valley 15 km. west of Concepcion del Oro, plant 18 inches tall, *Stanford et al. 536.*

Known from Crockett and Val Verde Counties, Texas, south through eastern Coahuila to southwestern Nuevo Leon. This species is very closely related to *B. curtipendula* and is perhaps no more than an extreme form of that species. The material cited above agrees closely with the type collection. In all the specimens, only a single spikelet is borne at the base of the spike-rachis, which is prolonged above and distinctly overtops the lower glume of the spikelet. Material of *B. curtipendula* from eastern Coahuila and Nuevo Leon frequently has reduced spikes and some specimens have occasional spikes bearing only a single spikelet. In these spikes the rachis is slightly shorter than or about equal to the first glume, and it does not distinctly surpass it, as in typical *B. uniflora.* Since the eastern material of *B. curtipendula* tends to have the dark-colored spikelets usually present in *B. uniflora* and to simulate that species in habit, the differences seem more technical than important.

Cathestecum erectum Vasey & Hack. Bull. Torr. Bot. Cl. **11**: 37. *t. 45* (1884).

CHIHUAHUA: Presidio del Norte, *Bigelow, Parry;* 10 mi. south of Ojinaga, one colony in ravine in low hills, *Johnston 8018.*

In Texas known from the Big Bend area, near Presidio, and near Porvenir. The plant in Texas and adjoining Mexico seems confined to areas of gypseous, frequently saline, Upper Cretaceous clays and shales. The type came from Presidio, Texas. The species is also reported from the Pacific slope of Mexico, from Sonora to El Salvador, cf. Swallen, Jour. Wash. Acad. **27**: 500 (1937).

Munroa squarrosa (Nutt.) Torr. Pac. R. R. Rep. **4**: 158 (1857).

CHIHUAHUA: Sandy soil near Juarez, Sept. 26, 1902, *Pringle;* near Colonia Diaz, *Nelson 6457.*

Central United States south into Chihuahua.

Buchloë dactyloides (Nutt.) Engelm. Trans. Acad. Sci. St. Louis **1**: 432 (1859).

COAHUILA: Saltillo, banks of ravine in compact mat, 1898, *Palmer 7;* 2 mi. west of Saltillo on road to Torreon, *Harvey 1087;* valley near Fraile, *Stanford et al. 271, 288.* CHIHUAHUA: Rancho El Pino, southeast of Sierra Rica, wet sandy arroyo, common, *Stewart 2405;* 10 km. east of Jimenez, *Harvey 1346.* ZACATECAS: Concepcion del Oro, cemetery, 1904, *Palmer 267;* valley 15 km. west of Concepcion del Oro, *Stanford et al. 552;* Cedros, sinks and flats, *Lloyd 211.*

Central United States and south in eastern Mexico to Puebla.

Phalaris canariensis L. Sp. Pl. 54 (1753).

COAHUILA: Monclova, 1939, *Marsh 1693.*

A Mediterranean species, introduced in various parts of America.

Phalaris caroliniana Walt. Fl. Carol. 74 (1788).

COAHUILA: Muzquiz, 1936, *Marsh 1078.* CHIHUAHUA: Common, forming large pure stands in low meadows and along ditches, 1908, *Palmer 32.*

Widely distributed in the southern half of the United States and in adjoining Mexico.

Trichachne insularis (L.) Nees, Agrost. Bras. 86 (1829).

COAHUILA: Santa Anna Canyon, *Marsh 430;* hills 20 mi. west of Saltillo, *Shreve & Tinkham 9829.* CHIHUAHUA: Rocky hills near Chihuahua, Aug. 1885, *Pringle 378.*

Florida to New Mexico and south to Argentina. A coarse plant in the tropics but becoming small in stature in our area and frequently rather similar in aspect to *T. californica,* but readily distinguished from it by its proportionately narrower, lanceolate spikelets, bearing sordid or tawny, rather than pure white or purplish, hairs.

Trichachne Hitchcockii Chase, Jour. Wash. Acad. **23**: 454 (1933).

COAHUILA: Sierra Cruces, limestone hillside just west of Santa Elena, rare, *Johnston 8195.*

Known from a few collections from Texas (San Antonio west to Sanderson) and south to San Luis Potosi.

Trichachne californica (Benth.) Chase, Jour. Wash. Acad. **23**: 455 (1933).

COAHUILA: Don Martin Dam, *Harvey 935;* Hermanas, *Marsh 1626;* Monclova, 1880, *Palmer 1341;* mouth of Cañon Cuervo Chico, under bushes on rocky flat, *Johnston 8570;* Rosario, among bushes in mogote, *Johnston 8825;* 14 mi. east of Paila, *Shreve & Tinkham 9899;* north of Sierra Cruces, about mogote west of San Rafael, *Johnston & Muller 1040.* CHIHUAHUA: Rancho El Pino, southeast of Sierra Rica, rocky slope, *Stewart 2409;* Coahuilan boundary 1 mi. east of Poza de Villa, among bushes on silty plain, *Johnston 8173;* Chihuahua, 1935, *LeSueur 77.*

Texas to Colorado and Arizona, and south to central Mexico.

Digitaria sanguinalis (L.) Scop. Fl. Carn. ed. 2, **1**: 52 (1772).

COAHUILA: Muzquiz-La Mariposa, 1936, *Marsh 1049;* Monclova, 1939, *Harvey 1165;* Saltillo, 1898, *Palmer 387.* CHIHUAHUA: Presa de Chihuahua, 1936, *LeSueur 142;* 5 km. west of Camargo, 1939, *Harvey 1415.*

Widely introduced European garden weed.

Leptoloma cognatum (Schult.) Chase, Proc. Biol. Soc. Wash. **19**: 192 (1906).

COAHUILA: Sabinas, *Nelson 6822* (US); Santo Domingo, open slopes of igneous hill, *Wynd & Mueller 482;* Sierra Cruces, edge of gypsum bed in arroyo south of Santa Elena, only one plant seen, *Johnston 9405.* CHIHUAHUA: 4 mi. southeast of Organos, in low bushes on grassy slope, fairly common, *Stewart & Johnston 2047;* Chihuahua, hills and plains, *Pringle 489* (US).

Eastern United States to Minnesota and Texas and west along the boundary to Arizona; south through eastern Mexico to San Luis Potosi.

Eriochloa gracilis (Fourn.) Hitchc. Jour. Wash. Acad. **23**: 455 (1933).

COAHUILA: Torreon, under bushes on banks of Rio Nazas, 1898, *Palmer 509.* CHIHUAHUA: Cieneguita, wet arroyo bottom, *Johnston & Muller 1417;* Los Medanos, 1935, *LeSueur 64;* near the Sacramento, Chihuahua, Sept. 16, 1886, *Pringle 812;* 20 km. south of Camargo, *Harvey 1385.*

Texas to Arizona and south to Central America.

Eriochloa punctata (L.) Desv. ex Hamilt. Prodr. Ind. Occ. 5 (1825).

COAHUILA: Monclova, *Harvey 1147.*

Louisiana and eastern Texas south in eastern Mexico to Vera Cruz; South America.

Brachiaria Meziana Hitchc. Contr. U. S. Nat. Herb. **12**: 140 (1908).

COAHUILA: Saltillo, along irrigation ditch, 1910, *Hitchcock 402.* CHIHUAHUA: Valley near Chihuahua, Sept. 20, 1885, *Pringle 375.*

Coahuila and Chihuahua south to Oaxaca.

Paspalum distichum L. Syst. Nat. ed. 10, **2**: 855 (1759).

COAHUILA: Saltillo, 1898, *Palmer 259, 391.* CHIHUAHUA: Rancho El Pino, southeast of Sierra Rica, wet sandy arroyo, *Stewart 2401;* 5 km. west of Camargo, *Harvey 1407.* DURANGO: Mapimi, 1898, *Palmer 553.*

Along streams and ditches and other wet places, widely distributed in America.

Paspalum pubiflorum Rupr. ex Fourn. Mex. Pl. **2**: 11 (1886).

COAHUILA: Yerda Spring, *Marsh 292;* Santa Anna Canyon, *Marsh 435;* Palm Canyon, *Marsh 324;* Muzquiz, *Marsh 1156;* Mesa Grande, northwest of Hac. Encantada, wet arroyo, fairly common, *Stewart 1619;* Hermanas, *Marsh 2259;* Monclova, *Marsh 1721;* 50 km. south of Monclova, *Harvey 1126;* Sierra Hechiceros, Cañon Indio Felipe, creek bank, *Stewart 91;* Sierra Cruces, Cañon Tinaja Blanca, arroyo bank, erect, *Stewart 1133;* Torreon, 1898, *Palmer 515;* Jimulco Springs, May 13, 1885, *Pringle 427.* CHIHUAHUA: Sierra Almagre, Ojo Almagre, about spring, becoming 6 ft. tall, *Johnston & Muller 1201;* near Chihuahua, by streams, Sept. 1885, *Pringle 374;* 5 km. west of Camargo, *Harvey 1405a.*

Louisiana and Texas south to southern Mexico.

Paspalum crinitum Chase in Hitchc. Contr. U. S. Nat. Herb. **17:** 237 (1913).

COAHUILA: Chojo Grande, 27 mi. southeast of Saltillo, about summit of waterfall in moist place, 1904, *Palmer 338.*

Reported by Chase, Contr. U. S. Nat. Herb. **28:** 61 (1929) from Coahuila, San Luis Potosi, Jalisco, and Puebla.

Paspalum Hartwegianum Fourn. Mex. Pl. **2:** 12 (1886).

COAHUILA: 24 km. east of Don Martin Dam, *Harvey 949.*

Texas south to southern Mexico.

Paspalum mutabile Chase, Contr. U. S. Nat. Herb. **28:** 61 (1929).

COAHUILA: Palm Canyon, Muzquiz area, *Marsh 978.*

Northeastern Mexico south to Hidalgo.

Paspalum ciliatifolium Michx. Fl. Bor. Am. **1:** 44 (1803).

CHIHUAHUA: Los Medanos, 1935, *LeSueur 62.*

A very variable species of sandy soils, widely distributed in the eastern half of the United States; reported from the West Indies and Central America. The cited collection is an unusually glabrous plant and keys to *P. propinquum* in Chase's monograph. I am, however, perfectly content to refer it to typical *P. ciliatifolium;* cf. Rhodora **36:** 21 (1934). Chase cites a collection of *P. stramineum* Nash from near Juarez, Chihuahua ("Paso del Norte, *Pringle 1123*"). This is presumably a form of the present species with puberulent foliage and somewhat hairy fruit, i.e. the var. *stramineum* (Nash) Fernald.

Panicum ramisetum Scribn. U. S. Dept. Agric., Div. Agrost. Cir. **27:** 9 (1910).

COAHUILA: Rio Grande Valley near Piedras Negras, April 23, 1900, *Pringle 8323.*

Texas south into adjoining Coahuila. The present species probably should be united with *P. Reverchoni* Vasey (1889), an older species having practically the same geographical distribution.

Panicum lanuginosum Ell. var. **Lindheimeri** (Nash) Fernald, Rhodora **36:** 77 (1934).

COAHUILA: Muzquiz, *Marsh 1171;* Cañon Agua Grande, west of Las Delicias, by water, erect, *Stewart 2800.*

A phase of a variable species widely distributed in the eastern United States. Although ranging with the other variants of the species farther northward and eastward, the present glabrous form is the most common, if not the only, phase of the species in south central and trans-Pecos Texas.

Panicum oligosanthes Schultes, var. **Scribnerianum** (Nash) Fernald, Rhodora **36:** 80 (1934).

COAHUILA: Sierra del Carmen, Cañon Sentenela, *Wynd & Mueller 519;* Sierra Hechiceros, Cañon Indio Felipe, common on creek bank, *Stewart 74.*

Widely distributed in the United States; in Mexico known only from Coahuila.

Panicum pedicellatum Vasey, U. S. Dept. Agric., Div. Bot. Bull. **8**: 28 (1889).

COAHUILA: Sierra Madera, Cañon Charretera, common in gravelly bed of arroyo in oak belt, *Johnston 8919*.

Central Texas and eastern Coahuila.

Panicum fasciculatum Sw. Prodr. Veg. Ind. Occ. 22 (1788).

Panicum fasciculatum var. *reticulatum* Beal, Grasses No. Am. **2**: 117 (1896).

CHIHUAHUA: Plains near Chihuahua, Sept. 2, 1885, *Pringle 379, 380;* 6 mi. west of Piloncillo, low place in grassland, *Johnston 7863*.

Florida; Texas to Arizona and south into South America.

Panicum arizonicum Scribn. & Merr. U. S. Dept. Agric., Div. Agrost. Cir. **32**: 2 (1901).

COAHUILA: San Antonio de los Alamos, summit of tuff cliffs, gravelly flat, two plants only, *Johnston 8250*. CHIHUAHUA: 7½ mi. south of Pirámide, silty flat, flooded by storm-water, rare, *Johnston 8100;* 10 mi. southeast of Organos, fairly abundant on gentle grassy slope, *Stewart & Johnston 2034;* north of El Carmen, 1935, *LeSueur 69;* Chihuahua, *Pringle 487* (US); Meoqui, 1935, *LeSueur 37;* 20 km. south of Camargo, *Harvey 1391*.

Trans-Pecos Texas to southern California and south in western Mexico to Oaxaca.

Panicum hirticaule Presl, Rel. Haenk. **1**: 308 (1830).

COAHUILA: Rancho Las Uvas, east side Valle Acatita, shale on slope, *Stewart 2701*. CHIHUAHUA: Llano Chilicote, 7 mi. east of Chilicote Station, grassy flat, *Johnston 7992;* Chihuahua, 1935, *LeSueur 12;* Meoqui, 1935, *LeSueur 32;* 20 km. south of Camargo, *Harvey 1378;* 6 mi. west of Piloncillo, lava hillside, *Johnston 7866*.

Texas to southern California and south to South America. An annual species, becoming large and coarse in the tropics. Our reduced northern form is 1–3 dm. tall.

Panicum filipes Scribn. ex Heller, Contr. Herb. Frankl. Marsh. College **1**: 13 (1895).

COAHUILA: El Berrendo, *Harvey 1186*.

Texas and eastern Coahuila.

Panicum Hallii Vasey, Bull. Torr. Bot. Cl. **11**: 64 (1884).

COAHUILA: Yerda Spring, *Marsh 288;* Santa Anna Canyon, *Marsh 427;* Hillcoat Canyon, west of Buena Vista Ranch, July 13, 1938, *Marsh 1278;* 2 mi. northwest of Fronteras, road to Natadores, silty desert plain, *Johnston 7170;* near Rancho Santa Teresa, south of Castaños, *Wynd & Mueller 174;* mountains west of Saltillo, 1880, *Palmer 1338;* hills 20 mi. west of Saltillo, *Shreve & Tinkham 9821;* Sierra del Pino, La Noria, meadows and arroyo-bank, *Johnston & Muller 467, 694, Stewart 1211;* Sierra Madera, Cañon Charretera, ledges on sunny slope in oak belt, *Johnston 9104;* 14 mi. east of Paila, *Shreve & Tinkham 9897;* San Antonio de los Alamos, gravelly flat on top of tuff cliffs, *Johnston 8250;* Sierra Cruces, 8 mi. north of Santa Elena, stony flat, *Johnston & Muller 1017;* 7 mi. south of Jaco, about mogote, *Johnston & Muller 1111*. CHIHUAHUA: Rancho El Pino, southeast of Sierra Rica, rocky slope, *Stewart 2395;* Coahuilan boundary a mile east of Pozo de Villa, silty plain, *Johnston 8175;* Sierra Santa Eulalia, Aug. 1885, *Pringle 376*.

Texas to Arizona and south to Hidalgo and Durango.

Panicum lepidulum Hitchc. & Chase, Contr. U. S. Nat. Herb. **15**: 75 (1910).

Based upon *Pringle 487,* collected Sept. 22, 1885, by stream in rocky hills near (west of) Chihuahua, the type, and on material from Durango and the Federal District. I have not seen the type collection. The other specimens originally cited, however, suggest that it may possibly be only a form of *P. Ghiesbreghtii* Fourn.

Panicum bulbosum H.B.K. Nov. Gen. et Sp. **1**: 99 (1815).

COAHUILA: Sierra del Carmen, Aug. 26, 1936, *Marsh 630;* Sierra del Carmen, Cañon Sentenela, *Wynd & Mueller 514;* Sierra Gloria, *Marsh 1875.* CHIHUAHUA: River canyon west of Chihuahua, moist places, Aug. 7, 1885, *Pringle 377.*

Trans-Pecos Texas to Arizona and south to Oaxaca.

Panicum virgatum L. Sp. Pl. 59 (1753).

Panicum plenum Hitchc. & Chase, Contr. U. S. Nat. Herb. **15**: 80 (1910).

COAHUILA: Sierra del Pino, head of Cañon Ybarra, dry hillside, *Stewart 1248;* Sierra del Pino, La Noria, arroyo banks, *Johnston & Muller 465.* CHIHUAHUA: Pirámide, low ground, coarse clumps 2–4 ft. tall, *Johnston 8140.*

United States, except the Pacific States, south to Central America.

Panicum Havardii Vasey, Bull. Torr. Bot. Cl. **14**: 95 (1887).

CHIHUAHUA: Los Medanos, 1935, *LeSueur 82.*

Extreme western Texas, eastern New Mexico, and northern Chihuahua, in sandy places. Hitchcock & Chase, Contr. U. S. Nat. Herb. **15**: 94 (1910), report a collection from "Paso del Norte, *Pringle 1124.*"

Panicum agrostoides Spreng. Pl. Pugil. **2**: 4 (1815).

Panicum condensum Nash in Small. Fl. S. E. U. S. 93 (1903).

COAHUILA: Muzquiz Swamp, 1936, *Marsh 928.*

Eastern United States and northeastern Mexico.

Panicum obtusum H.B.K. Nov. Gen. et Sp. **1**: 98 (1816).

VERNACULAR NAME: Zacate Gramilla.

COAHUILA: Open country between Rancho Santo Domingo and Hac. Piedra Blanca, *Wynd & Mueller 486;* Santa Anna Canyon, *Marsh 463;* Yerda Spring, *Marsh 964;* vicinity of Encantada Ranch headquarters and eastward, July 27 or 28, 1938, *Marsh 1514, 1535;* desert near Rancho Santa Teresa, south of Castaños, *Wynd & Mueller 204;* Saltillo, in graveyard, 1898, *Palmer 394;* 24 km. northwest of Fraile, south slope of mountain, *Stanford et al. 397a;* La Ventura, *Nelson 3908* (US); Torreon, overflowed land, 1898, *Palmer 504;* 5 km. northeast of Jimulco, dry canyon, *Stanford et al. 125;* Sierra del Pino, 10 km. southwest of La Noria, dry hillside, *Stewart 1266a;* Sierra del Pino, La Noria, meadow on flat, *Johnston & Muller 698;* Sierra Cruces, 3 km. west of Santa Elena, black loamy flat, *Stewart 834;* charco on plain southeast of Almagre, wet meadow, *Johnston & Muller 1225.* CHIHUAHUA: Rancho El Pino, southeast of Sierra Rica, wet sandy arroyo, *Stewart 2398;* 2 mi. west of Pozo de Villa, sabaneta, *Johnston 8164;* Llano de Chilicote, flats 7 mi. east of Chilicote Station, *Johnston 7990;* Chihuahua, *Pringle 476* (US); south of Chihuahua, 1936, *LeSueur 131;* 10 km. east of Jimenez, *Harvey 1349.* ZACATECAS: Concepcion del Oro, cemetery, 1904, *Palmer 266;* mountain 18 km. west of Concepcion del Oro, *Stanford et al. 582.*

Missouri and Texas to Colorado and Arizona, and south to central Mexico. Growing in wet soil or low places where storm water frequently collects.

Oplismenus hirtellus (L.) Beauv. Ess. Agrost. 54, 168 (1812).

COAHUILA: Palm Canyon near Muzquiz, Sept. 19, 1936, *Marsh 985.*

Northern Mexico to Argentina.

Echinochloa colonum (L.) Link, Hort. Berol. **2**: 209 (1833).

COAHUILA: Sierra del Carmen, Aug. 29, 1936, *Marsh 699;* Santa Anna Canyon, *Marsh 428, 431;* Sabinas River, Muzquiz, *Marsh 405;* El Berrendo, *Harvey 1179;* Monclova, *Marsh 1844;* 12 km. north of Agritos, damp arroyo, *Stewart 1282;* Llano de Guaje, 5 km. west of mouth of Cañon Ybarra, about tanque, *Stewart 1920;* Tanque Jerico, north of Rancho El Fuste, under bushes near tank, *Johnston 8342;* Parras, bottom-land, 1898, *Palmer 454;* Torreon, under bushes along Rio Nazas, 1898, *Palmer 508.* CHIHUAHUA: Presidio del Norte, *Bigelow;* Presa de Chihuahua, *LeSueur 134;* Sierra Organos, *LeSueur 176;* Jimenez, banks of Rio Florido, *Harvey 1330.*

A European weed, widely distributed in gardens and bottom-lands.

Echinochloa Walteri (Pursh) Heller, Cat. No. Am. Pl. ed. 2, 21 (1900).

COAHUILA: Muzquiz Swamp, *Marsh 891.*

Eastern United States south to Texas and northern Coahuila.

Echinochloa crus-galli (L.) Beauv. Ess. Agrost. 53 (1812).

COAHUILA: Sierra del Carmen, Sept. 8, 1936, *Marsh 751;* Hermanas, *Marsh 1576;* Cuatro Cienegas, 1939, *Marsh 2023;* Saltillo, 1898, *Palmer 380, 418.* CHIHUAHUA: Presa de Chihuahua, *LeSueur 135.*

Widely distributed weedy plant in gardens and wet soils.

Chaetium bromoides (Presl) Benth. ex Hemsl. Biol. Centr. Am. Bot. **3:** 503 (1885).

Hitchcock, Contr. U. S. Nat. Herb. **17:** 259 (1913), reports this species from "CHIHUAHUA: Chihuahua, *Palmer* in 1886." The data on the specimen is possibly erroneous. Except for this specimen, the species is known only from central Mexico south into Central America.

Setaria lutescens (Weigel) Hubbard, Rhodora **18:** 232 (1916).

CHIHUAHUA: 5 km. west of Camargo, 1939, *Harvey 1413.*

A European weed, widely distributed in temperate North America.

Setaria geniculata (Lam.) Beauv. Ess. Agrost. 51, 178 (1812).

COAHUILA: 20 mi. northwest of La Babia, open valley floor, *Wynd & Mueller 431;* Santa Anna Canyon, *Marsh 434;* Sabinas River, Muzquiz, *Marsh 396;* Muzquiz Swamp, *Marsh 936;* valley below Saltillo, frequent, 2 ft. tall, Sept. 23, 1848, *Gregg 536;* Saltillo, 1898, *Palmer 383;* Parras, 1898, *Palmer 451;* Jimulco Springs, May 13, 1885, *Pringle 431.* CHIHUAHUA: Chihuahua, *LeSueur 138.*

Southeastern United States west to Texas and south to Argentina. The type of *Chaetochloa gibbosa* Scribn. & Merr., referred to *C. macrostachya* by Hitchcock, Contr. U. S. Nat. Herb. **22:** 204 (1920), properly belongs in the synonymy of the present species.

Setaria verticillata (L.) Beauv. Ess. Agrost. 51, 178 (1810).

COAHUILA: Monclova, 1939, *Marsh 1841;* Parras, shaded garden, 1898, *Palmer 453.* CHIHUAHUA: Presa de Chihuahua, 1936, *LeSueur 137.*

A European weed.

Setaria Grisebachii Fourn. Mex. Pl. **2:** 45 (1886).

COAHUILA: Sierra del Carmen, Sept. 8, 1936, *Marsh 762;* Jardin del Sur, Sept. 3, 1936, *Marsh 776;* Sierra Guajes, Cañon Madera, east of Buena Vista, hillside, *Stewart 1503;* Palm Canyon, *Marsh 983;* Saltillo, in garden, 1898, *Palmer 385;* San Lorenzo Canyon, 6 mi. southeast of Saltillo, mouth of canyon, 1904, *Palmer 397;* Chojo Grande, shade of rocky ledges, 1904, *Palmer 336, 337;* Sierra del Pino, La Noria, hillsides and meadows, *Stewart 1206;* San Antonio de los Alamos, talus at base of cliffs, *Johnston 8275.* CHIHUAHUA: 7 mi. northwest of Temporales de Honorato, abundant in mogote, *Stewart & Johnston 1989;* Chihuahua, *LeSueur 25;* rocky hills northeast of Chihuahua, shaded places, Sept. 16, 1885, *Pringle 381.*

Texas to Arizona and south to southern Mexico. A native annual, very suggestive of *S. verticillata* in general habit.

Setaria macrostachya H.B.K. Nov. Gen. et Sp. **1**: 110 (1816).

Chaetochloa leucopila Scribn. & Merr. U. S. Dept. Agric., Div. Agrost. Bull. **21**: 26 (1900).

Setaria leucopila Schum. in Just's Bot. Jahresb. **28**[1]: 417 (1902).

Coahuila: Allende, *Marsh 1791;* Sierra del Carmen, Aug. 8, Sept. 6 and 13, 1936, *Marsh 687, 852, 903;* northwest of Hac. La Babia, open valley floor, *Wynd & Mueller 441;* Cañon Milagro, Sierra Guajes, shaded places, *Stewart 1707;* trail from south end of Hillcoat Mesa to Buena Vista headquarters, July 27, 1938, *Marsh 1504;* Cuatro Cienegas, *Marsh 2027, Harvey 1209a;* Monclova, *Marsh 1696;* Saltillo, 1898, *Palmer 378;* east base of Picacho del Fuste, about bushes on flat, *Johnston 8433;* north of Sierra Cruces, about mogote west of San Rafael, *Johnston & Muller 1041;* Sierra Cruces, sunny hillside 5 km. west of Santa Elena, *Stewart 833;* Parras, 1880, *Palmer 1363* (isotype of *S. leucopila*); Parras, 1898, *Palmer 449.* Chihuahua: Silty plain on Coahuilan boundary 1 mi. east of Pozo de Villa, *Johnston 8174;* Rancho El Pino, southeast of Sierra Rica, rocky slope, *Stewart 2396;* Los Medanos, 1935, *LeSueur 55;* 20 km. south of Camargo, *Harvey 1383.* Zacatecas: Concepcion del Oro, 1904, *Palmer 261.*

Central and southern Texas to Arizona and south to Central America. A very variable species in height, leaf-width, and size and form of the spike, apparently in response to varying ecological conditions. Our common form has the leaves less than 8 mm. broad, the spike cylindrical, and the plant usually 4–8 dm. tall. It has been described as *S. leucopila.* More vigorous plants have leaves 10–15 mm. wide, the plant over a meter tall, and the spike cylindrical or broadest below the middle and more or less attenuate above. Typical *S. macrostachya* is this large form with cylindrical spike. From the large forms with attenuate inflorescence there are numerous transitions to *S. Scheelei,* a more robust plant with more or less branched open inflorescence.

Setaria Scheelei (Steud.) Hitchc. Proc. Biol. Soc. Wash. **41**: 163 (1928).

Coahuila: Torreon, 1898, *Palmer 505.* Chihuahua: Ojo Almagre, Sierra Almagre, about spring, 6 ft. tall, *Johnston & Muller 1202.*

Texas and northeastern Mexico. *Setaria villosissima* (Scribn. & Merr.) Schum. is probably a synonym of this species.

Cenchrus myosuroides H.B.K. Nov. Gen. et Sp. **1**: 115 (1816).

Coahuila: Santa Anna Canyon, *Marsh 437;* Saltillo, *Hitchcock 5647* (US); Cienega Grande, May 18, 1847, *Gregg 702;* Tinaja del Norte, Sierra Cruces, 25 km. northwest of Santa Elena, among rocks in shaded canyon, not common, *Stewart 2151.* Chihuahua: Wet places near Chihuahua, May 25, 1885, *Pringle 429;* Meoqui, 1936, *LeSueur 140;* 60 km. north of Escalon, *Harvey 1302.*

Texas (Uvalde to Brewster Counties) south through Mexico to South America.

Cenchrus echinatus L. Sp. Pl. 1050 (1753).

Coahuila: Monclova, 1880, *Palmer 1343;* Monclova, 1939, *Marsh 1831.*

Chase, Contr. U. S. Nat. Herb. **22**: 61 (1920), reports the species from Torreon (*Hitchcock 7558*). Texas to Arizona and south into tropical America.

Cenchrus pauciflorus Benth. Bot. Voy. Sulphur 56 (1840).

Vernacular name: Chancaquilla.

COAHUILA: On desert 25 mi. southwest of Sabinas, *Wynd & Mueller 218;* Rancho Agua Dulce, valley floor, *Wynd & Mueller 404;* 20 mi. northwest of Hac. La Babia, valley floor, *Wynd & Mueller 444;* Yerda Spring, 1936, *Marsh 287;* Hac. Encantada, abundant on flats, 1941, *Stewart 1733;* Monclova, 1939, *Marsh 1823;* near Esmeralda, fairly common along arroyo, *Stewart 2179;* Cañon Agua Grande, west of Las Delicias, on flats, common, *Stewart 2825.* CHIHUAHUA: 1935, *LeSueur 7;* 20 km. south of Camargo, 1939, *Harvey 1393.*

Chase, Contr. U. S. Nat. Herb. **22:** 71 (1920), reports the species from Saltillo. This species is probably indigenous to Mexico and Texas and was formerly much less generally distributed than at present. It has become a widely distributed and obnoxious weed along roads and about towns in waste ground. Chase refers the common, apparently indigenous *Cenchrus* of central United States to *C. pauciflorus,* but that seems doubtfully correct, for the broader darker green leaves and the shape and armature of the burs of that plant are more suggestive of *C. echinatus.*

Imperata brevifolia Vasey, Bull. Torr. Bot. Cl. **13:** 26 (1886).
Imperata Hookeri (Anderss.) Hack. in DC. Monogr. Phan. **6:** 97 (1889).

Collected in the bottoms of the Rio Grande on the Texan side of the river between El Paso and old Fort Quitman, and almost certainly to be found on the Chihuahuan side also.

Andropogon hirtiflorus (Nees) Kunth, Rév. Gram. **1:** Suppl. xxxix (1830).

COAHUILA: Sierra del Carmen, Cañon Sentenela, *Wynd & Mueller 548.* CHIHUAHUA: Sierra Organos, common on oak-clad slopes south of Organos, *Stewart & Johnston 2069;* rocky hills northeast of Chihuahua, Aug. 29, 1885, *Pringle 383.*

Trans-Pecos Texas to Arizona and south into tropical America. Our plants represent the Mexican var. *feensis* (Fourn.) Hitchc. The plant closely resembles *A. scoparius* and *A. cirratus,* from which it differs chiefly in the scabrid strigose hairy glumes.

Andropogon cirratus Hack. Flora **68:** 119 (1885).

CHIHUAHUA: Rocky hills northeast of Chihuahua, Oct. 17, 1885, *Pringle 382.*

Southeastern Arizona to trans-Pecos Texas (east to the Davis Mts.) and south into Chihuahua and eastern Sonora. Closely related to *A. scoparius* and probably only a well-marked geographical variety, differing in having the hairs on the spikelet and pedicels scanty or nearly absent.

Andropogon scoparius Michx. Fl. Bor. Am. **1:** 57 (1803).

COAHUILA: Sierra del Carmen, Aug. 26, 1936, *Marsh 607;* Hillcoat Canyon, west of Buena Vista Ranch, July 13, 1938, *Marsh 1272;* Hillcoat Mesa, lying west of Encantada Ranch, July 25, 1938, *Marsh 1433;* Sierra del Pino, La Noria, along arroyo bottom and on rocky flats among scrub-oaks, *Johnston & Muller 449, 661;* tableland north of Cañon Cuervo Chico, rocky slopes of low rounded limestone hills, *Johnston 8558.*

Eastern United States west to Idaho and northern Arizona, apparently entering Mexico only in northern Coahuila. Our material falls into the var. *neomexicana* (Nash) Hitchcock, cf. Rhodora **37:** 143 (1935).

Andropogon virginicus L. var. **tenuispatheus** (Nash) Fern. & Grisc. Rhodora **37:** 142 (1935).

COAHUILA: Cañon Agua Grande, west of Las Delicias, near water, erect, 3 m. tall, scarce, *Stewart 2818.*

Wet ground from southeastern United States to California and south into tropical America.

Andropogon ternarius Michx. Fl. Bor. Am. **1**: 57 (1803).

COAHUILA: Sierra de los Guajes, Cañon Madera, fairly abundant on hillsides, *Stewart 1504;* Sierra Madera, Cañon Charretera, rocky bed of open arroyo in oak belt, common, becoming 4 ft. tall, *Johnston 9074.*

Delaware to Missouri and south to Florida and central Texas, entering Mexico only in northern Coahuila.

Andropogon Hallii Hack. Sitzungsb. Akad. Wiss. Wien **89**[1]: 127 (1884).

CHIHUAHUA: Los Medanos, 1935, *LeSueur 61.*

Sandy places from North Dakota to Utah, and south to Arizona and trans-Pecos Texas and northern Chihuahua.

Andropogon Gerardi Vitman, Summa Pl. **6**: 16 (1792).

Andropogon furcatus Muhl. ex Willd. Sp. Pl. **4**: 919 (1806).

COAHUILA: Sierra del Pino, meadows in the pine forests north of La Noria, common and conspicuous, *Johnston & Muller 542, Stewart 1226.*

Widely distributed in eastern and central United States. Known in Mexico only in Coahuila.

Andropogon saccharoides Sw. Prodr. 26 (1788).

Andropogon barbinodis Lag. Gen. et Sp. Nov. 3 (1816).

Andropogon perforatus Trin. ex Fourn. Mex. Pl. **2**: 59 (1886).

VERNACULAR NAME: Zacate aceite.

COAHUILA: Sierra del Carmen, July 29, 1936, *Marsh 638;* Hillcoat Canyon, west of Buena Vista Ranch, July 13, 1938, *Marsh 1313;* Hillcoat Mesa, lying west of Encantada Ranch, July 25, 1938, *Marsh 1435;* Hermanas, *Marsh 1628* and *2254;* Monclova, 1880, *Palmer 1347;* Monclova, *Marsh 1692;* desert near Rancho Santa Teresa, *Wynd & Mueller 207;* 2 mi. west of Saltillo, *Harvey 1096;* Saltillo, 1898, *Palmer 4, 261, 810;* Sierra del Pino, La Noria, *Stewart 1212, Johnston & Muller 667;* Sierra Madera, Cañon Charretera, bed of arroyo, *Johnston 9075;* 10 km. southwest of El Oro, on bajillo, *Stewart 3028;* Sierra Jimulco, 5 km. northeast of Jimulco, *Stanford et al. 132.* CHIHUAHUA: Vicinity of Rancho El Pino, 10 km. southeast of Sierra Rica, rocky slopes, *Stewart 2410;* near Juarez, May 30, 1888, *Pringle 1994;* Agua Caliente, 1935, *LeSueur 51;* Chihuahua, 1935, *LeSueur 2;* arroyo 20 km. south of Camargo, *Harvey 1382, 1389;* 6 mi. west of Piloncillo, grassland, *Johnston 7879.* ZACATECAS: Concepcion del Oro, 1904, *Palmer 262.*

Alabama and Missouri west to southern California and south to Argentina. A variable widely spread species which I am here accepting in the broad sense used by Hackel in his monumental treatment of the genus. Attempts to segregate out certain forms, such as *A. barbinodis,* by stressing length of peduncle, hairiness of the nodes, shape of panicle, size of spikelets, etc., have been singularly unsuccessful but persistent. The characters used show little tendency to vary together and some of them are probably associated with the vigor and rapidity of growth. Significantly, these segregates and the restricted species have practically the same geographical distribution in Mexico and the United States and commonly may be detected in the same locality. Some plants of *A. saccharoides* have a conspicuous pore developed on the glumes and have been distinguished as *A. perforatus.* The distribution of the form is sporadic and may occur in plants referred either to *A. saccharoides* or to *A. barbinodis*. Pitted glumes are known in other species of *Andropogon*. I see no reason why the development should be given specific recognition in the present case.

Sorghum halepense (L.) Pers. Syn. Pl. **1**: 101 (1805).

COAHUILA: Sierra del Carmen, Sept. 8, 1936, *Marsh 760;* trail from the southern end of Hillcoat Mesa to Buena Vista headquarters, July 27, 1938, *Marsh 1508;* Santa Anna Canyon, *Marsh 436;* Monclova, *Marsh 1663;* Saltillo, weed in field, *Hitchcock 5649* (US). CHIHUAHUA: Arroyo 20 km. south of Camargo, *Harvey 1398.*

A Mediterranean grass, now widely introduced into the warmer parts of America. A serious weed in irrigated lands, particularly in the Laguna District.

Sorghastrum nutans (L.) Nash in Small, Fl. S. E. U. S. 66 (1903).

COAHUILA: Palm Canyon near Muzquiz, *Marsh 986.*

Eastern United States and south into Mexico.

Heteropogon contortus (L.) Beauv. ex R. & S. Syst. Veg. **2**: 836 (1817).

COAHUILA: Sierra del Carmen, Aug. 22, 1936, *Marsh 583;* igneous hill near Santo Domingo, *Wynd & Mueller 470;* Palm Canyon, near Muzquiz, *Marsh 993;* Puerto del Norte, Cuatro Cienegas, *Harvey 1206;* Monclova, 1880, *Palmer 1346;* Puerto Santo Lazaro, Sierra Gavia, *Muller 3070;* limestone hills near Santa Rosa, *Shreve & Tinkham 9582;* 14 mi. east of La Paila, *Shreve & Tinkham 9893;* Sierra Cruces, stony flats between bushes 8 mi. north of Santa Elena, *Johnston & Muller 1018.* CHIHUAHUA: Sierra Organos, 1937, *LeSueur 161;* Sierra Santa Eulalia, *Pringle 480;* Meoqui, 1936, *LeSueur 141;* 13 km. southwest of Jimenez, *Harvey 1340.*

Florida to Arizona and southward; widely distributed in the warmer parts of the world. Although growing on limestone, this species is more abundant on igneous rocks, particularly basalt. Usually growing on rocky slopes and at times dominating large areas.

Heteropogon melanocarpus (Ell.) Benth. Jour. Linn. Soc. Bot. **14**: 71 (1882).

Hitchcock, Contr. U. S. Nat. Herb. **17**: 212 (1913), cites a collection from the Mapula Mts., Chihuahua, *Pringle 820*. The species is widely distributed in the warmer parts of the world and extends north through western Mexico to Arizona.

Trachypogon Montufari (H.B.K.) Nees, Agrost. Bras. 342 (1829).

CHIHUAHUA: Rocky flat just east of Organos, locally common on ledges, *Stewart & Johnston 2059;* Chihuahua, *LeSueur 15.*

Southern and eastern Texas; Arizona; Mexico to Argentina.

Elyonurus barbiculmis Hack. in DC. Monogr. Phan. **6**: 339 (1889).

CHIHUAHUA: Rocky flats just east of Organos, locally common about ledges, leaf-tufts bright green, *Stewart & Johnston 2058;* west of Chihuahua, 1935, *LeSueur 14;* Cerro Coronel, Chihuahua, rocky hills, Aug. 5, 1885, *Pringle 423.*

Trans-Pecos Texas to Arizona and south to Durango.

Manisuris altissimus (Poir.) Hitchc. Jour. Wash. Acad. **24**: 292 (1934).

COAHUILA: Sabinas River, near Muzquiz, 1936, *Marsh 404.*

Wet places in the warmer parts of the world; introduced into America. The species has been collected repeatedly on the Texan bank of the river in the Big Bend of the Rio Grande.

Hackelochloa granularis (L.) Kuntze, Rev. Gen. **2**: 776 (1891).

CHIHUAHUA: Open canyon in igneous hills 20 km. north of Chihuahua, sprawling in moist gravel, rare, *Stewart & Johnston 2128;* hills near Chihuahua, *Pringle 1057* (US).

Arizona south through Chihuahua to Central America. A weedy grass widely distributed in the warmer parts of the world. Said to be introduced in our area, but, if so, introduced at a very early date, for it was collected at unfrequented places in southeastern Arizona by Charles Wright as early as 1851.

Coix lacryma-jobi L. Sp. Pl. 972 (1853).

COAHUILA: Saltillo, July 1880, *Palmer 1337.*

A species of the Old World tropics, widely cultivated in America for its bead-like fruits and frequently spontaneous.

Tripsacum dactyloides L. Syst. Nat. ed. 10, 1261 (1759).

Tripsacum dactyloides var. *occidentale* Cutler & Anderson, Ann. Mo. Bot. Gard. **28**: 258 (1941).

COAHUILA: Sierra del Carmen, Cañon Sentenela, *Wynd & Mueller 536;* Sierra Encantada, 7 km. west of Buena Vista, fairly common in wet canyon, *Stewart 1450;* Santa Anna Canyon, *Marsh 438;* Palm Canyon, near Muzquiz, *Marsh 982.*

Connecticut to Iowa and south to Florida and through Texas and northeastern Mexico to San Luis Potosi. Hitchcock, and recently Cutler & Anderson, have placed the *Tripsacum* of northeastern Mexico in *T. lanceolatum* Rupr. I am, however, unable to separate Texan specimens from those collected in Coahuila, Nuevo Leon, Tamaulipas, and eastern San Luis Potosi. Characters in the size, shape, and surface of the segments of the female inflorescence readily separate these specimens from the more southerly and westerly *T. lanceolatum.*

ARNOLD ARBORETUM,
HARVARD UNIVERSITY.

PLANTAE PAPUANAE ARCHBOLDIANAE, XIII*

E. D. MERRILL AND L. M. PERRY

MELASTOMATACEAE

OUR study of the Melastomataceae as represented by the material from the Richard Archbold Expeditions to New Guinea and the specimens collected by Brass and Kajewski in the Solomon Islands follows the basic work of Mansfeld, Bot. Jahrb. **60:** 105–143. 1925. We have found nothing new in the Osbeckieae, Oxysporeae, or Sonerileae. In the Dissochaeteae the only new records we have are of *Medinilla* Gaudichaud. The genus is so diverse or variable in character that we have accepted Mansfeld's interpretation, although we are not wholly convinced that *Hederella* Stapf rightfully belongs here. In the Papuan material the new species may be readily placed in Mansfeld's key, and for the convenience of future workers we have inserted a running key patterned after that of Mansfeld. For the consideration of the Solomon Islands material, it may be helpful to note one particular point. Towards the end of Mansfeld's key, p. 118, one finds the caption, "Flores bracteis persistentibus stipati" (flowers surrounded by persistent bracts). The only authentic material available for comparison in this group was a very fragmentary specimen of *M. Schlechteri* Mansfeld, an isotype, and in the unnamed collections a specimen which we determined as representing *M. Pulleana* Mansf. In both of these species the bracts are always at the nodes of the inflorescences, the ultimate pair being at the base of the pedicel. On the other hand, in much of the Solomon Islands material the inflorescences are characterized not only by persistent bracts similarly placed, but in addition have a pair of persistent bracteoles (usually more showy and larger than the bracts) at the base of the calyx. This same feature is found in a number of Philippine species and also in those of Polynesia. Taken together, the species probably form a definite section of *Medinilla,* with a geographical range south from the Philippines, including the Solomon Islands, and eastward to western Polynesia (Fiji and Samoa). Another distinctive group in the Philippines, represented by *Cephalomedinilla* Merr., which we now believe ought to be considered as a section of *Medinilla,* also occurs in the Solomon Islands.

In most of the species with setose nodes, it has been somewhat difficult to characterize the pubescence satisfactorily. Mansfeld has used the term plumose-pilose, or, if the trichomes were shorter, furfuraceous. In most cases in our work this has been designated as subplumulose-pilose, for the projections forming the "feathery" part are mostly very short, sometimes hardly even barbellate, and are found either all along the main hair, or, in some instances, only at the base of it.

*Botanical Results of the Richard Archbold Expeditions. See Jour. Arnold Arb. **24:** 207–217. 1943.

In the Astronieae there are several new species of *Astronidium* A. Gray, and in the Memecyleae one new species of *Memecylon* Linnaeus.

Medinilla Gaudichaud

A. Leaves verticillate, opposite, or often appearing alternate, mostly equal in size, or if unequal, similar in shape; inflorescence bracteate or not, the flowers not bracteolate.

B. Plants glabrous, or if pubescent, the nodes not setose.

C. Leaves verticillate or opposite.

D. Leaves verticillate.

Medinilla cauliflora Hemsl. Kew Bull. **1895:** 135. 1895.

SOLOMON ISLANDS: Bougainville: Kupei Gold Field, *Kajewski 1671, 1718,* April 1930, alt. 950 m. and 1000 m., common on rain-forest trees; Koniguru, Buin, *Kajewski 2142,* August 1930, alt. 900 m., common on taller trees of rain-forest; Guadalcanal: without further locality, *Kajewski 2644,* May 1931.

The field-notes may be summarized as follows: plant up to 1.5 m. long; petals white; calyx light green; fruit dark red to black, up to 9 mm. long and 8 mm. diameter. This appears to be the first record of any collection of this species since the original description.

Medinilla quadrifolia Blume, Flora 509. 1831; Cogn. Monog. Phan. **7:** 574. 1891; Mansf. Nov. Guin. Bot. **14:** 203. 1924, Bot. Jahrb. **60:** 119. 1925.

SOLOMON ISLANDS: Bougainville: Kugumaru, Buin, *Kajewski 1986,* July 1930, alt. 150 m., rain-forest (semi-scandent; fruit white when ripe, almost globose, 1 cm. diameter). Malaysia and New Guinea.

D. Leaves always opposite.

E. Leaves sessile or subsessile.

Medinilla Forbesii Bak. f. Trans. Linn. Soc. II. Bot. **9:** 55. 1916; Mansf. Bot. Jahrb. **60:** 121. 1925; vel aff.

NETHERLANDS NEW GUINEA: Balim River, *Brass 11754,* December 1938, alt. 2100 m., a few specimens in *Vaccinium* scrub (erect shrub 1 m. high; petals pale pink; ovary and pedicel red); 15 km. southwest of Bernhard Camp, Idenburg River, *Brass 11899,* January 1939, alt. 1800 m., mossy forest, frequent in open situations (large shrub 2 m. high; calyx and pedicels red; petals white).

With no material for comparison, we find it difficult to distinguish *Medinilla Forbesii* Bak. f., *M. novo-guineensis* Bak. f., and *M. Bakeriana* Mansf. Both specimens cited above have cymose inflorescences in lateral fascicles at the nodes. The other two species, according to the descriptions, have fascicled flowers. The leaves of *Brass 11754* are smaller (11 × 6 cm.) than those of *Brass 11899* (19 × 10 cm.), but the structure of the flowers is the same.

Medinilla Peekelii Mansf. Notizbl. Bot. Gart. Berl. **10:** 282. 1928.

SOLOMON ISLANDS: Ysabel: Maruto, *Brass 3395,* December 1932, alt. 300 m. (epiphytic shrub with pale fleshy leaves; flowers pale purple; fruit smooth, fleshy, red). The type was described from a collection made in the Bismarck Archipelago.

E. Leaves petiolate.

F. Flowers not solitary.

Medinilla Hollrungiana Mansf. Bot. Jahrb. **60:** 120. 1925.

NETHERLANDS NEW GUINEA: Boemi, 40 km. from Nabire, *Kanehira & Hatusima*

12728, March 1940, alt. 300 m., in forest; Bele River, 18 km. northeast of Lake Habbema, *Brass 11355,* November 1938, alt. 2200 m., common in grassy second growths on river banks (upright shrub 2 m. high; leaves fleshy and brittle, the average size $\pm$ 14 $\times$ 6 cm.; flowers pink, with red calyx and pedicel). BRITISH NEW GUINEA: Mafulu, *Brass 5180* (det. Markgraf), September - November 1933, alt. 1250 m., bed of creek in lower forest, rare (sparsely foliaged shrub 1 m. tall; leaves fleshy; numerous lateral fascicles of reddish pink flowers); Palmer River, 2 miles below junction of Black River, *Brass 7114* (det. Markgraf), June 1936, alt. 100 m., occasional in a special swamp forest community in the ridges (semiscandent epiphytic shrub; leaves fleshy; flowers dark pink; fruit red). Described from Northeastern New Guinea.

Medinilla tenuipedicellata Bak. f. Trans. Linn. Soc. II. Bot. **9:** 53. *t. 3, f. 44–47.* 1916.

NETHERLANDS NEW GUINEA: 15 km. southwest of Bernhard Camp, Idenburg River, *Brass 11878, 12066,* January 1939, alt. 1800 m., mossy forest, gregarious in semi-shade (branches protruding $\pm$ 20 cm. above the thick ground moss; flowers pale purple-pink; — the second collection a shrub 60 cm. tall; calyx white, rimmed with red; petals pink).

Part of the material of these collections is an exact match for the plate, but the rest shows considerable variation in the size of the leaves, some of which are as large as 11 cm. long and 4 cm. broad.

Medinilla Versteegii Mansf. Bot. Jahrb. **60:** 125. 1925.

NETHERLANDS NEW GUINEA: 4 km. southwest of Bernhard Camp, Idenburg River, *Brass 13714,* March 1939, alt. 850 m., frequent on trees along river in rain-forest (epiphytic shrub about 1 m. high; flowers white; fruit red); Bernhard Camp, Idenburg River, *Brass 13996,* April 1939, alt. 50 m., frequent in flooded rain-forest of river plain (epiphytic shrub 2 m. high; flowers pinkish white; fruit red). BRITISH NEW GUINEA: Palmer River, 2 miles below junction of Black River, *Brass 7198, 7254* (det. Markgraf), July 1936, alt. 100 m., common on river bank trees (large epiphytic shrub or small tree with brittle leaves; terminal panicles of waxy white flowers; fruit red, 6–7 mm. diameter). In *Brass 7254* the inflorescences are lateral and axillary. The species has been reported previously for both Northeastern New Guinea and Netherlands New Guinea.

Medinilla exigua sp. nov.

Arbuscula epiphytica 2 m. alta glaberrima multiramosa; ramis teretibus cinereis; ramulis angulatis vel sulcatis nodosis; foliis oppositis similibus chartaceis ellipticis, 1.2–3 cm. longis, 0.7–1.5 cm. latis, basi anguste cuneatis, apice obtusis, trinerviis, nervis supra inconspicuis subtus distinctis; petiolo 4–9 mm. longo; floribus in cymas axillares vel terminales paucifloras (1–3) dispositis; pedunculo communi 3–6 mm. longo, bracteis minutis; pedicellis $\pm$ 4 mm. longis; calycis tubo anguste obconico vix 3 mm. longo, limbo truncato 1 mm. longo; petalis 4, oblanceolatis, circiter 1 cm. longis, apice acutis; staminibus 8, antheris 3.5 mm. longis postice calcaratis, calcare 1 mm. longo, antice inappendiculatis; fructibus immaturis urceolatis.

NETHERLANDS NEW GUINEA: 18 km. southwest of Bernhard Camp, Idenburg River, *Brass 12696* (TYPE), February 1939, alt. 2050 m., rain-forest of a ravine (profusely branched epiphytic shrub 2 m. high, with fragile white flowers and fleshy red fruit).

This species is readily distinguished by the small leaves, the angular branchlets, and the reduced cymes.

F. Flowers solitary.

Medinilla Erpetina Triana, Trans. Linn. Soc. **28:** 87. *t. 7, f. 94 d.* 1871–73; Cogn. Monog. Phan. **7:** 589. 1891.

Erpetina radicans Naud. Ann. Sci. Nat. III. **15:** 299. *t. 14.* 1851.

SOLOMON ISLANDS: Y s a b e l: Mount Marescott, *Brass 3260*, December 1932, alt. 1000 m., mountain forests, common (small climber adhering closely to tree-trunks; leaves dark green, thick and somewhat fleshy; flowers purple; fruit red, fleshy); Tiratona, *Brass 3531*, December 1932, alt. 600 m., mountain forests, common (small root-climber; flowers reddish); B o u g a i n v i l l e: Lake Luralu, Koniguru, Buin, *Kajewski 2066*, August 1930, alt. 1500 m., on rain-forest trees, common (vine; petals pink; stamens light yellow; style light red).

We suspect this is the species represented by *Medinilla nodosa* Fosberg, the main difference being in the more obtuse posticous appendage of the anther of the latter. However, since neither type is available for examination at present, it seems best only to call attention to the very strong resemblance between the two. Fosberg suggests that his species is closest to *M. acutifolia* Hemsl. from the Solomon Islands. From the context, the latter name is undoubtedly an error for *M. cauliflora* Hemsl.

C. Leaves, although opposite, often appearing alternate; inflorescence mostly borne on verrucae (Hederella Stapf).

Medinilla longistylis Mansf. Bot. Jahrb. **60:** 124. 1925.

BRITISH NEW GUINEA: Palmer River, 2 miles below junction of Black River, *Brass 7044* (det. Markgraf), June 1936, alt. 100 m., on a ridge crest (climbing to the crown of a very tall tree, the slender branches pendent 6–8 m. below the limbs of the tree; upper surface of leaves shining, the nerves deeply impressed above, prominent below; flowers pink). The species is recorded previously only from the type, collected in Northeastern New Guinea.

Medinilla lysipetala (F. v. Muell.) Mansf. Bot. Jahrb. **60:** 124. 1925; vel. aff.
Catanthera lysipetala F. v. Muell. Jour. Bot. **24:** 289. 1886.
Medinilla anomala Cogn. Monog. Phan. **7:** 1185. 1891.
Hederella Forbesii Stapf in Hook. Icon. **25:** *t. 2415*. 1895.

NETHERLANDS NEW GUINEA: 15 km. southwest of Bernhard Camp, Idenburg River, *Brass 12302*, January 1939, alt. 1800 m., frequent in mossy forest (root-climbing epiphyte; leaves convex; unopened flowers a dark reddish pink); 8 km. southwest of Bernhard Camp, Idenberg River, *Brass 12726*, February 1939, alt. 1600 m., common in open situations in mossy forest (leaves stiff, convex; flowers dark rose, not opening widely).

The material cited above and other material in our herbarium, from Northeastern New Guinea, show a considerable amount of variation, but we have been unable to distinguish more than one species in it. We are not at all sure that it belongs to *Medinilla lysipetala* (F. v. Muell.) Mansf., but it seems best to place it here provisionally. It is to be noted that the type was collected near the base of the Owen Stanley Range, whereas the material above cited shows a higher altitude. Mueller describes the leaves as strongly 5-nerved from near the base, but these collections have obviously 3-nerved leaves. The inflorescences are axillary as well as lateral.

B. At least the nodes setose or hairy.

G. Leaves sessile or subsessile.

Medinilla arfakensis Bak. f. in Gibbs, Phyt. & Fl. Arfak Mts. 158. 1917.

NETHERLANDS NEW GUINEA: 15 km. southwest of Bernhard Camp, Idenburg River, *Brass 12395*, January 1939, alt. 1500 m., rain-forest (epiphytic shrub 1.5 m. high; panicle red; flowers white). NORTHEASTERN NEW GUINEA: Kani Mountains, *Schlechter 17037* (isotype of *M. Brassii* Markgr.), December 1907, alt. 1000 m.

BRITISH NEW GUINEA: Bella Vista, *Brass 5478,* November 1933, alt. 1450 m., oak forest fringe (shrub 1.5 m. high; flowers pale pink).

These collections appear to suit the description of *Medinilla arfakensis* Bak. f. reasonably well. All have sessile leaves, small 5-merous flowers, and anthers with a posticous upwardly recurved spur. We have examined exact duplicates of *Schlechter 17037* (the type-number of *M. Brassii* Markgr.) in the herbarium of the New York Botanical Garden and in our own herbarium, and also the single specimen of *Brass 5114* cited in the original description. It would seem that Markgraf used the latter collection for most of his description of *M. Brassii,* but, wishing to retain the type at Berlin, designated Schlechter's specimen as the type. The two collections do not belong to the same species. Unfortunately the specific name must go with the type designated, rather than with the collection to which it more logically belongs.

Medinilla Lorentziana Mansf. Nov. Guin. Bot. **14**: 206. 1924, Bot. Jahrb. **60**: 128. 1925.

BRITISH NEW GUINEA: Palmer River, 2 miles below junction of Black River, *Brass 6934, 7300* (det. Markgr.), July 1936, alt. 100 m., epiphytic in ridge forests, fairly common (large loosely branched shrub; bark suberose, deeply furrowed; leaves concave, recurved, pale underneath; panicles terminal, conspicuous; peduncle and pedicels red; flowers pale waxy pink).

Type from Netherlands New Guinea, with a variety occurring also in Northeastern New Guinea.

Medinilla leucantha sp. nov.

Frutex epiphyticus; ramulis valde compresso-tetragonis, quadrialatis (alis approximatis), nodis dense setosis; foliis oppositis similibus sessilibus, basi pulvino persistente reflexo circumdatis, lamina anguste elliptica, 18–40 cm. longa, 8–13.5 cm. lata, utrinque angustata, basi subcordata, apice acuminata, acumine 1 cm. longo, novella subtus in costa, nervis ac acumine minute furfuracea, cito glabrata, 9–13-plinervia, nervis supra manifestis subtus perspicuis; inflorescentiis terminalibus vel axillaribus paniculatis 6–12 cm. longis fere glabris, interdum parce furfuraceis, minute pustulatis; pedunculo communi 2–5 cm. longo, ramis 1–1.5 cm. longis, saepissime quaternis, in verticillos 3–5 dispositis; bracteis minutis; pedicellis ± 5 mm. longis; calycis tubo cupuliformi 3 mm. longo, limbo 2 mm. longo truncato; petalis 5 oblanceolatis, circiter 7 mm. longis; staminibus 10, antheris 3 mm. longis, antice appendices duas subulatas gerentibus, postice calcaratis, calcare uncinato gracili 1 mm. longo; fructibus subglobosis ± 6 mm. diametro.

NETHERLANDS NEW GUINEA: Bernhard Camp, Idenburg River, *Brass 13770* (TYPE), April 1939, alt. 60 m., rain-forest (large epiphytic shrub with greenish white flowers and red fruit); 4 km. southwest of Bernhard Camp, Idenburg River, *Brass 13288,* March 1939, alt. 850 m., frequent epiphyte on low trees along river, and high on trees of forest (flowers translucent white); Dalman, 45 miles from Nabire, *Kanehira & Hatusima 12261*, March 1940, alt. 500 m., in *Agathis* forest (epiphyte 1 m. tall; flower white).

The leaves of *Medinilla leucantha* closely resemble those of *M. Teysmannii* Miq., according to the original description of the latter species, but the first may be readily distinguished by the much shorter inflorescence, the considerably smaller white flowers, and the anticous subulate appendages of the anthers.

G. Leaves petiolate.

Medinilla albida sp. nov.

Frutex 1–2.5 m. altus; ramulis tetragonis vel subteretibus interdum angustissime alatis, novellis subplumuloso-pilosis cito glabratis, maturis cinereis, nodis dense setosis; foliis chartaceis oppositis in quoque pari aequalibus vel subaequalibus; petiolo 7–12 mm. longo, novello piloso cito glabrato, basi pulvino angusto persistente reflexo circumdato; lamina oblongo-lanceolata vel lanceolato-elliptica, 9–23 cm. longa, 4–9 cm. lata, basi late cuneata, apice breviter acuminata, acumine 0.5–1 cm. longo, supra minute furfuracea vel glabra, subtus minute furfuracea et nervis pilosa, 7-plinervia, nervis supra manifestis subtus perspicuis; inflorescentiis terminalibus ± 7.5 cm. longis, paniculatis, axi pedicellisque ± furfuraceis, nodis inferioribus setosis; bracteis minutis; pedicellis ± 4 mm. longis; calyce 3 mm. longo, tubo cyathiformi, limbo truncato; petalis 5, obovato-ellipticis, 7 mm. longis; staminibus 10, antheris 2.5 mm. longis, antice inappendiculatis, postice calcaratis, calcare leviter uncinato, 0.7 mm. longo; stylo 4.5 mm. longo; fructibus subglobosis ± 6 mm. diametro.

NETHERLANDS NEW GUINEA: 6 km. southwest of Bernhard Camp, Idenburg River, *Brass 12944, 12993* (TYPE), February 1939, alt. 1200 m. and 1050 m., banks of rain-forest stream (shrub 1–2.5 m. high; flowers white; fruiting panicle wholly red).

The species suggests *Medinilla plumosa* Mansf., but the latter has definitely sessile leaves. Then again there is some resemblance between this and the description of *M. schraderbergensis* Mansf., but the pubescence of the latter is of simple hairs.

Medinilla Mansfeldiana sp. nov.

Verisimiliter arbor parva; ramulis dense hirsuto-setosis; nodis longe barbatis; foliis ellipticis, 10–20 cm. longis,.4.5–10 cm. latis, utrinque paullo angustatis, basi obtusiusculis, apice breviter acuminatis, 5-nerviis vel subquintuplinerviis, supra glabris, subtus praecipue costa nervisque parce setosis, venis obscuris; petiolo 1–1.5 cm. longo, parce setoso; inflorescentiis e nodis ramorum vetustiorum orientibus, paniculatis, ± 6 cm. longis; pedunculo 5 mm. longo, axi et ramulis consperse hirsutis, nodis barbellatis; bracteis 1–1.5 cm. longis, oblanceolato-ellipticis, subtus parce hirsutis; pedicellis brevibus, 2–5 mm. longis, dense setulosis; calyce cyathiformi, 4–5 mm. longo, longe setuloso; petalis non visis; staminibus 10, filamentis 3.5 mm. longis, antheris 4 mm. longis postice vix calcaratis breviter obtusis, antice breviter biauriculatis; stylo 9 mm. longo; fructibus subglobosis.

NORTHEASTERN NEW GUINEA: Goridjoa, *Schlechter 19744* (TYPE), June 1909, alt. 1200 m., mountain woods.

The species apparently is closely related to *Medinilla sogeriensis* Bak. f. and *M. Schlechteri* Mansf. It may be distinguished from the first by the larger inflorescence on the older branches, and from the second by the petiolate 5-nerved leaves. *M. Schlechteri* Mansf. has 7–9-plinerved leaves.

Medinilla Markgrafii sp. nov.

Medinilla Brassii Markgr. Brittonia **2**: 142. 1936, quoad *Brass 5114*, excl. spec. typ.

Frutex interdum scandens 1–2 m. altus; ramulis cinereis vel fuscescentibus obtuse angulatis vel novellis valde compressis glabris nodosis, nodis setosis; foliis subcoriaceis glabris oppositis ellipticis vel oblongo-ellipticis, 12–22 cm. longis, 4–10 cm. latis, basi cuneatis vel obtuse cuneatis, apice breviter acuminatis vel acutis, 5–7-plinerviis, venis subtransversis supra interdum manifestis subtus obscuris; petiolo ± 1.5 cm. longo, basi pulvino angusto persistente reflexo circumdato; stipulis interpetiolaribus setas ad nodos tegentibus; inflorescentiis paniculatis ± 10 cm. longis, axillaribus vel terminalibus, bracteatis, ad nodos ± setulosis; bracteis inferioribus ± 1.5 cm. longis sursum minoribus, subtus apicem versus interdum ± pubescentibus vel glabris, rubescentibus; pedicellis rubescentibus; floribus tetrameris; calyce 2.5–3 mm. longo, novello consperse crispe pilosulo, maturo glabro vel subfurfuraceo, truncato; petalis ± 5 mm. longis, albis; staminibus 8, antheris lineari-oblongis, 2.5–3 mm. longis, apice paullo angustatis, postice calcaratis, calcare brevi obtuso non recurvo; stylo glabro; fructibus globosis ± 5 mm. diametro.

BRITISH NEW GUINEA: Mount Tafa, *Brass 4018* (TYPE in herb. New York Bot. Gard., isotype in herb. A. A.), May 1933, alt. 2310 m., common on edge of rest house clearing (weak scandent shrub 1–2 m. tall; upper side of leaves iridescent green, the lower side pale; flowers white; pedicels reddish, unripe fruit dark green); same locality, *Brass 5114*, September 1933, alt. 2400 m., in a landslip shrubbery, rare (shrub 1 m. high; peduncle red; petals white; fruit green).

These two collections belong to a single species, which, according to Mansfeld's key for *Medinilla*, falls near *M. warica* Mansf., and, according to that of Baker f., near *M. rubiginosa* Cogn. However, *M. Markgrafii* differs from both of these in pubescence, but we cannot suggest a closer affinity at present. *Brass 5114* appears to have been used largely in the description of *M. Brassii* Markgr.; unfortunately it is not conspecific with the type designated for that species.

Medinilla rubiginosa Cogn. Monog. Phan. **7:** 598. 1891; Mansf. Bot. Jahrb. **60:** 128. 1925.

NETHERLANDS NEW GUINEA: 9 km. northeast of Lake Habbema, *Brass 10786, 10870,* October 1938, alt. 2750 m. and 2650 m., common in moist open spots of forest undergrowth (tree 2.5–3 m. high; panicle red; flowers white); Bele River, 18 km. northeast of Lake Habbema, *Brass 11535,* November 1938, alt. 2200 m., abundant in brushy second growths (shrub or tree 2–4 m. high; panicles red; flowers white; fruit green); Angi, Arfak Mountains, *Kanehira & Hatusima 13609, 13767, 13926,* April 1940, alt. 1900 m.

Previously known only from the type-collection.

A. Leaves opposite; each pair dimorphic (exceedingly unequal in size and unlike in shape), except in M. tulagiensis; inflorescence with both bracts and bracteoles.

The remaining species of *Medinilla* in this treatment are all from the Solomon Islands; as stated in our introduction, they belong to a section with a geographic range from the Philippines to western Polynesia. No representatives of this section have thus far been reported from New Guinea.

KEY TO THE SOLOMON ISLANDS SPECIES WITH BRACTEOLATE FLOWERS

Inflorescence open, usually racemose; calyx-limb truncate.
Leaves of each pair somewhat unequal in size, otherwise similar...... *M. tulagiensis.*

Leaves of each pair exceedingly unequal in size, the smaller usually ovate or ovate-orbicular and sessile or subsessile.
Larger leaf of each pair sessile or subsessile.
Branchlets and inflorescence glabrous; larger leaf of each pair ± 25 cm. long.... ....*M. Kajewskii.*
Branchlets and inflorescence pilose; larger leaf of each pair 6.5–13 cm. long.... ....*M. luraluensis.*
Larger leaf of each pair obviously petiolate.
Plant apparently glabrous; inflorescence 10–17 cm. long.........*M. anisophylla.*
At least the nodes and the calyces pubescent; inflorescence smaller, up to 10 cm. long.
Floral bracteoles large, 1.5–2.3 cm. long.
Bracteoles pink; leaves with a long narrow acumen, almost glabrous beneath when mature.................................*M. calliantha.*
Bracteoles dirty cream-color or greenish white; leaves short-acuminate, pubescence ± persisting on the lower surface.
Leaves elliptic or lance-elliptic, rounded at base; floral bracteoles 1.5 cm. long...*M. pubiflora.*
Leaves ovate-elliptic, cordate at base; floral bracteoles 2–2.3 cm. long.... ....*M. vagans.*
Floral bracteoles small, 5–6 mm. long.
Larger leaf of each pair lanceolate; inflorescence 1.5 cm. long; plant very sparsely pubescent...................................*M. lancifolia.*
Larger leaf of each pair lance-elliptic; inflorescence ± 10 cm. long; branchlets, lower surface of leaves, and inflorescence obviously pubescent.... ....*M. rubescens.*
Inflorescence capitate (very compact); calyx-limb 4-lobed.
Larger leaf of each pair petiolate; flowers large, the calyx 1.5 cm. long.......... ....*M. cephalantha.*
Larger leaf of each pair sessile or subsessile; flowers smaller, the calyx 7 mm. long... ....*M. sessilis.*

Medinilla tulagiensis sp. nov.

Frutex scandens; ramulis novellis brunnescentibus barbellato-pilosis, vetustioribus cinereis glabris; nodis barbellatis demum glabratis; foliis chartaceis ellipticis in quoque pari paullo disparibus: majoribus 12–14 cm. longis, 5–6 cm. latis, basi rotundatis, apice acutis, glabris vel novellis subtus consperse pilosis, quintuplinerviis, venis utrinque interdum manifestis; petiolo 2–2.5 cm. longo; foliis minoribus 3.5–8 cm. longis, 2.5–3.7 cm. latis, petiolo 0.5–1.5 cm. longo, caeterum ut majoribus; inflorescentiis axillaribus racemosis solitariis vel interdum duobus in axillis, ± 13 cm. longis; axi pedicellisque novellis subplumuloso-pilosulis deinde glabratis; bracteis oblanceolatis, ± 1 cm. longis; pedicellis ± 1 cm. longis; bracteolis 1–1.3 cm. longis, ellipticis, basi elongato-cuneatis, parce pubescentibus; floribus 4-meris; calyce 4 mm. longo, minute subplumuloso-piloso, limbo minute 4-dentato; petalis in alabastro 5 mm. longis; staminibus 8, antheris 4 mm. longis, postice calcaratis antice inappendiculatis; ovario 4-loculato; fructibus subglobosis ± 7 mm. diametro.

SOLOMON ISLANDS: Tulagi: *Brass 3521* (TYPE), January 1933, alt. 50 m., rain-forests, common (showy climber with pale rather fleshy leaves; bracteoles white; petals pink; fruit white).

Medinilla Kajewskii sp. nov.

Frutex scandens; ramulis teretibus glabris nodis barbellatis demum glabris; foliis sessilibus vel subsessilibus glabris chartaceis valde disparibus: majoribus ellipticis, ± 25 cm. longis, 11–12 cm. latis, utrinque paullo angustatis, basi rotundatis vel subcordatis, apice acutis vel breviter acuminatis, subseptuplinerviis, venis subtransversis supra inconspicuis subtus manifestis; minoribus late orbicularibus ± 4 cm. longis et 5 cm. latis, apice rotundatis, mucronatis, quintuplinerviis; inflorescentiis axillaribus brevibus; bracteis obovatis obtusis, 6 mm. longis, 5 mm. latis; pedicellis ± 1 cm. longis; bracteolis ut bracteis; fructibus subglobosis, 7 mm. diametro; seminibus semiconicis, complanatis, apice rotundatis, vix 1 mm. longis, 0.6–0.8 mm. latis.

SOLOMON ISLANDS: Bougainville: Kupei Gold Field, *Kajewski 1633* (TYPE), April 1930, alt. 900 m. (common climber ascending 4 m.; bracts white; pedicels and petals purple).

This species is readily recognizable by its strongly unequal and sessile leaves, its short open inflorescence, and its rather large somewhat hood-shaped seeds.

Medinilla luraluensis sp. nov.

Frutex scandens; ramulis teretibus nodosis glabratis, novellis pilosis, pilis crassis subplumulosis, nodis novellis barbellatis demum glabris; foliis subcoriaceis valde disparibus: majoribus subsessilibus vel breviter petiolatis (petiolo 3–5 mm. longo), 6.5–13 cm. longis, 2.5–6 cm. latis, basi cordatis paullo inaequalibus, apice acutis vel breviter acuminatis, supra glabris, subtus basim versus costa pubescentibus, quintuplinerviis; minoribus sessilibus subrotundatis vel ovatis, ± 2 cm. longis et 2.5 cm. latis, cordatis, obtusiusculis, supra glabris subtus nervis ± pilosis; inflorescentiis axillaribus ± 10 cm. longis; axi pedicellisque parce pilosulis; bracteis ovato-orbicularibus basi breviter cuneatis, 8 mm. longis, 6 mm. latis, subtus consperse pilosulis; pedicellis 1–1.3 cm. longis; bracteolis ut bracteis; calyce in alabastro pilosulo, 2.5 mm. longo; petalis 3.5 mm. longis; staminibus 8, antheris postice calcaratis; ovario 4-loculato; fructibus subglobosis 5 mm. diametro.

SOLOMON ISLANDS: Bougainville: Lake Luralu, *Kajewski 2061* (TYPE), August 1930, alt. 1500 m., rain-forest, common (climbing shrub or vine; leaves with purple veins on lower surface; bracts showy pink; fruit white with minute teeth on calyx-tube).

The bracts and bracteoles of this species are smaller than in most of the group of species with dimorphic leaves.

Medinilla anisophylla sp. nov.

Frutex scandens glaber; ramulis cinerascentibus teretibus nodosis; foliis chartaceis, valde disparibus: majoribus 12–16 cm. longis, 4.5–8.5 cm. latis, basi emarginatis vel rotundatis, apice acuminatis, acumine ± 1.5 cm. longo, quintuplinerviis vel subseptuplinerviis, venis vix manifestis; petiolo 2–3.5 cm. longo; minoribus ovatis, ± 2 cm. longis latisque, basi subcordatis, apice acutis, subsessilibus vel brevissime petiolatis; inflorescentiis axillaribus racemosis, 10–17 cm. longis, bracteis ± 1 cm. longis, lanceolatis; pedicellis ± 1 cm. longis; bracteolis obovato-orbicularibus circiter 1.5 cm. diametro; calycis limbo 4-denticulato; antheris (tantum uno viso) 3.5 mm. longo, postice crasse calcaratis, antice biappendiculatis; fructibus 5–7 mm. diametro.

SOLOMON ISLANDS: San Cristobal: Puepue River, *Brass 2793* (TYPE), September 1932, alt. 50 m., riverine rain-forest, common (profusely flowering loosely branched shrub, scandent; leaves fleshy, pale green; each flower between two large fleshy greenish white persistent bracts; corolla pink; filaments purple and red).

Medinilla calliantha sp. nov.

Frutex scandens; ramulis novellis dense et grosse patenti-pilosis, pilis basi sub lente subplumulosis, cito glabratis teretibus nodosis, nodis dense setulosis; foliis valde disparibus: majoribus chartaceis ellipticis, 13–20 cm. longis, 6.5–12 cm. latis, basi rotundatis vel obtusis, apice obtusis deinde abrupte acuminatis, acumine 1.5–2 cm. longo sublineari, novellis dense patenti-pilosis cito glabratis, maturis utrinque glabris vel subtus costa nervisque parce pilosis, 5–7-plinerviis; petiolo ± 1 cm. longo, glabrato; minoribus ovatis, 4.5 cm. longis, 3 cm. latis, sessilibus caeterum ut majoribus; inflorescentiis racemosis paucifloris verisimiliter terminalibus vel axillaribus, 5–7 cm. longis; bracteis 7 mm. longis, 4 mm. latis, oblongo-spathulatis, roseis; axi pedicellisque dense et grosse patenti-pilosis; pedicellis circiter 1 cm. longis, floribus 4-meris decussatim oppositis; bracteolis ovato-orbicularibus, circiter 2 cm. longis latisque, basi rotundatis, apice obtusiusculis, utrinque consperse subplumuloso-pubescentibus vel interdum conspersissime pilosis; calyce cyathiformi, ± 5 mm. longo, dense piloso; petalis 1 cm. longis, 6 mm. latis, ellipticis; antheris 6 mm. longis, postice 1.5 mm. calcaratis, antice minute biappendiculatis; stylo ± 8 mm. longo, apice angustato; stigmate minuto.

SOLOMON ISLANDS: Ysabel: Tiratona, *Brass 3220* (TYPE), *3328, 3540,* November and December 1932, alt. 600 m., mountain forests, common (large stiffly branched climber; bark corky, furrowed, thick; young parts covered with brown hairs; fruit in *3220* yellow, in *3328* white).

Medinilla calliantha var. **bella** var. nov.

A forma typica differt ramulis novellis parce subplumuloso-pilosulis; foliis glabris; inflorescentiis ± pilosulis.

SOLOMON ISLANDS: Bougainville: Without field label, *Kajewski 1746A;* Guadalcanal: Uulolo, Tutuve Mountain, *Kajewski 2504* (TYPE of var.), April 1933, alt. 1200 m., rain-forest, common (climbing shrub, very showy; veins of leaves pink; flowers pink).

This variety closely resembles the species but is much more nearly glabrous, with slightly smaller flowers and fruit; the leaves tend to be narrower, the innermost pair of nerves arising from the midrib 2.5 cm. above the base, whereas in *M. calliantha* they are not more than 2 cm. above the base.

Medinilla pubiflora sp. nov.

Frutex scandens; ramulis teretibus nodosis cinereis, novellis brunneis dense piloso-hirsutis, pilis sub lente subplumulosis, deinde glabratis; foliis valde disparibus: majoribus chartaceis ellipticis vel lanceolato-ellipticis, 14–17(–27) cm. longis, 7.5(–12.5) cm. latis, basi rotundatis interdum leviter inaequalibus, apice acutis vel breviter acuminatis, supra conspersissime subtus (costa nervisque ± dense) brunneo-pilosis, 5–7-plinerviis, nervis supra manifestis, subtus prominulis, venis subtus manifeste clathratis; petiolo 1–1.5 cm. longo, dense piloso; minoribus sessilibus vel subsessilibus late ovato-orbicularibus, 2.5(–4) cm. longis, 2.5(–3) cm. latis, 5-nerviis, basi cordatis, apice obtusis apiculatis; inflorescentiis axillaribus, racemosis, ± 4 cm. longis; axi dense, bracteis et bracteolis utrinque pilosis; bracteis vix 1 cm. longis, cuneatis interdum foliiformibus; pedicellis 4 mm. longis; bracteolis ovatis, 1.5 cm. longis latisque; floribus tantum in alabastro visis; calyce 5 mm. longo, dense piloso, tubo cyathiformi, limbo truncato; petalis 4; staminibus 8, antheris postice longiuscule crasse calcaratis, antice non visis.

SOLOMON ISLANDS: Bougainville: Koniguru, Buin, *Kajewski 2153* (TYPE), August 1930, alt. 900 m., rain-forest, common (vine or semi-scandent shrub; flowers dirty cream-color, covered with fine hairs); Kugumaru, Buin, *Kajewski 1958,* July 1930, alt. 150 m., rain-forest, common (scandent shrub; bracts dirty cream-color; petals light purple); Kieta, *Kajewski 1564,* March 1930, alt. 100 m., in gullies in rain-forest, common (shrub up to 2 m. high; bracts white, covered with brown hair, giving them a dirty appearance; petals pink-blue; anthers dark blue).

In general habit, *Medinilla pubiflora* calls to mind *M. vagans,* but the pubescence is more evenly distributed and denser, the base of the leaf is rounded rather than cordate, the inflorescence is shorter, and the bracteoles are smaller than in the latter species.

Medinilla vagans sp. nov.

Frutex vagans; ramulis teretibus, novellis obtuse angulatis sulcatis, parce patenti-pilosis, cito glabratis, nodis barbatis; foliis valde disparibus: majoribus ovato-ellipticis usque 11 cm. longis, 5.5–8 cm. latis, basi cordatis, apice abrupte breviter acuminatis, acumine 5–10 mm. longo, supra glabris vel basim versus costa nervisque ± pilosis vel stellato-pubescentibus, subtus praecipue costa nervisque pilosis, 7-plinerviis, nervis prominulis, venis distincte subclathratis; petiolo ± 2 cm. longo, subtus glabrato supra patenti-piloso; minoribus 3 cm. longis, 2.5 cm. latis, subsessilibus vel breviter petiolatis, caeterum ut majoribus; inflorescentiis cymosis axillaribus, circiter 5 cm. longis, paucifloris (verisimiliter 2), pedunculo ad 1 cm. supra basim bibracteato, bracteis caeterum 4 basi pedicellorum, subovato-orbicularibus, ± 7 mm. longis latisque basi interdum anguste cuneatis, utrinque pilosis vel subplumuloso-pubescentibus; bracteolis ovato-ellipticis, 2–2.3 cm. longis, 1–1.5 cm. latis, utrinque pilosis et subplumuloso-pubescentibus; calyce circiter 5 mm. longo, campanulato, dense subplumuloso-piloso; petalis 4, subobovatis, 10 mm. longis, 7 mm. latis, apice emarginatis; staminibus 9 (in duobus floribus dissectis), antheris (in alabastro) 4 mm. longis, postice obtuse breviter calcaratis, calcare verruculoso, crasso, antice biauriculatis; stylo 5 mm. longo.

SOLOMON ISLANDS: Ysabel: Tataba, *Brass 3438* (TYPE), January 1933, alt. 50 m., amongst regrowth trees on a rain-forest clearing (large rambling shrub; leaves dull; bracteoles white; petals and filaments pale pink; anthers blue; fruit greenish white; a very showy plant, with brown indument).

This species is fairly easy to recognize by the ovate-elliptic cordate leaves in unequal pairs and the pubescent cymose (subracemose) inflorescence with rather large white bracts.

Medinilla lancifolia sp. nov.

Frutex scandens; ramulis subteretibus cinereis nodosis glabris, nodis minute stellato-pubescentibus deinde glabratis; foliis valde disparibus: majoribus chartaceis lanceolatis, 4–9 cm. longis, 1–3 cm. latis, utrinque angustatis, basi cuneatis, apice obtuse acuminatis, novellis consperse stellato-pubescentibus cito glabratis, vel consperse minute papillatis, triplinerviis vel interdum subquintuplinerviis; petiolo usque 5 mm. longo glabro; minoribus sessilibus ovatis usque 1.7 cm. longis, 1 cm. latis; inflorescentiis axillaribus, ± 1.5 cm. longis, racemosis, novellis consperse stellato-pubescentibus; bracteis albido-viridescentibus, usque 6 mm. longis et 3 mm. latis, subcuneiformibus, consperse minute pubescentibus; pedicellis 2 mm. longis; bracteolis ut bracteis; calyce minute pubescente, tubo cyathiformi, ± 3 mm. longo, limbo vix 2 mm. longo; petalis 4, obovatis, 6 mm. longis, apice abrupte acutis; staminibus 8, antheris 4 mm. longis; stylo ± 7 mm. longo, apice angustato; stigmate minuto.

SOLOMON ISLANDS: Bougainville: Kupei Gold Field, *Kajewski 1699* (TYPE), April 1930, alt. 950 m., growing from crevices in tall rain-forest trees (petals mauve; anthers blue; bracts cream-green).

In the short bracteate inflorescence the species somewhat suggests *Medinilla involucrata* Merr., but it is amply distinct from that species in the size and venation of the leaves as well as in the lack of pubescence.

Medinilla rubescens sp. nov.

Frutex scandens; ramulis novellis dense subplumoso-pilosis deinde glabratis nodosis; foliis valde disparibus: majoribus chartaceis lanceolato-ellipticis, 9–14 cm. longis, 3.5–6 cm. latis, basi rotundatis vel emarginatis, apice acutis vel breviter acuminatis, supra costa nervisque praecipue ad basim pilosis, subtus (costa nervisque dense) ferrugineo-pilosis, 5–7-plinerviis, nervis prominulis, venis ± distinctis; petiolo circiter 2 cm. longo, dense pilosulo; minoribus sessilibus vel breviter petiolatis (petiolis 2–3 mm. longis), ovatis, 1.5–3 cm. longis, 1–2 cm. latis, 5-plinerviis caeterum ut majoribus; inflorescentiis axillaribus, paniculatis vel cymosis, 5–10 cm. longis, ramis paucis racemiformibus; axi pedicellisque pilosulis vel pubescentibus; nodis bracteatis; bracteis oblanceolatis basi cuneatis, 5 mm. longis, 2 mm. latis, glabratis; bracteolis late ovatis obtusis, circiter 5 mm. longis et 4 mm. latis, stellato-pubescentibus; calyce 2 mm. longo, cyathiformi, dense pubescente; petalis 4, ellipticis, obtusis, 4–5 mm. longis; staminibus 8, antheris 3 mm. longis, antice biauriculatis, postice breviter calcaratis, calcare crasso verruculoso; fructibus subglobosis, ± 5 mm. longis.

SOLOMON ISLANDS: Guadalcanal: Uulolo, Tutuve Mountain, *Kajewski 2514* (TYPE), April 1931, alt. 1200 m., rain-forest, common (scandent shrub; flowers and bracts pink; small green fruit 6 mm. diameter).

Medinilla cephalantha sp. nov.

Frutex scandens; ramulis teretibus, novellis dense hirsutis cito glabratis, brunneis deinde cinereis nodosis, nodis setosis; foliis valde disparibus: majoribus chartaceis ellipticis vel late ellipticis usque 25 cm. longis et 15 cm. latis, basi rotundatis vel obtusis, apice obtusis subinde abrupte acuminatis, novellis dense hirsutis, maturis glabris, 7-plinerviis, nervis saepe ad 1–2 cm. inter se distantibus, utrinque perspicuis, venis oblique transversis manifestis; petiolo 1.5–2.5 cm. longo, hirsuto; minoribus sessilibus vel subsessilibus, ovato-orbicularibus, 3 cm. longis, 2.5 cm. latis, basi cordatis, apice rotundatis subinde brevissime acuminatis; inflorescentiis sessilibus e ramulis vetustis defoliatis orientibus vel interdum axillaribus, capitatis, interdum oppositis, 2.5–6.5 cm. longis, dense multifloris; floribus subsessilibus vel breviter pedicellatis, pedicello ± 4 mm. longo, hirsuto; bracteis ut bracteolis, 1.5–1.7 cm. longis, late lanceolatis vel ellipticis, apice obtusis, basi sensim anguste cuneatis, subtus hirsutis; calyce 1.5 cm. longo, dense hirsuto, limbo 4-lobato vel 4-fido, intus piloso, lobis rotundatis retusis, petalis in alabastro tantum visis glabris; staminibus 8 aequalibus, antheris sub anthesi 6 mm. longis apice poro aperientibus, postice obtuse inconspicue calcaratis (calcare 0.5 mm. longo, crasso), antice biauriculato, auriculis minute verruculosis; stylo ± 1.5 cm. longo.

SOLOMON ISLANDS: Ysabel: Kakatio, *Brass 3255* (TYPE), December 1932, alt. 900 m., common in rain-forests (large scandent shrub; bracteoles pink; flowers white); Guadalcanal: Sorvorhio Basin, *Kajewski 2705*, January 1932, alt. 300 m., in wet gullies of rain-forest, common (small tree or large shrub; inflorescence pink); San Cristobal: Hinuahaoro, *Brass 3022*, September 1932, alt. 900 m., mountain rain-forests, common (scandent shrub with long drooping branches; flower pink).

On account of the variability within the genus *Medinilla* Gaudichaud, we are now inclined to believe that the Philippine *Cephalomedinilla* Merr. is probably best considered as a section of *Medinilla*. This species and *M. sessilis* from the Solomon Islands clearly belong to the same section, but both may be readily distinguished from the Philippine species by the stronger dimorphism of the pairs of opposite leaves, the smaller of these being ovate-orbicular rather than similar in shape to the larger ones.

Medinilla sessilis sp. nov.

Frutex scandens; ramulis teretibus ± hirsutis cito glabratis, nodis dense barbatis; foliis valde disparibus, sessilibus vel subsessilibus, basi pulvino persistente reflexo circumdatis: majoribus ellipticis utrinque angustatis, basi subcordatis, apice acuminatis, acumine ± 1 cm. longo, supra glabris, subtus costa nervisque (novellis dense) consperse pilosis, 5–7-plinerviis, nervis inter se ± 1 cm. distantibus, venis clathratis subtus prominulis; minoribus suborbicularibus vel ovato-orbicularibus fere semiamplexicaulibus, 1–1.5 cm. longis, circiter 2 cm. latis; inflorescentiis capitatis, ± 2 cm. diametro, axillaribus sessilibus; floribus subsessilibus; bracteis ut bracteolis, ± 1 cm. longis, late orbicularibus, basi anguste cuneatis, apice retusis vel truncatis, utrinque parce hirsutis; calyce 7 mm. longo, hirsuto, tubo obconico, limbo 3–4 mm. longo, 4-lobato, intus hirtello; petalis 4; staminibus 8, antheris postice calcaratis, antice verisimiliter appendiculatis (staminibus immaturis, appendicibus non visis); ovario apice piloso.

SOLOMON ISLANDS: Bougainville: Koniguru, Buin, *Kajewski 2023* (TYPE), August 1930, alt. 850 m., rain-forest, common (scandent; bracts purple).

This species is readily distinguished from *Medinilla cephalantha* Merr. & Perry by the sessile or subsessile larger leaf of each pair; also, the reflexed narrow base surrounding the leaf-attachment is much more obvious here than in the other species.

Astronia Blume

Astronia papetaria Bl. Rumphia **1**: 20. *t. 6*. 1835, var. **novo-guineensis** var. nov.

A forma typica differt foliis minoribus, 8–15 cm. longis, 1.5–4 cm. latis, in quoque pari vix aequalibus; petiolo 1.5–2 cm. longo ad ramuli insertionem non calloso-verrucoso; calycis lobis brevioribus, late triangularibus, acutiusculis.

NETHERLANDS NEW GUINEA: 4 km. southwest of Bernhard Camp, Idenburg River, *Brass 13292, 13454* (TYPE of var.), Mar. 1939, alt. 900 m., frequent in *Agathis* forest undergrowth, and occasional in rain-forest of ridges (tree 3–4 m. high; leaves brown beneath; flowers pink); 2 km. southwest of Bernhard Camp, Idenburg River, *Brass 13671*, March 1939, alt. 750 m., common in rain-forest of slopes (tree 5–6 m. high; leaves brown underneath; flowers pink).

The collections cited above show a strong similarity to Blume's plate of *Astronia papetaria* from the Moluccas, but differ as indicated above.

Astronia atro-viridis Mansf. Bot. Jahrb. **60:** 131. 1925.

NETHERLANDS NEW GUINEA: 9 km. northeast of Lake Habbema, *Brass & Versteegh 10466,* October 1938, alt. 2750 m., frequent in primary forest; Bele River, 18 km. northeast of Lake Habbema, *Brass & Versteegh 11151,* November 1938, alt. 2300 m., frequent substage tree of primary forest; 15 km. southwest of Bernhard Camp, Idenburg River, *Brass & Versteegh 11919, 11937,* January 1939, alt. 1780 m. and 1630 m., occasional in mossy forest, frequent in rain-forest (tree 20–28 m. high with black scaly bark; flowers white; fruit yellow-green). BRITISH NEW GUINEA: Mount Tafa, *Brass 4953.*

In these collections the leaves vary greatly in size from those of the original material, in some cases being as small as 4 × 2 cm.; again, occasionally the leaves are almost densely lepidote, and only slightly, if at all, furfuraceous, but the characters are too inconstant to be of value. At the apex for a very short distance the margins are rolled to meet, causing the apex to appear almost like an appendage attached to the rest of the leaf by a constriction.

Astronidium A. Gray

Astronidium nigrescens (Mansf.) Markgr. Notizbl. Bot. Gart. Berl. **12:** 48, 49. 1934.
Everettia nigrescens Mansf. Bot. Jahrb. **60:** 136. 1925.

NETHERLANDS NEW GUINEA: 15 km. southwest of Bernhard Camp, Idenburg River, *Brass 12091,* January 1939, alt. 1800 m., frequent in rather open rain-forest ravines (tree 4–5 m. high; inner surface of petals white, the outer surface pink; stamens and pistil white). Described from Northeastern New Guinea.

Astronidium novo-guineense sp. nov.

Arbor usque 10 m. alta; ramulis teretibus vel infra nodos subangulatis atro-cinereis glabris; foliis subcoriaceis ellipticis vel leviter obovato-ellipticis, basi obtusis vel cuneatis, apice brevissime et obtuse acuminatis vel acutiusculis, supra glabris, subtus praecipue nervis venisque minute furfuraceo-lepidotis, triplinerviis, nervis in laminae parte centrali 1.5 2 cm. a costa dispositis, supra insculptis, subtus perspicuis, venis clathratis, ± 7 mm. remotis, supra inconspicuis subtus prominulis, vena marginali 1–2 mm. intra marginem disposita, reticulo conferto; inflorescentiis terminalibus cymoso-paniculatis, ± 10 cm. longis latisque, glabris, pedicellis 6–7 mm. longis; calyce urceolato, tubo 2.5–3 mm. longo, limbo 1 mm. longo truncato; petalis 5, oblongis, 6 mm. longis; staminibus 10, in alabastro filamentis 4 mm. longis crassiusculis complanatis, antheris ± 5 mm. longis (in alabastro apice reflexis), postice calcaratis, calcare crasso, 1 mm. longo; stylo 5 mm. longo; ovario 4- vel 5-loculato.

NETHERLANDS NEW GUINEA: 18 km. southwest of Bernhard Camp, Idenburg River, *Brass 12695* (TYPE), February 1939, alt. 2150 m., mossy forest, common in gullies (up to 8–10 m. high; flower-buds white); 4 km. southwest of Bernhard Camp, Idenburg River, *Brass 13312,* March 1939, alt. 900 m., abundant in *Agathis* forest and more open parts of mossy forest (tree 6–7 m. high).

This species is very close to *Astronidium palauense* (Kaneh.) Markgr. (including *A. carolinense* (Kaneh.) Markgr., which, from a comparison of the isotypes, appears to be the same species). It differs in having an urceolate, not cupular, calyx, and a much closer reticulum in the leaves than is characteristic of the Micronesian material.

Astronidium insulare sp. nov.

Arbor usque 17 m. alta; ramulis teretibus, novellis inter nodos compressis leviter sulcatis et minute lepidotis; foliis oppositis ellipticis, 9–16 cm. longis, 4.5–7.5 cm. latis, basi obtusis subinde cuneatis ± 5 mm. decurrentibus, apice acutis vel breviter acuminatis, apiculatis, supra glabris, subtus minute lepidotis, triplinerviis, nervis in laminae parte centrali 2–2.5 cm. a costa dispositis, supra distinctis, subtus prominulis, venis clathratis ± 1 cm. remotis, supra manifestis subtus prominulis, venulis inconspicuis; petiolo 2–2.5 cm. longo; inflorescentiis immaturis 5 cm. longis, terminalibus, dense lepidotis; pedicellis 2 cm. longis; calyce 4 mm. longo obpyriformi, apice 5-lobato, lobis 0.4 mm. longis, ± 1.5 mm. latis, mucronulatis; ovario 5-loculato.

SOLOMON ISLANDS: Bougainville: Koniguru, Buin, *Kajewski 1999* (TYPE), August 1930, alt. 800 m., rain-forest, common (small tree up to 17 m. high; buds green).

The species is perhaps most like the description of **Astronidium novaehannoverae** (Engl.) comb. nov. (*Astronia novae-hannoverae* Engl. Bot. Jahrb. **7**: 468. 1886), from the Bismarck Archipelago. However, the calyx of the flower-buds, although still not approaching anthesis, appears to be about twice as large as that described for the latter species. We have not found any reference to Engler's species either in Mansfeld's "Die Melastomataceen von Papuasien," Bot. Jahrb. l.c., or in Markgraf's "Die Gattung Astronidium A. Gray," Notizbl. Bot. Gart. Berl. **12**: 47–50. 1934.

Astronidium montanum sp. nov.

Arbor usque 7–8 m. alta; ramulis tetragonis vix alatis, minute lepidotis; foliis tenuiter chartaceis, 10–15 cm. longis, 3.5–6 cm. latis, minute pellucido-punctatis, subtus minute papillatis parce minute lepidotis, basi cuneatis, apice obtuse acuminatis, trinerviis, nervis in laminae parte centrali 1–1.5 cm. a costa dispositis, venis marginalibus (2 vel 1) circiter 2–5 mm. intra marginem manifestis, venis clathratis ± 1 cm. remotis; petiolo 2–2.5 cm. longo, gracili; inflorescentiis terminalibus cymoso-paniculatis, ± 8 cm. longis latisque, glabris, ramis gracilibus; pedicellis circiter 7 mm. longis; bracteis non visis; calyce cyathiformi, 5–6 mm. longo, 5 mm. diametro, limbo subirregulariter 4-lobato, petalis 6, oblanceolato-oblongis, 12 mm. longis, apice obtusis; staminibus 12, filamentis complanatis, 9 mm. longis, antheris 7 mm. longis, linearibus, apice reflexis, postice calcaratis, calcare 1 mm. longo; stylo 10 mm. longo; ovario 5- vel 6-loculato.

SOLOMON ISLANDS: Guadalcanal: Uulolo, Tutuve Mountain, *Kajewski 2515* (TYPE), January 1931, alt. 1200 m., rain-forest, common (small tree 7–8 m. high; flowers light green).

In habit, *Astronidium montanum* suggests *A. victoriae* (Gillespie) A. C. Sm., of the Fiji Islands, but the leaves of the former are not rounded or obtuse at the base, and the flowers are about twice as large and lack the lepidote character of those of the Fijian species.

Astronidium muscosum sp. nov.

Arbuscula 3 m. alta; nodis perspicue setuloso-pilosis, internodiis, basi setuloso-pilosa excepta, glabris, valde compressis sulcatis; foliis coriaceis late ellipticis vel obovato-ellipticis, 18–29 cm. longis, 10–16 cm. latis, basi rotundatis vel obtusis, apice acutis vel breviter acuminatis, supra glabris subtus nervis venisque pilosis deinde glabratis, quintunerviis vel quintuplinerviis (nervo marginali non incluso), nervis supra insculptis subtus perspicuis, venis oblique transversis subclathratis, supra manifestis subtus prominulis, venulis subtus distinctis; petiolo 4–7 cm. longo, basi (1 cm.) dense piloso caeterum glabrato; inflorescentiis paniculatis terminalibus, 10–12 cm. longis latisque, ramis oppositis ± crispe pilosis; floribus subsessilibus ad ramulorum hirtellorum apicem dense glomeratis bracteatis, bracteis caducis; calyce clavato, 5 mm. longo, tubo 3.5 mm. longo basim versus minute consperse setuloso, lobis 5 obtusiusculis; petalis 5 in alabastris ¾ connatis; staminibus 10, filamentis 3.5 mm. longis complanatis, antheris laesis postice calcaratis, calcare 1.2 mm. longo, obvio reflexo apice expanso; stylo 4 mm. longo.

SOLOMON ISLANDS: San Cristobal: Hinuahaoro, *Brass 3035* (TYPE), September 1932, alt. 900 m., mountain rain-forest, rare (large shrub or small tree 3 m. high, with stiff ascending branches). Probably also belonging here is *Kajewski 2507* from Uulolo, Tutuve Mountain, Guadalcanal. The specimen has almost glabrous leaves and flower-buds, and the receptacle is densely pilose around the base of the calyx.

In leaf-outline and in contour of the flower-buds, *Astronidium muscosum* suggests *A. Brassii* Markgr. of New Guinea, but the latter has chartaceous triplinerved leaves, a smaller and much more open inflorescence, and lacks the obviously coarsely hairy petiole-bases and nodes which are so characteristic of our species. The specific name is chosen to indicate the last mentioned character.

Astronidium salomonense sp. nov.

Arbor usque 15 m. alta; ramulis novellis valde compressis tetragonis anguste alatis, minute lepidotis; foliis subcoriaceis ellipticis, 8–14 cm. longis, 3.5–7 cm. latis, basi cuneatis, apice abrupte breviter acuminatis, supra glabris vel utrinque minute lepidotis, triplinerviis, nervis in laminae parte centrali 1.5–2.5 a costa remotis, venis subtransversis clathratis utrinque manifestis; petiolo 1.5–2.5 cm. longo; inflorescentiis terminalibus, immaturis, 6–9 cm. longis, 10–14 cm. latis, subcorymboso-paniculatis; axi et ramulis valde compressis tetragonis; pedicellis circiter 1 cm. longis; alabastris tantum visis; calyce ovali, 9 mm. longo, 6–7 mm. diametro, apice irregulariter brevibus fissuris aperiente; petalis 6; staminibus 12; ovario 6-loculato.

SOLOMON ISLANDS: Bougainville: Kieta Gold Field, *Kajewski 1703* (TYPE), April 1930, alt. 1000 m., rain-forest, common (small tree up to 15 m. high; flower-buds green).

The general habit of *Astronidium salomonense* is similar to that of *A. aneityense* (Guillaumin) A. C. Sm., of the New Hebrides, but the leaves of the former are more nearly coriaceous and opposite, the flower-buds are larger, and the branchlets are definitely tetragonous.

Astronidium sessilifolium sp. nov.

Arbor usque 10 m. alta, glabra; ramulis novellis valde compressis, leviter sulcatis, parce minute lepidotis; foliis chartaceis sessilibus obovato-ellipticis, 15–25 cm. longis, 5–10 cm. latis, basim versus angustatis, apice obtusiusculis vel forsan acutiusculis, subtus minute granulosis, triplinerviis, nervis a costa supra basim 2.5–6 cm. ortis, in laminae parte centrali 3 cm. a costa distantibus; venis ascendenti-patentibus, circiter 1 cm. remotis, subtus prominulis, nervo marginali 4–7 mm. intra marginem disposito; inflorescentiis terminalibus, circiter 15 cm. longis et 10 cm. latis; axi, ramis ramulisque subangulatis valde compressis, sulcatis; pedicellis 5–8 mm. longis; alabastris globosis, ± 6 mm. diametro, calyce apice vix aperto; fructibus 6- vel 7-loculatis, depresso-globosis, 4–5 mm. altis, 7–8 mm. diametro, apice calycis limbo recto (3 mm. longo) margine leviter 6-lobato coronatis; seminibus 0.8 mm. longis, lineari-angulato-clavatis.

SOLOMON ISLANDS: Bougainville: Siwai, *Waterhouse 193* (ser. no. *22983*) (TYPE), January 1933, shrub or small tree near water; Koniguru, Buin, *Kajewski 2163*, August 1930, alt. 900 m., rain-forest, common (small tree up to 10 m. high; the flower-buds have a disagreeable odor when crushed).

This species, in the shape of the leaves and the lack of a petiole, suggests the Fijian *Astronidium sessile* (A. C. Sm.) A. C. Sm., but the main nerves in the latter lie 0.8–1.5 cm. within the margin, whereas in the former they are almost half way between the midrib and the margin; the flowers too are smaller in the Solomon Islands material and the bracts of the young inflorescence are oblong rather than orbicular.

Astronidium anomalum sp. nov.

Arbor parva 6–7 m. alta glabra; ramulis subteretibus brunneis; foliis tenuiter coriaceis lanceolato-ellipticis, 5–8 cm. longis, 1.8–3 cm. latis, utrinque angustatis, basi obtuse cuneatis, apice acutis vel breviter acuminatis, margine anguste recurvis, in sicco supra olivaceo-viridescentibus, subtus brunnescentibus, nervis primariis utrinsecus 11–14 late patentibus fere subtransversis, supra subobscuris, subtus manifestis, reticulo subtus vix manifesto, conferto, vena marginali 1–1.5 mm. intra marginem disposita; petiolo 0.8–1.7 cm. longo, gracili, supra canaliculato; inflorescentiis 4.5–7 cm. longis, 4–6 cm. latis, terminalibus cymoso-paniculatis, axi, ramis ramulisque valde compressis, subangulatis; pedicellis 1.5–2 mm. longis; floribus non visis; fructibus minute lepidotis vel glandulosis, depresso-globosis, 2.5 mm. longis, 3 mm. diametro, calycis limbo coronatis (limbo 5-lobato, 0.6–0.8 mm. longo), 3-loculatis; seminibus 0.8 mm. longis, apice 0.2–4 mm. latis, rectis vel leviter curvatis, cuneatis, apice truncatis vel suboblique truncatis, ± angulatis; placentis 3, circiter 1 mm. longis.

SOLOMON ISLANDS: Guadalcanal: Uulolo, Tutuve Mountain, *Kajewski 2623* (TYPE), May 1931, alt. 1500 m., rain-forest (small tree up to 6–7 m. high, with gnarled and twisted habit; fruit cream-green, about ¾ mature).

Although the fruit is small, in structure it is like that of *Astronidium* A. Gray. The leaves, however, are not triplinerved, as one usually finds in this genus, but have only the midrib obvious; the lateral pinnately arranged nerves are easily seen on the lower surface but are not at all raised.

Memecylon Linnaeus

Memecylon papuanum sp. nov.

Arbor parva circiter 9 m. alta, glabra; ramulis teretibus, novellis interdum inconspicue angulatis brunnescentibus; foliis coriaceis late ellipticis, 12–20 cm. longis, 5.7–11 cm. latis, basi cuneato-obtusis, apice abrupte acuminatis, costa supra impressa, subtus conspicua, venis primariis utrinque subobscuris vel vix manifestis, utrinsecus ± 12; petiolo circiter 5 mm.

longo, crasso; inflorescentiis axillaribus brevissimis, 5–7 mm. longis, bracteis 1–1.5 mm. longis, ovatis acutis; pedicellis 1 mm. longis; alabastris ovoideis, 4 mm. longis, vix 4 mm. latis; calyce obconico, 3 mm. longo, truncato; disco stamina circumdante costato; petalis 4 late ovatis, 2.5 mm. longis, 3 mm. latis, obtusiusculis; staminibus 8; fructibus pedicellatis, late globosis (5 mm. longis, 6 mm. diametro) calycis limbo (vix 1.5 mm. longo) coronatis.

NORTHEASTERN NEW GUINEA: Mountains near Yaduma, *Schlechter 19291,* April 1909, alt. 300 m. BRITISH NEW GUINEA: Ihu, Vailala River, *Brass 977* (TYPE), February 1926, rain-forest (small slender tree 30 feet high, with thick pale leaves).

Memecylon papuanum seems to be most like the descriptions of the Javanese *M. excelsum* Bl. and *M. floribundum* Bl., but these have larger fruits, less dense inflorescence, and longer pediceled flowers.

ARNOLD ARBORETUM,
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FERNS OF THE SECOND ARCHBOLD EXPEDITION TO NEW GUINEA*

E. B. COPELAND

THE ferns of the First Archbold Expedition to New Guinea were discussed by Dr. Carl Christensen, in Brittonia **2**: 265–317. 1937. These were from the high mountains of British New Guinea, and, from the 343 numbers collected, Christensen described 40 new species.

The Third Archbold Expedition collected in Netherlands New Guinea, mostly at high altitudes. From an incomparable wealth of more than 900 field numbers, I described 109 species as new. Publication of these began in the Philippine Journal of Science but was interrupted by war. To record and guard the names, I published brief diagnoses of 87 species, still awaiting publication and illustration in Manila, in the University of California Publications in Botany (**18**: 217–226. 1942).

The Second Archbold Expedition collected at low altitudes, although far from the coast, in the plains and foothills far up the Fly River. Such country is poor in ferns as compared with the mountains, and the ferns which do occur in the lowlands are mostly species of wide range. It is therefore not surprising that the 171 collection numbers of this expedition include no more than five definitely new species. Descriptions of these and comment on a few other species follow. All the numbers cited are represented in the Gray Herbarium, and the types of new species, unless otherwise indicated, are deposited in the author's herbarium.

Cephalomanes Ledermanni (Brause) comb. nov.

Trichomanes Ledermanni Brause in Bot. Jahrb. **56**: 35. 1920.

BRITISH NEW GUINEA: Fly River, 528-mile Camp, alt. 80 m., in ridge forests, *Brass 6663*.

Related to *C. atrovirens* Presl (*Trichomanes rhomboideum* J. Sm.), but distinguished, as correctly indicated by Brause, by smaller size, lax venation, and small, obconic involucres. The sori of our specimen are more abundant than on Brause's type, and therefore they occupy a larger part of the frond and occupy the ends as well as the acroscopic sides of the pinnae; some occur even below the ends, on the basiscopic sides.

Trichomanes maluense Brause is distinguished in part by just such a more ample production of sori. Whether or not its rather feeble other differences are more significant, I do not venture to guess.

Cyclosorus gregarius sp. nov.

C. rhizomate adscendente, sicco 6 mm. crasso, apice paleis fuscis lineari-lanceolatis glabris debilibus 3–4 mm. longis vestito; stipitibus approximatis, usque ad pinnas reductas 25 cm., ad pinnas normales 70 cm. altis,

*Botanical Results of the Richard Archbold Expeditions.

rhachibusque glabris; fronde, pinnis basalibus remotis abrupte reductis exclusis, fere 60 cm. alta et 25 cm. lata, pinnata, pinna apicali caeteris conforme sed minore; pinnis normalibus remotis, alternantibus, sessilibus, inferioribus fere 15 cm. longis et 15 mm. latis, gradatim acuminatis, basi late cuneatis, leviter crenato-lobatis lobis crenulatis, herbaceis, costa superne setulis inconspicuis inflexis praedita, aliter glabrescentibus, venulis acroscopicis 3, basicopicis 2 anastomosantibus; soris medialibus vel inframedialibus, indusio parce et breviter ciliato, caduco.

British New Guinea: Fly River, 528-mile Camp, alt. 80 m., *Brass 6759* (type), "gregarious in clumps over 1 m. high, on mud in shaded creek bottoms."

Indusia can be detected only on the youngest sori.

Lindsaea subtripinnata sp. nov.

L. gregis *L. heterophyllae* Dry. et *L. orbiculatae* (Lam.) Mett., fronde basi tripinnata, apice attenuata pinnata, pinnis medialibus pinnatis lanceolatis, pinnulis omnibus parvis, cuneatis plerisque obovato-cuneiformibus apice rotundatis, venis liberis, soro continuo vel rarius interrupto, indusio cum margine contermino.

British New Guinea: Tarara, Wassi Kussa River, Western Division, *Brass 8491* (type), common on banks of gullies in rain-forest.

The stipe is about 30 cm. and the lamina about 25 cm. long.

Great as is the variety of fronds referred to *L. orbiculata* and *L. heterophylla, L. subtripinnata* seems sufficiently distinguished by its small pinnules and the absence of larger undivided pinnae. The free venation is correlated with the fine dissection of the frond. I have no New Guinean specimen of either *L. heterophylla* or *L. orbiculata,* but the former has been reported from the island. The group runs riot in New Caledonia.

Oleandra subdimorpha sp. nov.

Epiphytica, caudice gracili, paleis supra basim peltatis, nigris marginem lacerum versus pallescentibus ad ramos laterales breves imbricatis ad caudices erectos elongatos sparsis; frondibus ad ramos approximatis, ad caudices remotis, pedicellis 4 mm. longis, stipitibus 12–18 mm. longis, frondium fertilium paullo longioribus; fronde sterili ca. 18 cm. longa et 4 cm. lata, basi subinaequaliter rotundata, apice abrupte in caudam angustissimam 3 cm. longam contracta, coriacea, glabra, venis arcte approximatis; fronde fertili longiore, 1 cm. lata, venis remotioribus, soris medialibus, indusiis late reniformibus, oblique insertis, atrocastaneis, coriaceis.

British New Guinea: Palmer River, 2 miles below junction with Black River, alt. 100 m., *Brass 6886* (type, in Gray Herb.), "stiff climbing epiphyte."

A relative of *O. Werneri* Ros., but less dimorphic, the base of the sterile frond broader, the sori farther from the margin.

Humata papuana sp. nov.

H. gregis *H. repentis,* rhizomate gracili late repente, paleis atrofuscis lanceolatis 3 mm. longis tum demum deciduis vestito, deinde glauco; frondibus remotis, dimorphis, sterilium stipitibus plerumque perbrevibus rarius usque ad 5.5 cm. longis, sparse et decidue squamiferis, laminis deltoideis usque ad 5 cm. longis, pinnatis pinnis infimis tantum pinnatifidis sessilibus apice rotundatis coriaceis glabris, segmentis sequentibus lobatis, superioribus integris; frondium fertilium stipitibus 9 cm. altis, gracilibus, laminis 7 cm. longis late deltoideis basi tripinnatifidis, soris et axialibus et ad bases dentium brevium inconspicuorum, indusiis quam longis multo latioribus, etenim marginem superantibus.

BRITISH NEW GUINEA: Palmer River, 2 miles below junction with Black River, alt. 100 m., *Brass 6987* (TYPE), "matted on branches of tall canopy trees." *Brass 6593,* Fly River, 528-mile Camp, alt. 80 m., "creeping in moss mats high on canopy trees, common," is a depauperate form of the same species, the sterile fronds at most 2 cm. long, on stipes 7 mm. long.

Related to *H. kinabaluensis,* which has the teeth subtending the sori more completely suppressed, and to *H. pusilloides,* which has them much more conspicuous. *Humata alpina* var. *edentula* Ros. is like *H. kinabaluensis* in suppression of the teeth; judging by a single specimen, the sterile frond is more contracted, but with longer pinnae.

? Polypodium neglectum Blume, Enum. Pl. Jav. 121. 1828, Fl. Jav. Fil. 133. *pl. 54, f. 1.* 1828.

BRITISH NEW GUINEA: Palmer River, alt. 100 m., common on branches of tall trees, *Brass 6881.*

The identification is by description and doubtful. The rhizome is "repens, filiforme, tenue, ramosum, paleis lineari-lanceolatis acutissimis . . . imbricatis albo-scariosis . . . vestitum," quoting, with omissions, Presl, Epim. 124; Presl's description is likely to have been based on a "Manila" plant of Meyen. Van Alderwerelt's description, Malayan Ferns 435, fits Brass' plant in most respects. Backer & Posthumus, Varenflora voor Java 195, reduce *P. neglectum* to *P. stenophyllum* Blume, which seems most unlikely to be correct. Brass' plant is certainly not *P. stenophyllum.*

P. redimiens Brause is also known to me from description only. This description fits Brass' plant as to the fronds, but the rhizome is said to be "pallidum," "auffallend bleich," while that of Brass' plant is partly fuscous, mostly black; and the paleae are said to be "clathratis, deltoideis margine spinuloso-dentato," all of which is inappropriate. However, I suspect its identity with our plant. There is near affinity to *Polypodium pyrolaefolium* Bergsmann, the type of *Crypsinus;* and, still nearer, to *P. Whitfordii* Copel., of Luzon.

Selliguea Archboldii sp. nov.

S. gregis *S. Feei,* rhizomate late repente, paleis nigris, basi peltatis fusco-marginatis, deinde in setas squarrosas abrupte contractis; frondibus remotis, sterilibus ca. 15 cm. longis et 35 mm. latis, abrupte caudatis, coriaceis, basi cuneatis, stipitibus 6 cm. longis, venis haud occultis; frondibus fertilibus 10–12 cm. longis et 12–15 mm. latis, basi attenuatis; soris superficialibus, e costa ad marginem protensis.

BRITISH NEW GUINEA: Fly River, 528-mile Camp, alt. 80 m., *Brass 6836* (TYPE, in Gray Herb.), "creeping epiphyte, common on branches of high canopy trees; fronds very stiff."

Most like *S. feeioides* Copel., of Fiji, Samoa, and Tahiti, but smaller, with smaller, darker and narrower paleae.

Cyclophorus dispar Christ in Nova Guinea **8**: 155. 1909; v. A. v. R. in Bull. Jard. Bot. Buitenz. II. **1**: 4. *pl. 2, f. 2, 3.* 1911.

British New Guinea: Palmer River, alt. 100 m., *Brass 6872, 6879, 7253, 7371,* epiphytic, mostly on mossy branches of canopy trees; very uniform.

The fronds are short-stipitate rather than subsessile, but the conformity with Christ's description is reasonably close. I find nothing like the lid over the soral cavity, nor the great tufts of hairs described and figured by van Alderwerelt. The indument of the nether surface of the sterile frond is persistent. The sori are in an irregular row, or in two or three hardly distinguishable rows. On fully fruiting fronds, the sori come into contact as they expand.

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NOTES ON THE FLORA OF KWANGSI PROVINCE, CHINA

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KWANGSI Province, in southern China, bordering on Kwangtung to the east, Yunnan to the west, and Tonkin to the south, received comparatively little attention from botanical collectors in the early years of the botanical exploration of China. In recent years, however, extensive and important collections have been assembled from Kwangsi, particularly through the initiative and interest of Prof. W. Y. Chun, Director of the Botanical Institute, Sun Yatsen University, Canton, Dr. F. P. Metcalf of Lingnan University, Canton, and Dr. A. N. Steward of the University of Nanking, Nanking, China. Various expeditions organized by these men, and supported, in part, by grants made from the Arnold Arboretum of Harvard University, have operated in most parts of Kwangsi. Yet it is clear that the area has not been thoroughly covered from a botanical standpoint, and the desirability of additional future explorations is indicated. The material assembled at the Arnold Arboretum, on which this study is based, represents that institution's share of the collections made under coöperative arrangements with the several Chinese institutions.

This study is based on representatives of a few selected families of plants and clearly indicates what may be expected in the form of additions to our knowledge of the flora of China as the work of identification progresses. Twenty-six new species and two new varieties are described, nine of the species having been so designated by Dr. E. D. Merrill in his preliminary work on the collections. This study was made possible by a grant from the Milton Fund of Harvard University to Dr. Merrill, to assist him in preparing data for publication on the very extensive collections of Chinese botanical material assembled at the Arnold Arboretum in recent years.

PROTEACEAE

Helicia Loureiro

Helicia vestita W. W. Smith var. **mixta** var. nov.

A typo differt foliis brevioribus latioribus integris vel sursum irregulariter pauce dentatis.

HAINAN: Man-ning, *S. K. Lau 28252,* Nov. 26, 1936, a tree 10 m. high, in forest, fruit green. KWANGTUNG: Shih Wan Tai Shan, *H. Y. Liang 69841,* July 23, 1937, a tree 12 m. high, in mixed forests. KWANGSI: Shang-sze District, Shih Wan Tai Shan, near Iu Shan Village, *W. T. Tsang 22430,* June 2–7, 1933, a tree 22 ft. high, fairly common in thickets, flowers yellow; Tseung-yuen, Liow Shiang, *C. Wang 39624* (TYPE), June 30, 1936, a tree 20 m. high, in thin woods, flowers white.

These specimens closely resemble each other and represent a form differing from the Yunnan type in that the leaves are shorter and relatively broader (about 10–16 cm. long and 5.5–6 cm. broad), entire or with only a few shallow distant teeth near the apex.

ANNONACEAE

Orophea Blume

Orophea anceps Pierre, Fl. For. Cochinch. **1:** *t. 46.* 1881; Finet & Gagnep. in Lecomte, Fl. Gén. Indo-Chine **1:** 117. 1908.

KWANGSI: Pin-lam, *S. P. Ko 55657,* Aug. 29, 1935, a shrub on forested slopes, fruits yellowish red.

Although three species of *Orophea* are known from Hainan, this is the first record of the genus in continental China. Indo-China.

HAMAMELIDACEAE

Corylopsis Siebold & Zuccarini

Corylopsis cordata Merrill in herb. sp. nov.

Frutex 2–3 m. altus, ramulis glabris rubro-brunneis parce lenticellatis; foliis subchartaceis petiolatis glabris utrinque subconcoloribus oblongo-ovatis vel subelliptico-ovatis, 10–15 cm. longis, 6–9 cm. latis, perspicue acute acuminatis, basi distincte cordatis, margine sinuato-dentatis, dentibus longe mucronulatis, nervis lateralibus utrinsecus 7–9 laxis, inferioribus parce ramosis, cum costa supra leviter impressis, subtus elevatis perspicuis, venulis dense reticulatis tenuibus, supra leviter elevatis, subtus perspicuis; petiolis 2–2.5 cm. longis glabris; floribus ignotis; infructescentiis subspicatis vel racemosis, 3–3.5 cm. longis, pedunculis circa 1 cm. longis, pubescentibus vel glabrescentibus; capsulis 1 cm. longis, 8 mm. crassis, glabris, brunneis subsessilibus vel breviter crasseque pedicellatis; seminibus nigris, 8 mm. longis, laevibus, nitidis.

KWANGSI: Shang-sze District, Shih Wan Tai Shan, near Iu Shan Village, *W. T. Tsang 22261* (TYPE), May 11, 1933, a fairly common shrub 2 m. high in thickets; Shih Wan Tai Shan, Tang Lung Village, *W. T. Tsang 24256,* Sept. 14, 1934, a shrub 10 ft. high, fairly common in thickets; Shih Wan Tai Shan, Nam She Village, *W. T. Tsang 24747,* Nov. 26, 1934, like the preceding number.

A species close to *Corylopsis Wilsonii* Hemsley, differing in the broader leaves, which are glabrous on both surfaces and more strongly toothed, the shorter infructescences, and the smaller fruits.

Eustigma Gardner & Champion

Eustigma Balansae Oliv. in Hook. Ic. Pl. **20:** *t. 1954.* 1891; Guillaum. in Lecomte, Fl. Gén. Indo-Chine **2:** 710. 1920.

KWANGSI: Lin Yuin District, Na I, *A. N. Steward & H. C. Cheo 696,* June 14, 1933, a shrub 6 m. high, in valley, alt. 1000 m., fruits (immature) green.

This species was originally described from Tonkin, in Indo-China. New to China.

SIMARUBACEAE

Brucea J. F. Miller

Brucea acuminata sp. nov.

Frutex, ramis rubro-brunneis subdense albo-lenticellatis; foliis 40–45 cm. longis, rhachibus teretibus puberulis, petiolis 7–8 cm. longis, teretibus puberulis; foliolis circa 15, oppositis, breviter petiolulatis chartaceis, oblongo-lanceolatis, 5–8 cm. longis, 1.5–2.5 cm. latis, longe graciliter acuminatis, basi obtusis vel late acutis, aequalibus vel subobliquis, margine integris, supra atro-viridibus, subtus viridibus, utrinque minute consperse pubescentibus, nervis lateralibus utrinsecus 8–10, supra subconspicuis, subtus elevatis distinctis, venis tertiariis supra inconspicuis, subtus conspicuis vel obscuris, petiolulis ad 3 mm. longis; floribus ignotis; infructescentiis axillaribus (ut videtur, plerumque in axillis defoliatis) gracilibus elongatis, ad 15 cm. longis, rhachibus parce puberulis vel glabratis, pedicellis 4–5 mm. longis, puberulis, calyce persistente minuto 4-partito, fructibus ovoideis, 8–9 mm. longis, 6–7 mm. crassis, in sicco brunneis (ex collectore rubris), extus glabris in sicco subreticulatis.

KWANGSI: Ching Hsi District, *S. P. Ko 56114* (TYPE), Dec. 10, 1935, a shrub along roads in the margins of thickets or forests.

This species is apparently allied to *Brucea mollis* Wall., originally described from India, its variety *tonkinensis* Lecomte being recorded from Indo-China and from southern China. The new species is distinguished by its much smaller, narrower, longer acuminate, and shorter petiolulate leaflets and its slender infructescences.

STERCULIACEAE

Reevesia Lindley

Reevesia tomentosa sp. nov.

Arbor circa 12 m. alta, ramis teretibus stellato-tomentosis, ramulis dense stellato-tomentosis, indumento ferrugineo; foliis subcoriaceis oblongo-ovatis, 8–14 cm. longis, 3–6 cm. latis, acutis vel obtusis, basi rotundatis vel obscure subcordatis, supra olivaceis, disperse stellato-tomentosis, subtus pallidioribus dense brunneo-tomentosis, nervis lateralibus utrinsecus 6–10, supra impressis, subtus elevatis, venis tertiariis supra leviter impressis, subtus subconspicuis; petiolo dense brunneo-tomentoso, 1–3 cm. longo; floribus ignotis; fructibus longe pedicellatis, lignosis, circa 4 cm. longis, 3 cm. latis, obovoideo-oblongis, apice rotundatis leviter depressis, basi acutis, extus dense stellato-tomentosis, indumento ferrugineo; pedicellis 2.5–3 cm. longis; seminibus circa 2.6 cm. longis, alis brunneis circa 2.2 cm. longis, basim versus 0.8 cm. latis, oblongis, apice oblique rotundatis.

KWANGSI: Yung District, Ta Tseh Tsuen, *A. N. Steward & H. C. Cheo 922* (TYPE), Sept. 3, 1933, a tree 12 m. high, valley roadside, alt. 350 m.

A species allied to *Reevesia pubescens* Mast., but the leaves are more densely tomentose beneath and also scattered stellate-tomentose above, and the mature fruits are densely covered by brownish stellate hairs.

FLACOURTIACEAE

Hydnocarpus Gaertner

Hydnocarpus Merrillianus sp. nov.

Arbor, ramulis teretibus dense fulvo-pubescentibus; foliis chartaceis oblongo-ellipticis, 18–25 cm. longis, 6.5–11.5 cm. latis, abrupte acutis, basi late acutis, margine integris leviter revolutis, supra atro-viridibus glabris, subtus viridibus parce pubescentibus, venis lateralibus utrinsecus 7 vel 8, supra conspicuis, subtus elevatis distinctis, valde arcuatim adscendentibus, venulis reticulatis, utrinque perspicuis; petiolis 1.5–3.5 cm. longis, dense fulvo-pubescentibus; floribus ignotis; fructibus magnis axillaribus solitariis globosis, junioribus dense fulvo-pubescentibus, maturis castaneo-velutinis, 8 cm. diametro, pericarpio 5 mm. crasso; seminibus numerosis compresso-ovoideis, 2.5 cm. longis, 1.7 cm. latis; pedicellis 1 cm. longis.

KWANGSI: Tai Chin Shan, *S. P. Ko 55311* (TYPE), June 14, 1935, *55421*, July 4, 1935, a tree, in woods or borders of woods on slopes.

This is the second species of the genus known from China and the first one from continental China, the other, *Hydnocarpus hainanensis* (Merr.) Sleumer, being known from Hainan. This new species is characterized by the large, entire leaves with densely pubescent petioles, and the large globose fruits.

PASSIFLORACEAE

Passiflora Linnaeus

Passiflora Papilio sp. nov.

Suffruticosa scandens glabra, ramis subligneis gracilibus 2.5 mm. diametro, ramulis ultimis 1 mm. diametro; foliis subchartaceis, petiolatis, supra in sicco olivaceis, subtus pallide glaucescentibus minute consperse puberulis, 3–5 cm. longis, 9.5–12 cm. latis, basi rotundato-truncatis, apice latissime retusis in lobos 2 ovatos magnos divergentes rotundato-acuminatos abeuntibus, quove 5–7 cm. longo, 2.5–4 cm. lato, margine integris, costa media in mucronulum brevissimum abeunte, nervis lateralibus circa 3, jugo maximo subtriplinervio manifesto ramoso, caeteris subobscuris, venulis supra obscuris, subtus subconspicuis; petiolis circa 3 cm. longis, in partibus inferioribus glandulas binas ferentibus; cirrhis gracilibus glabris ad 6 cm. longis; floribus ignotis; fructibus globosis, 1–1.2 cm. diametro, pedicellis gracilibus, 1 cm. longis, medium versus articulatis; seminibus 3.5 mm. longis, cinereonigris foveolatis.

KWANGSI: Tai Chin Shan, *S. P. Ko 55426* (TYPE), July 7, 1935, scandent on trees on slopes.

A very distinct species, characterized by the broad, divergently 2-lobed leaves, which suggest a butterfly in shape, and the small fruits. The field label has notes on the flowers, but the specimen studied has only detached fruits, some of them with remnants of the calyx. The available flowering parts are too fragmentary for description, although, judging from the unique shape of the leaves as compared with other Chinese species, the flower is apt to be of interesting structure.

Passiflora kwangsiensis sp. nov.

Passiflora cupiformis sensu Chun, Sunyatsenia **4**: 184. 1940, pro parte; non Masters.

Suffruticosa scandens glabra, ramis subligneis. 3 mm. diametro; foliis chartaceis glabris late ellipticis vel leviter obovato-ellipticis, 8–11 cm. longis, 7–9.5 cm. latis, latissime rotundatis vel truncato-rotundatis, obscure undulatis, basi rotundatis ad modum angustissime peltatis, 3–5-nerviis, integris, supra in sicco olivaceis, subtus pallidis, costa nervisque utrinque elevatis distinctis, nervis inferioribus ramosis, venulis dense reticulatis, utrinque elevatis conspicuis; petiolis 4–5 cm. longis, in partibus inferioribus glandulas binas ferentibus; cirrhis gracilibus glabris usque ad 7 cm. longis; floribus ignotis; fructibus axillaribus, 2- vel 3-fasciculatis, globosis, circa 2 cm. diametro, glabris; pedicellis 1.5 cm. longis, medium versus articulatis; seminibus 3.5 mm. longis, pallidis, foveolatis.

KWANGSI: Ling Yuin District, *S. K. Lau 28577* (TYPE), July 10, 1937, scandent in light woods, fruits green.

A species apparently close to *Passiflora cupiformis* Mast., but differing in the vegetative details, the leaves being broadly elliptic to obovate-elliptic, broadly rounded or truncate-rounded at their apices and sometimes even undulate, their bases being broadly rounded and sometimes very narrowly peltate.

THYMELAEACEAE

Wikstroemia Endlicher

Wikstroemia paniculata sp. nov.

Frutex, ramis ramulisque teretibus glabris gracilibus, ramulis ultimis vix 1 mm. diametro; foliis oppositis chartaceis breviter petiolatis oblongo-ellipticis vel lanceolatis, ad 5.5 cm. longis et 1.6 cm. latis, plerumque acutis, basi acutis vel rotundatis, margine leviter revolutis, utrinque glabris, supra viridibus, subtus paullo pallidioribus, nervis lateralibus circa 20 utrinque subconspicuis in venam a margine ipso circa 1 mm. remotam cum margine parallelam anastomosantibus, venulis obscuris; petiolis ad 3 mm. longis; inflorescentiis terminalibus vel lateralibus paniculatis valde ramosis, ad 5 cm. longis, breviter adpresse pubescentibus, ramis racemiformibus, ad 2.5 cm. longis, pedicellis 0.5–1 mm. longis, sub perianthio articulatis, basi persistentibus; floribus luteis parvis, ad 4 mm. longis, 4-meris, perianthii tubo circa 4 mm. longo et 1.5 mm. crasso, parce pubescente, lobis 4 minutis 0.5 mm. longis; antheris 8, 2-seriatis, linearibus, 0.5 mm. longis; ovario glabro; fructu immaturo ovoideo, 6 mm. longo.

KWANGSI: Ching Sai Village, *S. P. Ko 55710* (TYPE), Sept. 7, 1935, a shrub in open places near slopes, flowers yellow.

A distinct species, strongly characterized by its leaves with lateral veins united into a single vein parallel with and close to the leaf-margins, and by the much-branched panicles bearing rather small flowers.

ALANGIACEAE

Alangium Lamarck

Alangium Chungii sp. nov.

Frutex vel arbor parva, ramulis ultimis atro-brunneis gracilibus teretibus leviter adpresse tomentosis vel glabrescentibus; foliis chartaceis longe petiolatis late ovatis, 11–22 cm. longis, 9–16 cm. latis, acutis, basi cordatis valde inaequilateralibus, 3–6-nerviis, margine integris, supra glabris costa nervisque interdum parce tomentosis exceptis, nervis lateralibus utrinque 4–6 prope marginem anastomosantibus, utrinsecus conspicuis, venulis dense reticulatis, utrinsecus perspicuis; petiolis 5–10 cm. longis, teretibus minute adpresse tomentosis; inflorescentiis axillaribus adpresse tomentosis vel subtomentosis, ad 8 cm. longis, 1- vel 2-ramosis, 4–7-floris, pedunculis 2–3.5 cm. longis, pedicellis 1–2 cm. longis; floribus 2–2.5 cm. longis; calycis tubo infundibuliformi, 2 mm. longo, leviter tomentoso, margine minute 5–7-lobato; petalis 6 vel 7 basi leviter cohaerentibus, lanceolatis, 2–2.5 cm. longis, 1.5 mm. latis, extus tomentosis, intus glabris; staminibus 6 vel 7, circa 1.8 cm. longis, filamentis 6 mm. longis, dilatatis dense villosis, antheris linearibus, 1.2 cm. longis, connectivo villoso; disco subgloboso; ovario 1-loculari, stigmate capitato 4-partito; fructu ignoto.

KWANGSI: no data, *Z. S. Chung 82038* (TYPE).

A species related to *Alangium platanifolium* (Sieb. & Zucc.) Hance and *A. barbatum* (C. B. Clarke) Harms, differing from the former in the strictly entire leaves and the smaller flowers and from the latter in the longer petiolate leaves, larger flowers, and the densely villose filaments.

CLETHRACEAE

Clethra Linnaeus

Clethra Liangii sp. nov.

Frutex 2–2.5 m. altus, ramis brunneis, ramulis glabris vel novellis plus minusve tomentosis; foliis chartaceis oblongis vel late oblongo-lanceolatis, 6–12 cm. longis, 1.8–3.5 cm. latis, acuminatis, deorsum plus minusve angustatis, basi acutis, distanter serrulatis, deorsum integris, supra atro-viridibus primo minute stellatis, subtus pallide viridibus primo tomentosis, utrinque mox glabris, costa supra impressa, subtus valde elevata, nervis lateralibus utrinsecus 8–12, supra leviter impressis, subtus perspicuis, arcuatim anastomosantibus, venulis subconspicuis vel obscuris; petiolis 6–10 mm. longis; inflorescentiis 1–7 terminalibus racemosis, ad 12 cm. longis, dense stellatim brunneo-tomentosis multifloris, pedunculis ad 3.5 cm. longis, floribus circa 5 mm. longis, pedicellis 2–3 mm. longis, bracteolis lanceolatis, 4–5 mm. longis, tomentosis caducis interdum persistentibus; calyce 2 mm. longo, 5-dentato utrinque tomentoso; petalis 5, retusis albis lineari-obovatis, 5 mm. longis, glabris; filamentis 3.5 mm. longis, inferne dilatatis, antheris 1.5 mm. longis; ovario dense pubescente; stylis ad 6 mm. longis, glabris, stigmate minute 3-lobato; fructu immaturo 3 mm. diametro, pubescente, stylo persistente, 5 mm. longo.

KWANGTUNG: Ta Mien Shan, Shih Wan Tai Shan, *H. Y. Liang 69645* (TYPE), July 14, 1937, a shrub 2 m. high, in dense forest, flowers white. KWANGSI: Pin-lam, Ching Sai, *S. P. Ko 55527*, Aug. 22, 1935, a shrub 2.5 m. high, on forested slopes, alt. 900 m., flowers white.

A species possibly most closely allied to *Clethra Bodinieri* H. Lév., differing, among other characters, in the numerous racemes with dense brown non-appressed indumentum and stouter pedicels.

Clethra polyneura sp. nov.

Frutex, ramis robustis brunneis junioribus dense breviter substellatim fulvo-pubescentibus; foliis subchartaceis lanceolatis, circa 15 cm. longis et 4 cm. latis, longe acuminatis, basi subrotundatis vel late acutis, margine dense incurvato-serrulatis, deorsum integris, primo pubescentibus, supra mox glabris, subtus mox glabrescentibus costa nervisque interdum parce pubescentibus exceptis, costa supra leviter impressa, subtus elevata, nervis lateralibus utrinsecus 18–25 adscendentibus ad marginem arcuato-anastomosantibus, supra subconspicuis, subtus perspicuis, venulis subconspicuis; petiolis 1–2 cm. longis, pubescentibus; racemis circa 7, subfasciculatis, terminalibus ad 17 cm. longis, densifloris fulvo-tomentosis, pedunculis circa 1 cm. longis, ebracteatis, floribus circa 5 mm. longis, pedicellis 1–2 mm. longis, bracteolis lineari-lanceolatis ad 7 mm. longis, tomentosis caducis; calyce 2.5 mm. longo, 5-dentato toto subalbido-pubescente; petalis 5 obovatis, 5 mm. longis, apice valde truncatis; filamentis gracilibus 4–5 mm. longis, antheris 1 mm. longis; ovario pubescente; stylis 3 mm. longis, glabris, stigmate integro.

KWANGSI: Ling Wan District, *S. K. Lau 28767* (TYPE), in 1937, no field notes available.

This species is very close to *Clethra kaipoensis* H. Lév., differing chiefly in the more narrowly lanceolate leaves, with more numerous lateral veins and closer denticulations, and the elongated lanceolate bracteoles.

COMBRETACEAE

Combretum Linnaeus

Combretum kwangsiense sp. nov.

Frutex scandens, ramis cinereo-albidis, glabris, cortice longitudinaliter rimoso, ramulis dense lepidotis, lepidibus minutis; foliis chartaceis breviter petiolatis ellipticis vel late oblongo-ellipticis, 14–17 cm. longis, 7–10 cm. latis, rotundatis, basi late acutis, margine leviter revolutis, supra olivaceo-viridibus, subtus pallide viridibus, utrinque minute albido-punctatis, nervis lateralibus utrinsecus 7 vel 8, cum costa supra tenuiter subtus valde prominulis, nervis prope marginem arcuato-anastomosantibus, venulis reticulatis, supra subconspicuis, subtus elevatis perspicuis; petiolis circa 1 cm. longis; floribus ignotis; infructescentiis racemosis simplicibus axillaribus, 6–8 cm. longis, polycarpicis, pedunculis 1.5–2 cm. longis, minute lepidotis, fructibus in stipitibus circa 1 mm. longis, luteo-brunneis, e collectore luteis, sparse minute glandulosis (glandulis flavidis), nitidis, in ambitu ellipticis vel elliptico-ovoideis, ad 15–18 mm. longis et latis, 4-alatis, utrinque rotundatis.

KWANGSI: Yang District, Ch'ang An, *Steward & Cheo 1194* (TYPE), Oct. 23, 1933, vine, on rocks in forest, alt. 200 m., fruit yellow.

A species allied to *Combretum Alfredii* Hance, but distinguished by the larger, broader leaves, smaller infructescences, and much smaller fruits.

EBENACEAE

Diospyros Linnaeus

Diospyros siderophyllus sp. nov.

Arbor parva 5 m. alta, partibus junioribus fructibusque exceptis glabris (floribus ignotis), ramis teretibus nigris glabris, ramulis ultimis circa 1.5 mm. diametro, brunneis glabris vel breviter adpresse hirsutis; foliis subcoriaceis, oblongis, 8–14 cm. longis, 2–4 cm. latis, breviter obtuse acuminatis, basi acutis, supra in sicco atro-olivaceis, glabris, subtus paullo pallidioribus glabris vel consperse breviter adpresse hirsutis, costa supra impressa, subtus valde elevata, nervis lateralibus utrinsecus 10–12, gracilibus curvato-adscendentibus anastomosantibus, supra subconspicuis vel inconspicuis, subtus elevatis, venulis reticulatis, utrinque subconspicuis vel obscuris; petiolis ad 1 cm. longis, crassis nigris glabris vel parcissime hirsutis; fructibus axillaribus vel in axillis defoliatis solitariis sessilibus globosis, circa 2 cm. diametro, dense breviter adpresse brunneo-hirsutis, 5- vel 6-locellatis; seminibus circa 8 mm. longis et 5 mm. latis, compressis, albumine aequabili; sepalis 4 sub fructu patulis valde coriaceis late triangularibus, circa 8 mm. longis et 6 mm. latis, acutis hirsutis.

KWANGSI: Pin-lam, *S. P. Ko 55679* (TYPE), Sept. 1, 1935, a small tree 5 m. high, in forests on or near slopes; On Tak, *S. P. Ko 55773*, Sept. 19, 1935, a small tree 5 m. high, in similar habitats.

In the vegetative characters, this species resembles *Diospyros Roi* H.

Lecomte, differing in the leaves being generally narrower, olivaceous when dry, and with more numerous lateral veins. It differs further in the fruit, with its persistent calyx, which is densely brownish-appressed-hirsute, while the seeds are fewer in number.

STYRACACEAE

Styrax Linnaeus

Styrax oligophlebius Merrill in herb. sp. nov.

Frutex 2.5 m. altus, ramulis novellis dense breviter stellatim brunneo-tomentosis; foliis chartaceis vel subcoriaceis, supra glabris viridibus nitidis, subtus dense stellatim subfulvo-tomentosis oblongis, 4–6 cm. longis, 1.5–2.5 cm. latis, breviter acuminatis, basi acutis, integris, nervis lateralibus utrinsecus 5 vel 6, cum costa supra subconspicuis leviter impressis, subtus elevatis prominulis, venis tertiariis utrinque obscuris; petiolis 0.8–1.3 cm. longis, dense breviter stellatim tomentosis; inflorescentiis infructescentiisque ignotis; fructibus globosis, circa 1.2 cm. diametro, globosis vel subovoideis, rotundatis, extus dense cinereo-tomentosis, calyce persistente cupulato, 6 mm. alto, cinereo-tomentello leviter irregulariter lobato; pedicello circa 3 mm. longo.

KWANGSI: Shang-sze District, Shih Wan Tai Shan, Tang Lung Village, *W. T. Tsang 24489* (TYPE), Oct. 1–16, 1934, scattered shrubs, about 2 m. high, fairly common.

A distinct species, strongly characterized by its rather small, coriaceous, few-nerved leaves, which are green, glabrous, and glossy above and densely and brightly brownish-tomentose beneath, with short crowded stellate hairs.

SYMPLOCACEAE

Symplocos Jacquin

Symplocos kwangsiensis Merrill in herb. sp. nov. Subgen. *Hopea*, § *Bobua, Lodhra*.

Frutex circiter 2 m. altus, ramis nigris, primo plus minusve pubescentibus, vetustioribus glabris, ramulis novellis dense brunneo-pilosis atque longe ciliatis; foliis chartaceis utrinque subconcoloribus, supra nitidis, subtus longe ciliatis, oblongo-ovatis vel late ovato-lanceolatis, 2.5–4 cm. longis, 1–1.5 cm. latis, longe acute acuminatis, basi late acutis vel rotundatis, margine glanduloso-serrulatis, costa supra leviter impressa pilosa vel glabrata, nervis lateralibus utrinsecus 3 vel 4 utrinque subconspicuis arcuato-anastomosantibus, venis tertiariis obscuris; petiolis 2 mm. longis, ciliatis; inflorescentiis axillaribus in ramulis hornotinis fasciculatis subsessilibus paucifloris; floribus sessilibus, bracteis late ovatis, dense pubescentibus, 1 mm. longis; calycis tubo crasso, circa 1 mm. longo, lobis 5 late ovatis pubescentibus, 1 mm. longis; petalis 5 albis oblongis, 3.5 mm. longis, utrinque glabris; staminibus circa 20–25, filamentis liberis, glabris, circa 4 mm. longis; disco annulari cinereo-pubescente; ovario 3-loculari, stylo 5 mm. longo; fructibus ovoideis, 6 mm. longis, 4.5 mm. crassis, viridibus.

KWANGSI: Shang-sze District, Shih Wan Tai Shan, Tang Lung Village, *W. T. Tsang 24383* (TYPE), Sept. 30, 1934, a shrub 5 ft. high, fairly common on dry steep slopes, in thickets, flowers white, fragrant. KWANGTUNG: Shih Wan Tai Shan, *H. Y. Liang 70044*, Aug. 7, 1937, shrub, 2 m. high, in dense woods, fruits green to black.

A distinct species, apparently allied to *Symplocos glandulifera* Brand and *S. yunnanensis* Brand, both of Yunnan, the latter extending also to

Kwangsi and Indo-China. It may be readily distinguished from both of these, among other characters, by its unusually small leaves.

Symplocos mollipila sp. nov. Subgen. *Hopea*, § *Bobua, Lodhra.*

Frutex vel arbor parva, ramulis novellis teretibus gracilibus dense fulvo-villosis; ramis vetustioribus plus minusve pubescentibus, glabrescentibus, foliis chartaceis breviter petiolatis oblongis, 5–10 cm. longis, 2.5–4 cm. latis, perspicue acuminatis, basi late cuneatis vel rotundatis, margine integris, supra subnitidis breviter et conspersissime pubescentibus, subtus molliter pilosis, costa supra leviter impressa dense pubescente, subtus elevata, nervis lateralibus utrinsecus circa 10, utrinque subconspicuis, prope marginem anastomosantibus; petiolis 2–3 mm. longis, dense villosis; floribus ignotis; infructescentiis axillaribus fasciculatis subsessilibus 1–4-fructigeris, bracteis minutis, late ovatis, 1.5 mm. longis, pubescentibus, fructibus ellipsoideis, 1 cm. longis, 7.5 mm. crassis, parce pubescentibus vel glabrescentibus, leviter longitudinaliter sulcatis, 3-locularibus, lobis calycinis persistentibus rotundatis, 1.5 mm. longis, pubescentibus.

KWANGSI: Ling Wan District, *S. K. Lau 28722, 28725* (TYPE), 1937, no field notes available.

A species apparently close to *Symplocos glandulifera* Brand, differing in the shorter leaves, which are not glandular on the margins and which have broader, sometimes rounded bases, as well as in the shorter fruits.

Symplocos punctato-marginata A. Chev. ex Guillaum. Bull. Soc. Bot. France **79**: 174. 1932; Lecomte, Fl. Gén. Indo-Chine **3**: 1004. 1933; Merr. Lingnan Sci. Jour. **15**: 424. 1936.

Symplocos Stewardii Sleumer, Repert. Sp. Nov. **42**: 266. 1937, syn. nov.

KWANGSI: Yung District, Ta Tseh Tseun, *A. N. Steward & H. C. Cheo 771* (isosyntype of *S. Stewardii* Sleumer), Aug. 8, 1933, a shrub 5 m. high, in valley forests, alt. 540 m., flowers white, fragrant, *865* (isosyntype of *S. Stewardii* Sleumer), Aug. 1933, a tree 12 m. high, in forests, alt. 540 m., flowers white, fragrant; Shang-sze District, Shih Wan Tai Shan, near Hoh Lung Village, *W. T. Tsang 22569* (isosyntype of *S. Stewardii* Sleumer), June 26, 1933, a shrub 10 ft. high, fairly common, in thickets, flowers white; Shih Wan Tai Shan, Tang Lung Village, *W. T. Tsang 24189*, Sept. 4, 1934, a shrub 15 ft. high, fairly common in thickets, flowers white, fragrant, fruits black.

Originally described from Indo-China. In recording the species from Kwangtung, Merrill has also noted the occurrence of Chevalier's species in Kwangsi, mentioning *Steward & Cheo 771* and *865*. This was apparently overlooked by Sleumer. An additional specimen, besides those noted by Merrill and by Sleumer, *Tsang 24189*, shows that, together with the other specimens, the Kwangsi plant is virtually the same as the Indo-Chinese species.

Symplocos myriadenia Merr. Univ. Calif. Publ. Bot. **10**: 428. 1924.

KWANGSI: Shang-sze District, Shih Wan Tai Shan, near Hoh Lung Village, *W. T. Tsang 22568*, June 26, 1933, *22648*, July 6, 1933, a small tree 9–15 ft. high, fairly common in thickets; Ling Wan District, *S. K. Lau 28627*, 1937. Indo-China. New to Kwangsi.

Symplocos anomala Brand, var. **nitida** var. nov.

A typo differt foliis 8–12 cm. longis, 3–5 cm. latis, supra valde nitidis, inflorescentiis calycibusque glabris.

KWANGSI: Waitsap District, Tong Shan, near Sap-luk Po Village, *W. T. Tsang 22738,* Sept. 8, 1933, *22752,* Sept. 10, 1933, a shrub 5–9 ft. high, in thickets, flowers white, fragrant, fruit black; Shang-sze District, Shih Wan Tai Shan, Tang Lung Village, *W. T. Tsang 24389,* Sept. 30, 1934, *24423* (TYPE), Oct. 1–16, 1934, a shrub 9–15 ft. high, fairly common in thickets, flowers white, fragrant.

This differs from the typical form of the species, which occurs in Szechuan, Kweichow, Hupeh, Hunan, Kiangsu, Anhwei, Chekiang, Fukien, Kwangsi, and Hainan, in the larger strongly shining leaves and the glabrous inflorescences and calyces.

RUBIACEAE

Xanthophytopsis Pitard

Xanthophytopsis kwangtungensis Chun & How, Sunyatsenia **4:** 14. *pl. 5.* 1939.

KWANGSI: Shang-sze District, Shih Wan Tai Shan, *W. T. Tsang 22306,* May 16, 1933, *22485,* June 17, 1933, *23966,* July 11–30, 1934, *23975,* Aug. 8, 1934, *24532,* Oct. 22–31, 1934. A woody plant 1–1½ ft. high, fairly common in thickets.

This species, originally described from Kwangtung, is the second species of the genus, which was originally described from Indo-China material. New to Kwangsi. The specimens above cited are all from various localities in the Shang-sze District, close to the Kwangtung border.

Ophiorrhiza Linnaeus

Ophiorrhiza succirubra King ex Hook. f. Fl. Brit. Ind. **3:** 82. 1880.

KWANGSI: Waitsap District, Sze Tze Shan, near Tung Chung Village, *W. T. Tsang 23347,* Dec. 4–6, 1933, 1 ft. high, fairly common in thickets, flowers white, odorless; Shang-sze District, Shih Wan Tai Shan, Nam She Village, *W. T. Tsang 24632,* Nov. 11, 1934, *24740,* Nov. 25, 1934, semi-woody, fairly common in thickets, flowers white or purplish-red, fragrant; Yao Shan, *C. Wang 40467,* Dec. 14, 1936, near streams, flowers white.

These specimens seem to represent the same entity as *Henry 11345* from Yunnan, which Dunn, Jour. Linn. Soc. Bot. **39:** 471. 1911, has identified as representing King's species. Himalayan region to Yunnan, and, if our identification is correct, also in Kwangsi.

Ophiorrhiza kwangsiensis Merrill in herb. sp. nov.

Herba prostrata adscendens 15–18 cm. alta ramosa, caulibus circiter 1 mm. diametro teretibus glabris, ramulis ultimis circa 0.5 mm. diametro plus minusve breviter curvato-hirsutis; foliis in paribus subaequalibus chartaceis vel submembranaceis cordato-ovatis, 1.5–1.75 cm. longis, 1–1.5 cm. latis, acutis, basi cordatis, utrinque glabris, in sicco supra subolivaceis, subtus pallidioribus, nervis lateralibus utrinsecus circa 5 obliquis, venulis inconspicuis; petiolis 0.5–1.5 cm. longis, glabris gracilibus; stipulis caducis; inflorescentiis terminalibus breviter pedunculatis (pedunculo sub fructu ad 12 mm. longo) cymosis paucifloris breviter pubescentibus, floribus immaturis circiter 2.5 mm. longis, pedicellis puberulis ad 1 mm. longis; bracteis bracteolisque linearibus vel lineari-lanceolatis acuminatis circiter 5 mm. longis, obscure consperse pubescentibus; sepalis 5 oblongo-lanceolatis acutis 1 mm. longis; corolla immatura 3 mm. longa; capsula pedicellata, circa 6 mm. lata et 2 mm. alta, breviter puberula, pedicellis ad 5 mm. longis.

KWANGSI: Shang-sze District, Shih Wan Tai Shan, Hoh Lung Village, *W. T. Tsang*

22425 (TYPE), June 4, 1933, 5 in. high, fairly common in thickets on steep slopes; Shih Wan Tai Shan, Tang Lung Village, *W. T. Tsang 24388,* Sept. 30, 1934, fairly common on steep slopes, flowers pale yellow.

A species characterized by its habit and by its small leaves and flowers.

Luculia Sweet

Luculia intermedia Hutchinson in Sargent, Pl. Wils. **3:** 408. 1916.

KWANGSI: Pin-lam, *S. P. Ko 55584,* Aug. 23, 1935, a shrub 1 m. high, in woods on slopes; Ching Sai Village, *S. P. Ko 55718,* Sept. 7, 1935, a shrub on slopes, flowers white. Burma and Yunnan.

Adina Salisbury

Adina Metcalfii Merrill in herb. sp. nov.

Frutex circa 2 m. altus, ramulis novellis castaneis, obscure tetragonis, glabris vel subglabris; foliis chartaceis petiolatis utrinque glabris, oblongis vel obovato-oblongis, 8–13.5 cm. longis, 3–5 cm. latis, perspicue acuminatis, basi longe attenuatis, supra olivaceo-viridibus, subtus paullo pallidioribus, costa supra leviter impressa, subtus elevata, nervis lateralibus utrinsecus 8–10, adscendentibus prope marginem anastomosantibus, supra subconspicuis, subtus elevatis, venis tertiariis utrinque subconspicuis; petiolis 1.5–2.5 cm. longis, tenuibus; inflorescentiis terminalibus, ad 8 cm. longis, glabris, capitulis circa 1.5 cm. diametro, 5–7-racemosim dispositis, interdum foliis reductis subtentis, pedunculis gracilibus, 2.5–5.5 cm. longis; calyce hirsuto, lobis oblongis, circa 1 mm. longis, obtusis; corollae tubo circa 4 mm. longo, glabro, lobis 5 ovatis glabris, circa 1 mm. longis; staminibus fauce corollae insertis, antheris apiculatis inclusis; stylis exsertis, circa 8 mm. longis, stigmate subgloboso.

KWANGSI: Ch'uan District, Pai-yun-an and vicinity, *W. T. Tsang 27683* (TYPE), June 18, 1937, a shrub about 2 m. high, fairly common in thickets, flowers yellow, fragrant.

In the racemosely arranged heads, this new species is allied to *Adina racemosa* Miq., differing, however, in the much narrower, long attenuate leaves and the glabrous corollas.

Mussaenda Linnaeus

Mussaenda anomala sp. nov.

Frutex scandens, ramulis pallide brunneo-cinereis consperse lenticellatis subadpresse pilosis glabrescentibus; foliis in paribus aequalibus ovatis vel elliptico-ovatis, 13–17 cm. longis, 7.5–11.5 cm. latis, acuminatis, basi acutis, utrinque conspersissime breviter pubescentibus, supra viridibus, subtus pallidioribus, nervis lateralibus utrinsecus 8–10, supra conspicuis, subtus elevatis curvato-subadscendentibus, venulis reticulatis, supra subconspicuis, subtus gracilibus; petiolis 2–2.5 cm. longis, leviter pubescentibus; stipulis caducis; inflorescentiis terminalibus sessilibus cymosis multifloris trichotomo-ramosis breviter subadpresse pubescentibus, circa 6 cm. longis; bracteis caducis, bracteolis acuminatis, lanceolatis pubescentibus ad 1 cm. longis, deciduis; pedicellis 2–3 mm. longis; calycis tubo oblongo, circa 5 mm. longo, adpresse subhirsuto, lobis plerumque 5, omnibus petaloideis, in lamina ampla petiolatis productis albis ovato-ellipticis, 2–4 cm. longis, 1.5–2.5 cm. latis, acutis, basi acutis vel cuneatis 5-nerviis, margine nervisque plus minusve pubescentibus, stipite 1.5–2.5 cm. longo; corollae tubo (alabastro) circa 1.2 cm. longo et 4 mm. crasso, superne ampliato, extus dense adpresse pubescente, intus superne dense sulphureo-piloso, inferne glabro, lobis plerumque 5, ovatis, breviter acuminatis, circa 3 mm. longis (immaturis), extus pubescentibus; staminibus 4 vel 5, in tubo insertis, antheris elongatis, 3 mm. longis, inclusis, subsessilibus; ovario 2-loculari, disco annulari, stylis circa 6 mm. longis, inclusis, stigmatibus 2 linearibus compressis, 4 mm. longis; fructu immaturo 6 mm. longo, 4 mm. crasso, seminibus ignotis.

KWANGSI: Tseung-yuen, Yao Shan, *C. Wang 39567* (TYPE), June 27, 1936, climbing on trees.

In the large, broad, thin leaves, this species superficially resembles *Mussaenda Esquirolii* H. Lév. (*M. Wilsonii* Hutchinson). Its one outstanding character, in which it differs from all other known representatives of the genus from China and Indo-China, and for that matter from most previously known representatives of the genus, is that not one but all of the calyx-lobes are accrescent and petaloid. This character has been noted in the Philippine *Mussaenda philippica* Rich. var. *aurorae* Sulit, Philip. Jour. Forestry **2:** 39. *t. 3. f. 1.* 1939.

Mussaenda kwangsiensis sp. nov.

Frutex scandens, ramulis teretibus dense adpresse pubescentibus; foliis tenuiter chartaceis in paribus aequalibus oblongo-lanceolatis vel lanceolatis, 8–11 cm. longis, 2.5–4 cm. latis, longe acute acuminatis, basi attenuatis vel cuneatis, supra sparse adpresse pubescentibus, subtus consperse molliter pubescentibus, nervis lateralibus utrinsecus 6–8 curvato-adscendentibus, utrinque conspicuis, venis tertiariis inconspicuis; petiolis 5–8 mm. longis, adpresse pubescentibus, axillis plerumque folia 2–4 valde reducta gerentibus; stipulis linearibus, 6 mm. longis, caducis; inflorescentiis terminalibus cymosis compactis, circa 4 cm. longis, vix ramosis, perspicue adpresse pubescentibus, bracteis bracteolisque linearibus, 0.5–1.5 cm. longis; floribus sessilibus confertis; calycis tubo oblongo, circa 5 mm. longo, dense pubescente, 5-lobato, lobis normalibus linearibus, 2.5–3 cm. longis, 1–2 mm. latis, sparse pilosis, longe acuminatis, lobis petaloideis paucis ovatis, saltem 6 cm. longis, 5–7-nerviis, acuminatis, utrinque consperse pubescentibus, stipitatis; corollae tubo 2–2.5 cm. longo, 1.5 mm. lato, sursum breviter ampliato, extus perspicue cinereo-pubescente, intus superne villoso, lobis 5 ovatis, 3 mm. longis, 1.5 mm. latis, acuminatis vel mucronatis; staminibus inclusis, antheris 4–5 mm. longis, filamentis glabris; stylo brevi, 5 mm. longo, glabro.

KWANGSI: Tseung-yuen, Yao Shan, *C. Wang 40448* (TYPE), Nov. 9, 1936, scandent in thickets, flowers yellow.

A species apparently in the group with *Mussaenda hirsutula* Miq., differing in the longer and narrower leaves and in the very slender, extremely long normal calyx-lobes, which mostly exceed the corollas in length.

Mussaenda densiflora sp. nov.

Frutex scandens saltem 2 m. altus, ramis teretibus perspicue villosis; foliis membranaceis vel tenuiter chartaceis in paribus aequalibus, late oblongo-lanceolatis vel anguste oblongo-ellipticis, 8–13 cm. longis, 3–5 cm. latis, longe acute acuminatis, basi acutis, plerumque late acutis, raro subrotundatis, supra conspersissime breviter ciliatis, subtus praesertim secus costam nervosque molliter pubescentibus, nervis lateralibus utrinsecus 8–10, curvato-adscendentibus, utrinque conspicuis, venis tertiariis inconspicuis vel subconspicuis; petiolis 1–2 cm. longis, pubescentibus; stipulis linearibus, 3–4 mm. longis, caducis; inflorescentiis terminalibus cymosis compactis, subcapitatis, circiter 6 cm. longis, breviter ramosis, perspicue molliter pubescentibus, bracteis bracteolisque linearibus, 1–1.5 cm. longis; floribus sessilibus, confertis; calycis tubo crasso, 2–3 mm. longo, dense pubescente, lobis plerumque 5, normalibus linearibus 8–15 mm. longis, 1–2 mm. latis, pubescentibus, uno interdum petaloideo ovato, 5–6 cm. longo, ad 3.5 cm. lato, acuto, utrinque consperse pubescente, stipitato, nervis 5–7, stipite circiter 1.5 cm. longo; corollae tubo 3–3.5 cm. longo, 1.5 mm. lato, sursum breviter ampliato, extus perspicue cinereo-pubescente, intus superne villoso, lobis 5, oblongo-lanceolatis, 7–8 mm. longis, 2–3 mm. latis, longe acuminatis, extus sparse pubescentibus vel glabrescentibus; staminibus inclusis, tubo in 1/5 superiore insertis, antheris 5–6 mm. longis, filamentis glabris; stylo glabro, 8 mm. longo, 2- vel 3-lobato; fructu ovoideo, 8–9 mm. longo, 6–7 mm. crasso, glabro, sepalis deciduis.

KWANGSI: Tai Ching Shan, *S. P. Ko 55121* (TYPE), May 25, 1935, a small scandent shrub, in woods, alt. 1250 ft., flowers yellow; Ching Sai Village, *S. P. Ko 55711*, a climber, fruit green.

This species is allied to *Mussaenda subsessilis* Pierre of Indo-China, differing chiefly in the much smaller petaloid sepals and the much longer and narrower corolla-lobes. A collection from Tonkin, Indo-China, *W. T. Tsang 29049*, is referable to this same species. The fruits have been described from *S. P. Ko 55711*, of which the leaf-bases are distinctly rounded rather than broadly acute.

Randia Linnaeus

Randia salicifolia sp. nov.

Frutex erectus glaber, ramis ramulisque gracilibus teretibus, ramulis circa 1.5 mm. diametro; foliis chartaceis glabris breviter petiolatis lanceolatis, 15–19 cm. longis, 1.5–3 cm. latis, sursum longe angustatis, apice acute acuminatis, basi acutis, supra atro-olivaceis, subtus pallidioribus, nervis lateralibus utrinsecus 9–12 gracilibus, utrinque subdistinctis, prope marginem arcuato-adscendentibus, reticulis obsoletis; petiolo 5–8 mm. longo; stipulis triangularibus, longe acuminatis, circa 6 mm. longis; floribus ignotis; infructescentiis oppositifoliis depauperato-cymosis, circa 1.5 cm. longis, fructibus junioribus globosis, circa 8 mm. diametro, in siccitate nigris, nitidis; pedicellis 4 mm. longis, bracteis minoribus oblongis circa 1 mm. longis.

KWANGSI: Ping-nan District, *C. Wang 40398* (TYPE), Nov. 2, 1936, a shrub, in dense forests, fruits green.

This species is manifestly close to *Randia Henryi* Pritzel, differing particularly in its elongated narrow leaves and reduced infructescences.

Ixora Linnaeus

Ixora Tsangii Merrill in herb. sp. nov.

Frutex parvus 1 m. altus, inflorescentiis leviter pubescentibus exceptis glaber, ramis teretibus 3 mm. diametro, internodiis 2.5–3.5 cm. longis; foliis chartaceis oblongo-lanceolatis, 13–20 cm. longis, 3–6 cm. latis, longe acuminatis, basi late acutis, subolivaceis subopacis, nervis lateralibus utrinsecus

14–16, supra distinctis, subtus elevatis, prope marginem arcuato-anastomosantibus; petiolis 1–1.5 cm. longis; stipulis circa 8 mm. longis deorsum oblongo-ovatis subabrupte caudato-acuminatis caducis; cymis terminalibus sessilibus e basi ramosis, circa 3.5 cm. longis, leviter pubescentibus trichotome ramosis, ramis primariis haud 1 cm. longis, floribus plerumque in ramulis secundariis in triadibus dispositis, pedicellatis, pedicellis 3–5 mm. longis, bracteis lineari-lanceolatis acuminatis circa 3 mm. longis, bracteolis minoribus; calycibus glabris circa 1.5 mm. longis, lobis ovatis acuminatis quam tubo brevioribus; corolla alba (ex collectore), tubo gracili 1.5–1.8 cm. longo haud barbato, lobis reflexis circa 5 mm. longis subrotundatis; antheris exsertis lanceolatis circa 3.5 mm. longis, stylis exsertis, ramis 1.5 mm. longis.

KWANGSI: Shang-sze District, Shih Wan Tai Shan, Tang Lung Village, *W. T. Tsang 24240* (TYPE), Sept. 8, 1934, a fairly common shrub in thickets, about 1 m. high, flowers white, fragrant.

This species is allied to *Ixora hainanensis* Merr. & Chun of Hainan, differing in the leaves having more numerous, prominent, and more oblique lateral nerves, and in the much shorter flowers with subrounded corolla-lobes. Moreover, the inflorescences are sessile, while in *I. hainanensis* they are distinctly pedunculate. *H. Y. Liang 70086,* from Shih Wan Tai Shan, Kwangtung Province, unfortunately with immature flowers, may represent the same species.

Psychotria Linnaeus

Psychotria kwangsiensis sp. nov.

Frutex parvus erectus ubique glaber, ramis ultimis crassis, 4 mm. diametro; foliis chartaceis grandis longe petiolatis ellipticis, circa 26 cm. longis et 12 cm. latis, apice acutis vel acuminatis, basi longe attenuatis, supra olivaceo-viridibus, subtus paullo pallidioribus, nervis lateralibus utrinsecus circa 16, utrinque conspicuis, prope marginem tenuiter curvato-arcuatis, venulis utrinque obscuris; petiolis 4–5 cm. longis; stipulis deciduis; floribus ignotis; infructescentiis terminalibus pedunculatis sublaxe cymoso-paniculatis, circa 7.5 cm. longis, pedunculis circa 4.5 cm. longis, bracteis lanceolatis acuminatis, circa 2.5 mm. longis, margine leviter ciliatis; fructibus oblongo-ellipsoideis subsessilibus vel breviter (ad 1 mm.) pedicellatis, 1 cm. longis, 4–5 mm. crassis, longitudinaliter sulcatis, glabris, calycis lobis lanceolatis circa 1 mm. longis plus minusve persistentibus coronatis; seminibus circa 1 cm. longis, plano-convexis, dorso leviter 4-costato, albumine haud ruminato.

KWANGSI: Chen Pien District, *S. P. Ko 56011* (TYPE), Nov. 5, 1935, on slopes in forested ravines, probably small in size.

A species strongly characterized by its large leaves and its characteristic fruits.

Lasianthus Jack

Lasianthus Tsangii Merrill in herb. sp. nov.

Frutex erectus circa 1 m. altus, ramulis inflorescentiis et foliis subtus villosis, indumento interdum sordide brunneo vel in venulis pallido, ramulis ultimis teretibus 3 mm. diametro; foliis subcoriaceis petiolatis oblongo-lanceolatis, 9–12.5 cm. longis, 3–4.2 cm. latis, acuminatis, basi acutis, supra glabris viridibus subnitidis, subtus paullo pallidioribus praesertim secus costam nervosque molliter villosis, nervis lateralibus utrinsecus 5–7, supra leviter impressis, subtus elevatis, perspicuis, curvato-adscendentibus, venis tertiariis parallelis, supra indistinctis, subtus elevatis; petiolo 8–10 mm. longo dense subadpresse hirsuto; inflorescentiis axillaribus sessilibus paucifloris, bracteis lanceolatis, dense villosis, circa 1 cm. longis; floribus sessilibus; calycis tubo circa 4 mm. longo piloso, lobis 5, anguste lanceolatis acuminatis crasse ciliatis circa 3 mm. longis, persistentibus; fructibus subovoideis glabris circa 4 mm. diametro.

KWANGSI: Shang-sze District, Shih Wan Tai Shan, Na Wai Village, *W. T. Tsang 23940* (TYPE), July 11–30, 1934, a shrub about 1 m. high, fairly common in thickets, fruits blackish blue.

This species is characterized by its prominently nerved leaves, which are glabrous above and prominently villose beneath, with sharply ascending lateral nerves, its axillary, few-flowered inflorescences with elongated, persistent, lanceolate, and densely villose bracts, and its persistent pubescent calyx-lobes. It resembles *L. Koi* Merr. & Chun in vegetative characters, but the leaves of the latter are narrowly caudate-acuminate, while the inflorescences are more crowded, more numerously flowered, and with numerous narrow and villous bracts.

Lasianthus kwangsiensis Merrill in herb. sp. nov.

Frutex erectus, ramis ramulisque pubescentibus, ramulis teretibus junioribus interdum obscure compressis olivaceis 1–2 mm. diametro; foliis chartaceis breviter petiolatis ovatis vel oblongo-ovatis, 6–9.5 cm. longis, 2.5–3.8 cm. latis, caudato-acuminatis, basi acutis, margine leviter revolutis, olivaceis, supra glabris, subtus ad costam nervosque distincte pubescentibus, nervis lateralibus utrinsecus 6 vel 7, utrinque distinctis, curvato-adscendentibus arcuato-anastomosantibus plerumque dense ciliatis, venis tertiariis parallelis supra subconspicuis, subtus distinctis; petiolo 5–7 mm. longo; stipulis dense pilosis caducis; inflorescentiis axillaribus sessilibus multifloris, bracteis minutis deciduis; floribus subsessilibus confertis fasciculatis; calycis tubo 2 mm. longo, extus dense pubescente, lobis 5 linearibus 2 mm. longis; corollae tubo 5–6 mm. longo hirsuto intus superne tomentoso, lobis 5 oblongo-ovatis circa 1.5 mm. longis; staminibus tubo insertis, antheris subexsertis; stylis tubo corollae subaequilongis, stigmatibus ciliatis 5-lobatis.

KWANGSI: Shang-sze District, Shih Wan Tai Shan, Nam She Village, *W. T. Tsang 24679* (TYPE), Nov. 18, 1934, a shrub 3 ft. high, in thickets, fairly common, flowers white, fragrant.

This species is near *Lasianthus Fordii* Hance, but it may be distinguished, among other characters, by its corolla being prominently hirsute.

Paederia Linnaeus

Paederia pertomentosa Merrill in herb. sp. nov.

Suffruticosa vel herbacea scandens, circa 3.5 m. alta, caulibus et ramis et foliis subtus dense breviter tomentosis, caulibus teretibus 2 mm. diametro, indumento sordide substramineo, ramulis circa 1 mm. diametro; foliis chartaceis, ovato-ellipticis vel oblongo-ellipticis, acute acuminatis, basi plerumque rotundatis, haud cordatis, interdum leviter decurrentibus, 6–11 × 2.5–5 cm., supra subolivaceis consperse puberulis ad costam dense puberulis, subtus densissime breviter subalbido-tomentosis, nervis primariis utrinsecus circa 8; petiolo puberulo, 2–5 cm. longo; inflorescentiis axillaribus et terminalibus, 15–30 cm. longis, dense breviter pubescentibus, lateralibus plerumque racemiformibus vel deorsum breviter ramosis, floribus in ramis subglomeratim dispositis, glomerulis inter se 1–3 cm. distantibus plus minusve confertis breviter pedicellatis; floribus rosaceis; calycibus dense tomentosis, dentibus triangularibus, acutis, intus glabris; corollae tubo extus dense puberulo, 5 mm. longo, lobis ovatis acutis, 1–1.2 mm. longis.

SOUTHERN KIANGSI: Hong San, *J. L. Gressitt 1471* (TYPE), June 23, 1936, in thickets, alt. 840 m.; Lung-nan District, Oo Chi Shan, near Lam Uk Village, *S. K. Lau 4733*, Oct. 1–25, 1934, a semi-woody climber, rare on dry steep slopes in forests. KWANGSI: Nam Tan-yuen, *C. Wang 40918*, June 26, 1937, scandent, in forests; Ling-chuan District, Hai-yan-shan, Lian-chai-miao, *W. T. Tsang 27825*, July 13–19, 1937, climber, 3 ft. high, fairly common in thickets on steep slopes.

This is one of the very tomentose forms formerly referred to *Paederia tomentosa* Bl. = *P. scandens* (Lour.) Merr. and to *P. foetida* Linn., but manifestly it is so different from these that there seems to be little justification in extending the limits of either species to take this extreme form. It is allied to *P. Cavaleriei* H. Lév., differing among other characters in the leaves being densely short-white-tomentose beneath.

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STUDIES OF SOUTH AMERICAN PLANTS, X
NOTEWORTHY MYRISTICACEAE AND VACCINIACEAE

A. C. SMITH

THROUGH the kindness of the authorities of the U. S. National Herbarium and the Instituto Botanico of Bogotá, a series of Colombian specimens representing the Myristicaceae and Vacciniaceae has been made available to me for study. Most of these specimens were collected in the Comisaria of Putumayo by J. Cuatrecasas and in the Department of Antioquía by R. D. Metcalf and J. Cuatrecasas. One new species is based upon a collection from Antioquía by Brother Daniel, while an Ecuadorean plant collected by A. Rimbach is also described as new. Eleven new species are here described; of interest is the discovery in Colombia for the first time of the genera *Semiramisia* and *Ceratostema* (sensu vero). In the following pages the place of deposit of specimens is indicated by parenthetical letters as follows: (A), Arnold Arboretum; (Col), Instituto Botanico, Universidad de Colombia, Bogotá; (US), U. S. National Herbarium.

MYRISTICACEAE

Dialyanthera parvifolia Markgraf in Notizbl. Bot. Gart. Berlin **9:** 964. 1926; A. C. Sm. in Brittonia **2:** 417. 1938, **3:** 339. 1939.

COLOMBIA: Putumayo: Selva higrófila del río San Miguel, en el afluente izquierda Quebrada de la Hormiga, alt. 290 m., *Cuatrecasas 11139* (Col, US); Mocoa, bosque higrófilo en la Quebrada del río Mulato, alt. 570–600 m., *Cuatrecasas 11314* (A, Col, US). BOLIVIA: La Paz: Prov. Larecaja, Tuiri, near Mapiri, alt. 490–750 m., *Krukoff 10734* (A, etc.).

In my monograph of 1938 I listed this species only from Peru and adjacent Brazil; the above-cited collections from the Amazonian portions of Colombia and Bolivia demonstrate that the species has a fairly wide range. In 1939 I reported the plant from Venezuela, and another collection from that country (*Williams 10210* [A], from National Park, alt. 850–1100 m.) is now available. *Dialyanthera parvifolia* is therefore now known to have a fairly extensive distribution along the western edge of the Amazon basin from Bolivia to Colombia and continuing northward to Aragua in Venezuela.

Virola peruviana (A. DC.) Warb. in Nova Acta Acad. Leop.-Carol. **68:** 188. 1897; A. C. Sm. in Brittonia **2:** 472. 1938.

COLOMBIA: Putumayo: Selva higrófila del río Putumayo; Puerto Porvenir, arriba de Puerto Ospina, hacia la Loma, alt. 230–250 m., *Cuatrecasas 10746* (Col, US).

The cited collection extends to Colombia the range of *V. peruviana,* previously recorded from Amazonian Peru and Brazil, but only from the southern tributaries of the Amazon. The Cuatrecasas specimen has leaf-blades up to 40 by 12.5 cm. (larger than those previously known), and its tomentum is perhaps somewhat more persistent throughout; nevertheless it agrees with earlier collections of the species in all essential details.

Virola calophylla Warb. in Nova Acta Acad. Leop.-Carol. **68**: 231. 1897; A. C. Sm. in Brittonia **2**: 474. 1938.

Colombia: Putumayo: Selva higrófila del río Putumayo; Puerto Porvenir, arriba de Puerto Ospina, hacia la Loma, alt. 230–250 m., *Cuatrecasas 10653* (Col, US).

The cited specimen is of especial interest as being the first Colombian collection which can be referred to *V. calophylla* without doubt. Otherwise the species has a range in Amazonian Brazil, Venezuela, and Peru. In 1938 I referred to *V. calophylla* the type of *V. incolor* Warb., a sterile juvenile specimen from Villavicencio, and thus the species has already been reported from Colombia, but only inadequately so. The Cuatrecasas collection, being in fruit, permits a correction of my earlier description. The pubescence of the fruit is much coarser than previously indicated, the individual hairs being somewhat more than 1 mm. in length, copiously jointed, and with numerous minute lateral branches, somewhat like the pubescence illustrated for *V. loretensis* A. C. Sm. (Brittonia **2**: *f. 7, g.* 1938). Apparently these hairs are at length deciduous, leaving the fruit closely tomentellous.

VACCINIACEAE

Semiramisia pulcherrima sp. nov.

Frutex ad 50 cm. altus ubique filamentis exceptis glaber, ramulis teretibus gracilibus ut videtur elongatis; petiolis subteretibus rugulosis 3–4 mm. longis; laminis subcoriaceis ovatis, 4.5–6 cm. longis, 2.5–3 cm. latis, basi rotundatis vel late obtusis, apice gradatim acuminatis, margine leviter recurvatis, 3-pli-nerviis, nervis secundariis prope basim orientibus apicem folii versus costa conjunctis, costa et nervis secundariis supra leviter impressis subtus elevatis, nervis marginalibus indistinctis et rete venularum immersis vel subtus paullo prominulis; inflorescentiis apicem ramulorum versus axillaribus racemosis 5–8-floris, basi bracteis paucis ovatis acutis circiter 1.5 mm. longis subtentis, rhachi subtereti 1–1.5 mm. diametro 1–2 cm. longa; floribus alternatis basi bracteatis, bracteis papyraceis elongato-deltoideis 1.5–2 mm. longis acutis parce glanduloso-marginatis; pedicellis teretibus 8–15 mm. longis apicem versus bibracteolatis (bracteolis ut bracteis sed minoribus), basi gracilibus, distaliter in calycem gradatim incrassatis; calyce obconico limbo incluso 10–15 mm. longo et apice ad 15 mm. diametro, limbo papyraceo erecto-patente lobis inclusis 5–6 mm. longo inconspicue nervato, lobis inconspicuis in cuspidem 0.5–0.8 mm. longam apiculatis margine biglandulosis, glandulis linearibus 0.5–2 mm. longis; corolla carnosa campanulato-cylindrica sub anthesi 40–50 mm. longa, basim versus 10–15 mm. ut videtur apice ad 20 mm. diametro, lobis deltoideis acutis 6–10 mm. longis et latis; staminibus corollam fere subaequantibus; filamentis liberis 6–8 mm. longis, 1–1.5 mm. latis, ubique praeter basim pilis circiter 0.2 mm. longis puberulis; thecis crassis circiter 8 mm. longis basi leviter incurvatis; tubulis gracillimis (basi circiter 0.4 mm. apicem versus circiter 0.25 mm. diametro) 25–30 mm. longis, poris terminalibus vel leviter obliquis dehiscentibus; stylo corollam subaequante gracili truncato.

Colombia: Putumayo: Alta cuenca del río Putumayo, filo de la Cordillera entre El Encano y Sibundoy; páramo de San Antonio del Bordoncillo, alt. 3250 m., 4 Enero 1941, *Cuatrecasas 11771* (Col, US no. 1798516, type), frútex de 0.50 m.; corola crasa rosado-anaranjada.

In its distinct and pilose filaments, *S. pulcherrima* resembles *S. Kar-*

steniana Kl., from which it differs in its smaller and fewer-nerved leaf-blades, shorter pedicels, and much larger flowers, especially the larger calyx and broader corolla. From the remaining species of *Semiramisia,* the new species differs in its separate and pilose filaments, as well as in details of foliage, its more complex inflorescence, and the proportions of its calyx and corolla, etc. *Semiramisia pulcherrima* is the first recorded specimen of the genus from Colombia, it having previously been known from the Andes of Venezuela, Ecuador, and Peru.

Ceratostema amplexicaule sp. nov.

Frutex, ramulis gracilibus teretibus molliter et breviter albo-pilosis; foliis sessilibus vel minutissime petiolatis, laminis subcoriaceis ovato-oblongis, 5–7.5 cm. longis, 3–4.5 cm. latis, basi profunde cordatis et amplexicaulibus, apice obtusis, margine leviter recurvatis, utrinque molliter pilosis vel puberulis ut videtur demum glabrescentibus, nervis secundariis utrinsecus circiter 4 basim versus orientibus cum costa supra subimmersis vel prominulis subtus prominentibus, infimis paullo reflexis, summis arcuatis et apicem laminae versus costa obscure conjunctis, rete venularum subimmerso; inflorescentiis racemosis subterminalibus ubique (i.e. rhachi, bracteis bracteolisque, pedicellis, calyce et corolla extus) pilis 0.5–0.8 mm. longis molliter albo-pilosis; rhachi leviter angulata 2.5–4.5 cm. longa 7–13-flora; bracteis sub pedicellis papyraceis deltoideis 2–3 mm. longis et latis acutis intus glabris; pedicellis subteretibus 10–17 mm. longis, cum calyce obscure articulatis, paullo infra medium vel basim versus bibracteolatis, bracteolis suboppositis ut bracteis sed minoribus et obscure pauciglanduloso-marginatis; calycis tubo cupuliformi obscure 10-costato sub anthesi circiter 3 mm. longo et 5 mm. diametro, limbo subpatente lobis inclusis circiter 3 mm. longo intus glabro, lobis 5 deltoideis acutis, circiter 2 mm. longis et 4 mm. latis, secus margines praeter apicem versus glandulis linearibus praeditis, sinibus acutis; corolla crasse carnosa urceolato-cylindrica vel juventute leviter angulata, sub anthesi 25–30 mm. longa et basim versus 6–7 mm. diametro, distaliter gradatim angustata, intus glabra, demum profunde 5-lobata, lobis subulatis ad 15 mm. longis et basi 3 mm. latis, apice subacutis; staminibus corollam subaequantibus vel leviter exsertis, filamentis membranaceis glabris mox liberis ligulatis 6–8 mm. longis, thecis valde granulosis 9–10 mm. longis 1–1.5 mm. crassis, tubulis gracillimis circiter 0.2 mm. diametro 13–14 mm. longis basim versus saepe tuberculato-granulosis, poris ovalibus oblique terminalibus circiter 0.7 mm. longis dehiscentibus; stylo corollam subaequante gracili (circiter 0.5 mm. diametro) truncato.

COLOMBIA: Putumayo: Vertiente oriental de la Cordillera, bosques higrófilos entre Mocoa y Sachamates, alt. 600–700 m., 29 Diciembre 1940, *Cuatrecasas 11407* (Col, US no. 1798507, TYPE), frútex; corola rojo-anaranjada.

In its subsessile leaf-blades, which are deeply cordate and amplexicaul at base, the new species resembles only *C. peruvianum* Gmel., the remaining species of the genus having leaf-blades cuneate to attenuate at base. In their pubescence, *C. amplexicaule* and *C. peruvianum* are essentially similar. However, the new species differs sharply from *C. peruvianum* in its very small calyx-lobes, those of Gmelin's species being 10–15 mm. long and 6–9 mm. broad. In other respects, also, the flowers of *C. peruvianum* are substantially larger than those of the new species, the corolla and stamens being about 40 mm. long. Furthermore, the leaf-blades of the new species are more nearly sessile and more obtuse at apex than those of *C. peruvianum*.

The genus *Ceratostema* Juss. (sensu Sleumer in Notizbl. Bot. Gart. Berlin **12:** 278–282. 1935, et A. C. Sm. in Bull. Torrey Bot. Cl. **63:** 307–308. 1936; non sensu falso A. C. Sm. in Contr. U. S. Nat. Herb. **28:** 335–348. 1932) has previously been known only from Ecuador (this being probably true even for *C. peruvianum*, the genotype). It should be noted that the present species falls into the genus *Englerodoxa* Hoer. as treated by me in 1932 (op. cit. 350–352), a synonym of *Ceratostema* Juss., which is now known to contain six species. The numerous other species which have been referred to *Ceratostema* belong to *Pellegrinia, Demosthenesia, Plutarchia,* etc. (see Sleumer, loc. cit. 1935, and A. C. Sm., loc. cit. 1936).

Psammisia flaviflora sp. nov.

Frutex scandens forsan epiphyticus ubique praeter filamenta glaber, ramulis subteretibus gracilibus (apicem versus 2–3 mm. diametro); petiolis crassis (2–3 mm. diametro) semiteretibus 6–12 mm. longis; laminis chartaceis oblongo-ellipticis, 13–20 cm. longis, 4.5–8 cm. latis, basi acutis et in petiolum decurrentibus, apice abrupte caudato-acuminatis (acumine gracili 1–1.5 cm. longo acuto), margine leviter recurvatis, 5- vel 7-pli-nerviis, nervis infimis e basi orientibus summis costa 1–2 cm. concurrentibus, costa nervisque supra paullo elevatis et saepe insculptis subtus prominentibus, rete venularum copioso utrinque prominulo; inflorescentiis ut videtur apicem ramulorum versus axillaribus subfasciculatis vel obscure breviracemosis, rhachi ad 4 mm. longa plerumque breviore; floribus paucis bracteis papyraceis deltoideis circiter 1.5 $\times$ 1.5 mm. subacutis pauciglanduloso-marginatis subtentis; pedicellis rugulosis crassis (1–2 mm. diametro) subcurvatis 15–20 mm. longis paullo supra basim bibracteolatis, bracteolis oppositis bracteis similibus; calyce coriaceo sub anthesi 8–10 mm. longo, tubo cupuliformi 4–6 mm. longo et circiter 7 mm. diametro, limbo erecto-patente lobis inclusis 3–4 mm. longo, lobis deltoideis acutis 2–3 mm. longis et 3–4 mm. latis, sinibus acutis; corolla carnosa subgloboso-urceolata, sub anthesi 7–8 mm. longa et circiter 6 mm. diametro, basim et apicem versus contracta, lobis 5 deltoideis circiter 1.5 $\times$ 1.5 mm. subacutis; staminibus 10, filamentis liberis submembranaceis ligulatis circiter 3.5 mm. longis margine superne ciliolato-puberulis antheras apice thecarum affixis, connectivis brevibus omnibus bicalcaratis (calcaribus subacutis conspicuis saepe antrorsis), antheris circiter 4 mm. longis, thecis valde granulosis circiter 3 mm. longis et 1.3–1.5 mm. crassis, tubulis distinctis gracillimis brevibus (circiter 1 mm. longis) acutis per rimas ovales dehiscentibus; stylo crasso corollam subaequante truncato.

ECUADOR: Guayas (?): Western Cordillera, valley of Río Chimbo, alt. 800 m., *Rimbach 67* (A, TYPE), shrub, climbing high among forest trees; peduncle and calyx-tube bright red, the calyx-lobes greenish, the corolla and lobes yellow.

The closest relative of this very distinct new species is the recently described *P. occidentalis* A. C. Sm. (in Am. Jour. Bot. **27:** 542. 1940), from western Colombia. However, *P. flaviflora* has leaf-blades with the secondary nerves oriented nearer the base and more prominent on the upper surface, while its inflorescence has fewer flowers and a shorter rachis. The flowers of the new species have longer pedicels and are substantially larger throughout, the calyx-lobes being entirely different in shape. Other small-flowered species of *Psammisia* with subfasciculate inflorescences — *P. Pennellii* A. C. Sm. and *P. caudatula* Sleumer — have quite distinct foliage as well as minor differences in floral proportions.

Psammisia ferruginea A. C. Sm. in Contr. U. S. Nat. Herb. **28:** 391. *pl. 10.* 1932.

COLOMBIA: Putumayo: Vertiente oriental de la Cordillera, entre Sachamates y San Francisco de Sibundoy, Quebrada de Susunga, alt. 1600–1800 m., *Cuatrecasas 11447* (Col, US), arbusto de ramas scandens; pedúnculos y cáliz rosado-cárdenos; corola rosada.

This very distinct species has previously been known only from the Departments of El Cauca and Nariño, and therefore the new record is of unusual interest; the type is a Lobb specimen of uncertain origin, but probably from the Pacific slope of Colombia.

Psammisia columbiensis Hoer. in Bot. Jahrb. **42:** 303. 1909; A. C. Sm. in Contr. U. S. Nat. Herb. **28:** 398. 1932.

COLOMBIA: Putumayo: Vertiente oriental de la Cordillera, entre Sachamates y San Francisco de Sibundoy, Quebrada de Susunga, alt. 1600–1800 m., *Cuatrecasas 11446* (A, Col), arbustito de ramas péndulas; pedúnculos, cálices y corolas rojos, ápice blanco.

This species has previously been recorded only from the type, collected by Lehmann in the "Central Andes of Popayán," Dept. El Cauca, alt. 2500–2800 m. The present collection agrees with the type in all essential characters, including the connate filaments, but has its leaf-blades slightly broader, 2.5–4.8 cm. broad.

Psammisia Cuatrecasasii sp. nov.

Frutex ramosus ubique praeter filamenta bracteas bracteolasque glaber, ramulis crassis (apicem versus circiter 8 mm. diametro) subteretibus; petiolis crassis (4–5 mm. diametro) circiter 2 cm. longis; laminis coriaceis siccitate olivaceis late ovato-oblongis, 22–27 cm. longis, 12–14 cm. latis, basi rotundatis vel obtusis et in petiolum paullo decurrentibus, apice ut videtur obtuse cuspidatis, margine anguste recurvatis, 7–9-pli-nerviis, nervis infimis e basi orientibus summis costa ad 5 cm. concurrentibus, costa nervisque supra subplanis subtus valde prominentibus, rete venularum subimmerso subtus leviter prominulo; inflorescentiis axillaribus racemosis 6–9-floris, rhachi crassa subtereti circiter 4 cm. longa, pedicellis sub anthesi 25–30 mm. longis, bracteis subcoriaceis oblongis circiter 6 mm. longis et 3 mm. latis apice rotundatis margine obscure ciliolato-puberulis subtentis, paullo supra medium bibracteolatis, bracteolis suboppositis papyraceis deltoideo-oblongis circiter 3 × 2 mm. acutis margine ciliolato-puberulis et pauciglandulosis; calyce coriaceo late cupuliformi, tubo circiter 2 mm. longo et 5 mm. diametro, limbo patente lobis inclusis 3–4 mm. longo, lobis 5 late ovatis, 2–3 mm. longis, 5–6 mm. latis, apice apiculatis, margine praeter apicem versus glanduloso-incrassatis; corolla carnosa cylindrico-urceolata sub anthesi 21–27 mm. longa, basim versus circiter 7 mm. diametro, supra ad 4 mm. angustata, lobis 5 incrassatis deltoideis subacutis circiter 3 × 3 mm.; staminibus 10, filamentis liberis subcarnosis ligulatis 6–7 mm. longis margine superne puberulis, connectivis superne alternatim conspicue bicalcaratis (calcaribus 0.7–1 mm. longis acutis antrorsis), thecis valde granulosis 8–9 mm. longis basi inconspicue tuberculatis, tubulis leviter cohaerentibus circiter 4 mm. longis per rimas ovales 2–3 mm. longas dehiscentibus; stylo filiformi sub anthesi conspicue exserto 25–30 mm. longo truncato.

COLOMBIA: Putumayo: Alta cuenca del río Putumayo en el Valle de Sibundoy extremo E., junto a San Francisco, alt. 2200 m., 1 Enero 1941, *Cuatrecasas 11562* (Col, TYPE), arbusto ramoso; péduneulo, cáliz y corola carmín, extremo blanco.

Psammisia Cuatrecasasii is at once distinguished by its large and proportionately broad 7–9-pli-nerved leaf-blades. In foliage it most suggests *P. Ulbrichiana* Hoer., but it has even broader leaves, larger bracts, and larger and much more conspicuously spurred stamens. Perhaps a closer relative of the new species is *P. falcata* (H. B. K.) Kl., a species with leaf-blades only 3.5–7 cm. broad and 5–7-pli-nerved, usually longer inflorescences, and smaller bracts.

Psammisia aestuans sp. nov.

Frutex (?) ubique praeter filamenta glaber, ramulis gracilibus (apicem versus 1 mm. vel minus diametro) subteretibus; petiolis gracilibus leviter canaliculatis 2–5 mm. longis; laminis subcoriaceis in sicco olivaceis vel saepe metallicis ovatis, 3–5 cm. longis, 1.2–2.2 cm. latis, basi rotundatis vel late obtusis, apice acumine gracili attenuato 1–2 cm. longo conspicue praeditis, margine anguste recurvatis, 3- vel 5-pli-nerviis (nervis exterioribus inconspicuis), nervis interioribus e costa ad 5 mm. supra basim orientibus, costa supra leviter impressa subtus cum nervis elevatis, nervis supra saepe prominulis, venulis immersis; inflorescentiis axillaribus breviter racemosis paucifloris (sub anthesi saepe unifloris), rhachi gracili 2–7 mm. longa basim versus minute bracteata, floribus bracteis papyraceis deltoideis acutis circiter 1 mm. longis et latis subtentis; pedicellis subteretibus rugulosis crassis (1.5–2 mm. diametro) circiter 12 mm. longis basim versus minute bibracteolatis, bracteolis suboppositis bracteis similibus; calyce minute ruguloso 7–8 mm. longo et summo diametro, tubo cupuliformi 4–5 mm. longo et diametro, limbo papyraceo erecto-patente lobis minute apiculatis inclusis 3–4 mm. longo, sinibus complanatis; corolla carnosa cylindrico-urceolata sub anthesi 15–17 mm. longa, basim versus 5–7 mm. diametro distaliter gradatim angustata, lobis 5 elongato-deltoideis acutis circiter 2×1.5 mm.; staminibus 10 corollam fere aequantibus, filamentis submembranaceis liberis ligulatis circiter 2 mm. longis et 1–1.5 mm. latis margine superne minute ciliolatis, connectivis angustis omnibus superne bicalcaratis (calcaribus acutis vel subacutis alternatim conspicuioribus), antheris circiter 13 mm. longis, thecis valde granulosis 5.5–6 mm. longis crassis (circiter 1.5 mm. diametro) basi incurvatis, tubulis liberis gracilibus 7–7.5 mm. longis per rimas ovales 0.7–1 mm. longas dehiscentibus; stylo filiformi corollam subaequante truncato; fructibus immaturis coriaceis subglobosis 7–8 mm. diametro, calycis limbo persistente coronatis.

COLOMBIA: Antioquía: La Ceja, Diciembre 1939, *Hermano Daniel 2178* (US no. 1778630, TYPE), corola en el base roja, en el ápice verde.

Psammisia aestuans is so distinct from the other species of *Psammisia* that one places it here with hesitation; yet, on the basis of floral characters, there can be no doubt of its place in the genus. The small, long-acuminate, few-nerved leaves suggest those of no other species of *Psammisia*, but the flowers are typical for the genus, although the inconspicuous calyx-lobes and the long anther-tubules are unusual.

Plutarchia angulata sp. nov.

Frutex, ramulis subteretibus apicem versus pilis 0.4–0.7 mm. longis dense cinereo-pilosis demum glabrescentibus; petiolis 1–3 mm. longis incrassatis (1.5–2 mm. diametro) ut ramulis pilosis; laminis subcoriaceis in sicco fusco-olivaceis late ovatis, 2.3–3.5 cm. longis, 2.2–4 cm. latis, basi leviter cordatis, apice obtusis vel subrotundatis, margine anguste recurvatis, supra minute puberulis mox glabris, subtus praecipue costa ut petiolis hispidulo-pilosis demum glabrescentibus, 7- vel 9-pli-nerviis, costa supra leviter impressa subtus elevata, nervis secundariis basim versus orientibus curvatis supra subimmersis subtus prominulis, venulis obscuris vel subtus paullo prominulis; inflorescentiis apicem ramulorum versus axillaribus vel subterminalibus 2–5-floris breviter racemosis, basi bracteis paucis papyraceis ovatis acutis pilosis 2–3 mm. longis circumdatis, rhachi subtereti rugulosa 5–25 mm. longa ut ramulis dense pilosa vel puberula; floribus bracteis papyraceis anguste oblongis acuminatis 3–4 mm. longis extus puberulis subtentis; pedicellis subteretibus dense pilosis 8–20 mm. longis basim versus bibracteolatis, bracteolis suboppositis bracteis similibus sed minoribus mox caducis; calyce cum pedicello articulato 12–15 mm. longo extus pilis albidis mollibus circiter 0.3 mm. longis dense piloso demum subglabrescente, tubo 4–6 mm. longo basi rotundato alis 4 conspicuis 2–3 mm. latis sinibus oppositis ornato, limbo 8–9 mm. longo erecto intus glabro fere ad basim 4-lobato, lobis subcoriaceis elongato-deltoideis basi 5–8 mm. latis forsan accrescentibus ad apicem acutum gradatim angustatis, sinibus acutis; corolla tenuiter carnosa tubulosa 4-angulata, sub anthesi 17–21 mm. longa et 5–6 mm. diametro, extus pilis 0.5–1 mm. longis densissime villoso-velutina, intus glabra, lobis 4 oblongo-deltoideis subacutis circiter 2 × 2 mm.; staminibus 8 similibus quam corolla paullo brevioribus, filamentis liberis carnosis glabris ligulatis 2–3 mm. longis, antheris 12–17 mm. longis, thecis minute granulosis 4–7 mm. longis et circiter 1 mm. diametro, tubulis latis flexilibus plerumque quam thecis circiter duplo longioribus per rimas elongatas dehiscentibus; disco inconspicuo glabro; stylo filiformi corollam subaequante, stigmate truncato vel minute subpeltato.

COLOMBIA: Putumayo: Alta cuenca del río Putumayo, filo de la Cordillera entre El Encano y Sibundoy; páramo de San Antonio del Bordoncillo, alt. 3250 m., 4 Enero 1941, *Cuatrecasas 11733* (Col, US no. 1798515, TYPE), frútex; cáliz y corola rosados.

Although *P. angulata* does not bear a close superficial resemblance to the other species of *Plutarchia*, its staminal characters indicate that it can belong to no other genus. It differs from the other species of the genus in its 4-merous flowers, its winged calyx-tube, and its angled densely pubescent corolla, while its proportionately broad cordate subsessile leaf-blades, which are soft-pilose beneath, are also characteristic. *Plutarchia pubiflora* (Wedd.) A. C. Sm. is perhaps the closest ally of *P. angulata*, but there are numerous obvious differences between the two species.

Cavendishia Cuatrecasasii A. C. Sm. in Rev. Acad. Colomb. Ci. Ex. Fís.-Quím. Nat. **5:** 38. 1942.

Since the publication of this well-marked species, two additional collections have come to my attention:

COLOMBIA: Putumayo: Vertiente oriental de la Cordillera, entre Sachamates y San Francisco de Sibundoy, alt. 1600–1750 m., *Cuatrecasas 11464* (A, Col, US), arbusto de ramas divaricadas; brácteas y flores rosado cárdenas; Huila-Caquetá: Cordillera Oriental sobre el filo divisorio, en Gabinete, alt. 2300–2450 m., *Cuatrecasas 8479* (Col, US), gran frútex; brácteas rosadas; cáliz muy largo, rosado; corola, base y ápice blanco rosado, tercio superior roja.

These specimens make desirable a slight amplification of the original description, as follows: petioles up to 15 mm. long; leaf-blades up to 18 cm. long and 9 cm. broad; corolla often only 22 mm. long, the stamens proportionately shorter than those originally described. These slight variations are no more than individual.

Cavendishia speciosa sp. nov.

Frutex ad 5 m. altus ubique praeter filamenta glaber, ramulis teretibus gracilibus (apicem versus 2–3 mm. diametro); petiolis subteretibus rugosis incrassatis (2–3 mm. diametro) 5–8 mm. longis; laminis coriaceis in sicco fuscis anguste oblongis, 8–14 cm. longis, 2–3.6 cm. latis, basi obtusis, apice caudato-acuminatis (acumine gracili 10–15 mm. longo), margine anguste et basim versus conspicue revolutis, 3-pli-nerviis, nervis paullo supra basim orientibus adscendentibus costa apicem versus inconspicue conjunctis, costa nervisque supra impressis subtus valde elevatis, nervis marginalibus interdum visis sed immersis, rete venularum immerso; inflorescentia axillari vel subterminali multiflora, rhachi crassa (4–6 mm. diametro) basi florum 30–40 incrassata; bracteis sub floribus membranaceis copiose reticulato-venosis obovato-oblongis, 30–40 mm. longis, 18–30 mm. latis, apice rotundatis vel conspicue bilobatis, dorso glandulas minutas subglobosas sessiles saepe copiose gerentibus; pedicellis teretibus crassis 6–7 mm. longis ut videtur ebracteolatis (bracteolis non visis forsan mox caducis); calyce 11–12 mm. longo, tubo breviter cylindrico 3–4 mm. longo et circiter 4.5 mm. diametro, limbo submembranaceo erecto lobis inclusis 7–8 mm. longo, lobis deltoideis acutis circiter 2 mm. longis et 3.5 mm. latis glandulas plures albas sessiles margine gerentibus, sinibus rotundatis; corolla tenuiter carnosa cylindrica, sub anthesi circiter 30 mm. longa et basim versus 5–6 mm. diametro, distaliter angustata, lobis 5 oblongis subacutis circiter 2×1.5 mm.; staminibus quam corolla multo brevioribus, filamentis ligulatis alternatim circiter 4 mm. et 7–8 mm. longis superne angustatis intus et margine distaliter pilosis, antheris alternatim circiter 11 mm. et 10 mm. longis, thecis 4–5 mm. longis, tubulis quam thecis paullo longioribus per rimas elongatas ovales dehiscentibus; stylo filiformi corollam subaequante, stigmate minute peltato.

COLOMBIA: Antioquía: Between Valdivia and Yarumal, alt. 2000 m., moist canyon, Feb. 20, 1942, *Metcalf & Cuatrecasas 30101* (A, TYPE, US), shrub 4–5 m. high; bracts vivid red, with brown glands; calyx white; corolla white and rose.

This beautiful and spectacular species is one of the most distinct in *Cavendishia*, being characterized by its thick 3-nerved leaf-blades, its membranaceous reticulate-veined bracts, its elongate glandular-margined calyx-limb, and its large showy corollas. Its closest relative is doubtless *C. Kalbreyeri* Mansf., also from Antioquía, from which it differs in its more elongate inflorescence with more numerous flowers, its larger and thinner bracts, its calyx with glandular rather than thick-margined lobes, its larger corollas, and its shorter and differently proportioned anthers, those of *C. Kalbreyeri* having tubules much longer than the thecae.

Cavendishia rosea sp. nov.

Frutex ad 5 m. altus ubique praeter filamenta glaber, ramulis subteretibus apicem versus 3–4 mm. diametro; petiolis inconspicuis incrassatis 2–5 mm. longis; laminis subcoriaceis siccitate olivaceis ovato-oblongis, 6–9 cm. longis, 2.5–4.3 cm. latis, basi conspicue cordatis, apice obtuse cuspidatis, margine leviter recurvatis, 5–7-pli-nerviis, nervis infimis patentibus debilibus, nervis superioribus costa ad 2 cm. concurrentibus vel e basi orientibus, costa nervisque supra prominulis vel subplanis subtus prominentibus, rete venularum utrinque paullo prominulo, venulis brevibus e costa saepe patentibus; inflorescentia apicem ramulorum versus axillari racemosa 20–30-flora, rhachi angulata 1.5–2.5 mm. diametro 8–9 cm. longa basi pedicellorum incrassata; floribus bracteis papyraceis oblongis 25–32 mm. longis et 8–12 mm. latis acutis conspicue punctatis subtentis; pedicellis teretibus 10–14 mm. longis basim versus decidue bibracteolatis, bracteolis papyraceis elliptico-oblongis, 4–6.5 mm. longis, 2–3 mm. latis, apice rotundatis et minute apiculatis; calyce breviter cylindrico leviter 5-angulato sub anthesi circiter 5 mm. longo, tubo 4–5 mm. diametro, limbo erecto papyraceo lobis inclusis 2–3 mm. longo, lobis saepe incurvatis late deltoideis subacutis circiter 1 mm. longis et 2.5 mm. latis, sinibus rotundatis; corolla subcarnosa cylindrica, sub anthesi 16–17 mm. longa et 4–5 mm. diametro, apice paullo angustata, lobis deltoideis subacutis circiter 0.7 $\times$ 1.5 mm.; staminibus corollam fere aequantibus alternatim leviter inaequalibus, filamentis submembranaceis ligulatis intus parce puberulis alternatim 2–2.5 mm. et 5–6 mm. longis, antheris alternatim 11–12 mm. et 10–11 mm. longis, thecis 3–4 mm. longis, tubulis quam thecis plus minusve duplo longioribus per rimas elongatas dehiscentibus; stylo filiformi corollam subaequante, stigmate minute subpeltato.

COLOMBIA: Antioquía: Between Valdivia and Yarumal, alt. 2200 m., shaded hillside, Feb. 20, 1942, *Metcalf & Cuatrecasas 30123* (A, TYPE, US), shrub 4–5 m. high; stems red-streaked; leaves green with red margins and reddish tinge above; bracts red; corolla rose-red; maturing calyx greenish yellow.

The new species is related only to *C. subamplexicaulis* A. C. Sm., also from northwestern Colombia, with which it has in common an elongate inflorescence and cordate-based leaf-blades. However, *C. rosea* differs from its ally in its proportionately narrower leaf-blades, which are less obviously clasping at base, have fewer and more prominent secondary nerves, and are cuspidate rather than obtuse at apex. The rachis of the new species is more slender, and the bracts and corollas are slightly larger; the anther-proportions are different from those of *C. subamplexicaulis,* in which the thecae and tubules are nearly equal in length. These two closely related species appear to have no other immediate allies.

Cavendishia Dugandiana sp. nov.

Frutex ad 6 m. altus, ramulis fusco-cinereis apicem versus gracilibus et cinereo-puberulis; petiolis subteretibus puberulis 2–4 mm. longis; laminis parvis coriaceis in sicco olivaceis anguste oblongis, 2–4 cm. longis, 0.8–1.4 cm. latis, basi rotundatis vel obscure subcordatis, apice obtusis et saepe minute mucronulatis, margine subplanis, supra inconspicue scabridis et parce brunneo-glandulosis, subtus pilos minutos brunneos dispersos gerentibus et interdum secus nervos basim versus puberulis, 3- vel obscure 5-plinerviis, nervis secundariis prope basim orientibus et costa supra leviter impressis subtus elevatis, rete venularum immerso; inflorescentia apicem ramulorum versus axillari breviter racemosa 2–4-flora, basi bracteis pluribus imbricatis submembranaceis extus glanduloso-pilosis (pilis brunneis vel albis circiter 0.2 mm. longis) glabrescentibus instructa, bracteis interioribus maximis oblongis ad 2 cm. longis et 0.8 cm. latis apice rotundatis vel leviter emarginatis; rhachi glabra leviter angulata sub anthesi ad 8 mm. longa, floribus bracteis eis basi rhachis similibus subtentis; pedicellis puberulis et parce albo-glandulosis, 2–3.5 mm. longis, basim versus uni- vel bibracteolatis, bracteolis linearibus circiter 3 mm. longis et 0.4 mm. latis conspicue albo-glanduloso-marginatis; floribus extus albo-puberulis; calyce 5–6 mm. longo, tubo cupuliformi sub anthesi circiter 3 $\times$ 3 mm., limbo suberecto intus glabro lobis inclusis 2–3 mm. longo, lobis 5 deltoideis acutis, 1–1.5 mm. longis, circiter 2 mm. latis, margine glandulas albas lineares patenter gerentibus, sinibus rotundatis; corolla tenuiter carnosa intus glabra cylindrica, sub anthesi 10–12 mm. longa et 4–5 mm. lata, apice paullo contracta, lobis deltoideis acutis circiter 1 $\times$ 1.5 mm.; staminibus 10 quam corolla paullo brevioribus, filamentis membranaceis alternatim circiter 1.5 mm. et 4 mm. longis margine puberulo-ciliolatis apice angustatis, antheris alternatim circiter 9 mm. et 8 mm. longis, tubulis quam thecis paullo longioribus per rimas elongatas dehiscentibus; stylo filiformi corollam subaequante subtruncato.

COLOMBIA: Antioquía: Between Yarumal and Medellín, alt. 2700 m., near stream-bed on páramo, Feb. 20, 1942, *Metcalf & Cuatrecasas 30159* (A, TYPE, US), shrub 4–6 m. high; bracts light rose-colored; calyx green, with silvery hairs; corolla red, green-tipped.

Cavendishia Dugandiana is characterized by its small leaves, pilose flowers, and linear glandular-margined bracteoles. Its closest relatives appear to be *C. Killipii* A. C. Sm. and *C. scabriuscula* (H. B. K.) Hoer., from both of which it is distinguished by its smaller and fewer-nerved leaf-blades, fewer-flowered inflorescences, shorter pedicels, smaller flowers, calyx-lobes with linear glands, etc.

It is a pleasure to dedicate this species to Dr. Armando Dugand G., Director of the Instituto Botanico, Universidad Nacional de Colombia, in recognition of his valuable work on the flora of Colombia.

Satyria arborea sp. nov.

Arbor ad 12 m. alta ubique praeter inflorescentiam glabra, ramulis crassis subteretibus cinereis; petiolis rugosis valde incrassatis (2.5–3 mm. diametro) 3–5 mm. longis; laminis coriaceis elliptico-oblongis, 11–12 cm. longis, 3.3–4 cm. latis, basi gradatim acutis, apice obtusis, margine valde recurvatis, 5-pli-nerviis, nervis interioribus e costa 2.5–4 cm. supra basim orientibus, nervis omnibus adscendentibus cum costa supra valde impressis (costa basim versus elevata) subtus prominentibus, rete venularum immerso; inflorescentiis cum floribus ubique molliter albo-pilosis vel puberulis (pilis 0.1–0.25 mm. longis), copiosis, in axillis foliorum mox delapsorum dispositis, racemosis, 10–25-floris; rhachi leviter angulata gracili 5–20 mm. longa basim versus interdum ramosa, basi bracteis pluribus imbricatis papyraceis ovatis acutis pauciglanduloso-marginatis 1–2 mm. longis et latis ornata; floribus bracteis oblongis acuminatis circiter 1.5 × 0.7 mm. subtentis; pedicellis gracilibus sub anthesi 13–18 mm. longis basim versus bibracteolatis; calycis tubo cupuliformi 1.5–2 mm. longo et circiter 3 mm. diametro, limbo papyraceo intus glabro subpatente lobis inclusis 1–1.5 mm. longo, lobis 5 inconspicuis apiculatis, sinibus complanatis; corolla tenuiter carnosa intus glabra cylindrico-urceolata, sub anthesi 8–11 mm. longa et basim versus 2–3 mm. diametro, lobis 5 deltoideis subacutis circiter 0.5 × 1 mm.; staminibus quam corolla multo brevioribus, filamentis glabris in tubo membranaceo 2.5–3 mm. longo connatis, antheris alternatim circiter 3 mm. et 3.5–4 mm. longis, tubulis thecas subaequantibus per rimas latas ovales dehiscentibus; stylo filiformi corollam subaequante, stigmate minute peltato.

COLOMBIA: Antioquía: Between Valdivia and Yarumal, alt. 2200 m., along roadside in partial shade, Feb. 20, 1942, *Metcalf & Cuatrecasas 30131* (A, TYPE, US), tree 10–12 m. high; calyx and corolla rose-colored, finely white-pilose, the corolla white distally.

Satyria arborea is apparently most closely allied to the recently described *S. Allenii* A. C. Sm. from Panama (in Ann. Mo. Bot. Gard. **28**: 451. 1941), from which it differs in its arborescent rather than epiphytic habit, shorter petioles, slightly larger leaf-blades with more highly connate secondary nerves, longer and more copiously flowered inflorescences, longer pedicels, and longer anthers (these being about twice as long in *S. arborea* than in *S. Allenii*). Another relative of the new species is *S. breviflora* Hoer., but the two plants differ in many details of foliage and inflorescence; the flowers of *S. breviflora* are larger throughout and are glabrous, at least at anthesis, while those of *S. arborea* are persistently puberulent.

Themistoclesia epiphytica sp. nov.

Frutex epiphyticus scandens vel dependens, ramulis gracilibus subteretibus juventute copiose brunneo-hispidis demum glabrescentibus; petiolis subteretibus 1–3 mm. longis ut ramulis hispidis glabrescentibus; laminis primo papyraceis demum coriaceis ovatis, 17–28 mm. longis, 8–14 mm. latis, basi obtusis vel subrotundatis, apice acumine gracili subulato 3–7 mm. longo terminatis, margine anguste recurvatis vel subrevolutis, juventute utrinque parce hispidulis mox glabrescentibus, inconspicue 3- vel 5-plinerviis, costa supra impressa subtus valde elevata, nervis secundariis basim versus orientibus obscuris subtus leviter prominulis vel immersis, rete venularum immerso; inflorescentia axillari vel e ramulis defoliatis oriente breviter racemosa 4–7-flora (floribus raro ad 1 reductis), rhachi pedicellisque plus minusve hispidulis; rhachi gracili plerumque 3–5 mm. longa, basi bracteis pluribus papyraceis oblongis acutis circiter 2 mm. longis circumdata; floribus bracteis anguste oblongis circiter 1.5 mm. longis apice hispidulis subtentis; pedicellis gracilibus 6–13 mm. longis medium versus bibracteolatis, bracteolis ut bracteis sed minoribus margine hispidulis; calyce 5–6 mm. longo extus pilis 0.15–1 mm. longis plus minusve dense hispidulo etiam interdum sparse brunneo-glanduloso, tubo obconico leviter 5-angulato 3.5–4.5 mm. longo 2.5–3 mm. diametro, limbo papyraceo erectopatente lobis inclusis circiter 1.5 mm. longo, lobis 5 apiculatis 0.3–0.7 mm. longis, sinibus complanatis; disco pulvinato minute vel conspicue hispido (pilis ad 0.5 mm. longis); corolla tenuiter carnosa praeter lobos parce hispidulos glabra, 9–10 mm. longa, 4–5 mm. diametro, lobis 5 deltoideis subacutis circiter 1 × 1.5 mm.; staminibus quam corolla paullo brevioribus, filamentis glabris membranaceis filiformi-ligulatis alternatim circiter 3 mm. et 4 mm. longis, antheris 5–5.5 mm. longis, thecis 1.5–2 mm. longis, tubulis quam thecis fere duplo longioribus per rimas ovales 0.7–1 mm. longas dehiscentibus; stylo filiformi corollam subaequante truncato.

COLOMBIA: Nariño: Páramo del Tábano, alto de la Cordillera, entre Pasto y El Encano, vertiente occidental, alt. 3200 m., 11 Enero 1941, *Cuatrecasas 11899* (A, TYPE, Col), frútex epifito, ramoso péndulo; corola vermellón; Putumayo: Alta cuenca del río Putumayo, filo de la Cordillera entre El Encano y Sibundoy; páramo de San Antonio del Bordoncillo, alt. 3250 m., *Cuatrecasas 11725* (Col, US), frútex epifito scandens; corola vermellón.

The genus *Themistoclesia,* which in 1932 (in Contr. U. S. Nat. Herb. **28:** 439–444) I supposed to consist of only six species, has since been greatly expanded; in the most recent treatment (Sleumer in Bot. Jahrb. **71:** 389–393. 1941) 17 species are recognized. *Themistoclesia epiphytica* is characterized by its epiphytic habit, proportionately long calyx-tube, and long filaments. It is probably most closely related to *T. Pennellii* (A. C. Sm.) Sleumer, from which it differs in its larger and acuminate leaf-blades, longer pedicels, slightly larger calyx and corolla, unequal filaments, and somewhat smaller and differently proportioned anthers. *Themistoclesia peruviana* A. C. Sm., another ally of the new species, differs in its more persistently hispid habit, short pedicels, short filaments, differently proportioned anthers, etc.

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THE COMPARATIVE MORPHOLOGY OF THE WINTERACEAE II. CARPELS

I. W. BAILEY AND CHARLOTTE G. NAST

With six plates

INTRODUCTION

IN a previous paper, Bailey and Smith (1) called attention to the remarkable stamens and carpel of *Degeneria,* suggesting that they might prove to be of considerable significance in interpreting the floral morphology of the Ranales. In this genus of the monotypic family Degeneriaceae, both the stamens and the carpel appear to be primitive, palmately 3-veined sporophylls of but slightly modified form. The lamina of the megasporophyll is adaxially folded or conduplicate and bears numerous ovules on its morphological upper surface. In other words, the ovules are not attached to the margins of a classical, involute, sealed sporophyll, but to the ventral surface of the megasporophyll as in certain of the Pteridospermae.

Carpels of a fundamentally similar type occur in the *Tasmannia* section of *Drimys* and in certan species of *Bubbia.* Other representatives of the Winteraceae exhibit various trends of specialization in the modification of these primitive ranalian megasporophylls. The numerous species of the six genera of the family provide abundant material for comparative studies and demonstrate that the salient trends of specialization in the megasporophylls of the Winteraceae are unlike those which characterize the Magnoliaceae and the Himantandraceae (Bailey, Nast, and Smith, 2).

MATERIAL AND METHODS

The herbarium specimens upon which our floral studies are based have been listed in Dr. Smith's papers (3, 4, 5) and need not be relisted here. The vascularization of carpels and other floral organs is commonly reconstructed by the laborious study of serial sections. We have found, however, that such investigations may be facilitated and much accelerated by carefully controlled clearing of flowers or parts of flowers. In the case of material from herbarium specimens, the following procedure is helpful and widely applicable to both flowers and leaves. The dry flowers or leaves are first heated in water until thoroughly saturated and freed of air. They are then transferred to a dilute aqueous solution of NaOH and placed in sealed bottles in an incubator at 55° C. until cleared to the desired degree. They are next washed free of NaOH and transferred to vials of 95% alcohol for visual study. Permanent mounts can be made by passing the material through absolute alcohol, diaphane solvent to diaphane or through absolute alcohol, toluene to clarite. The clarity of the vascularization depends upon the refractive index of the medium and the consistency of the tissues.

Commonly the venation shows best in alcohol, and the unmounted specimens may be turned for examination at all angles. Staining of the material is unnecessary either for visual examination or for photomicrography. The method is adequate except in cases where organs are excessively hairy or where they contain numerous clusters of sclereids, as in the floral parts of certain species of *Bubbia, Exospermum,* and *Zygogynum*. In dealing with such material, one is forced to rely largely upon serial sections.

CARPELS OF THE TASMANNIA SECTION OF DRIMYS

There is a conspicuous tendency in many ranalian families for the leaves to be adaxially folded or conduplicate during the earlier stages of their ontogenetic development. In such species of the *Tasmannia* section of *Drimys* as *D. piperita* Hook. f., the carpels resemble in external form these conduplicate young leaves. There is a similar differentiation of the megasporophylls into stipe (petiole), *Fig. 1,* and conduplicate lamina, compare *Figs. 1* and *12*. The more or less closely approximated ventral surfaces[1] of the conduplicate megasporophyll frequently are not extensively and firmly concrescent prior to and during anthesis. Thus, the conduplicate lamina may be spread open without serious or extensive rupture and distortion of the carpel or of its constituent tissues, *Fig. 17*.

The carpels are vascularized by three veins, a median vein and two lateral veins. The median vein frequently bifurcates and has numerous conspicuous branches of considerable length, *Fig. 17*. The two lateral veins commonly have short branches that are directed both outward toward the margins of the megasporophyll and inward toward the branches of the median vein, *Figs. 1* and *3* and left half of *Fig. 17*. In certain cases, the lateral veins have extensive branches that run parallel to them, right half of *Fig. 17*. The ovules are remote from the margins of the megasporophyll and are invariably attached between the median and the lateral veins, i.e. in the parts of the carpel where the branches of the median and lateral vascular systems tend to overlap and anastomose. The ovules are vascularized in part by extensions of the veinlets of the lateral systems (*a* in *Figs. 17* and *18*), in part by extensions of the veinlets of the median system (*b* in *Figs. 17* and *18*), and in part by strands arising from anastomosed

[1]In order to avoid confusion in morphological descriptions, it is essential to recognize that the terms ventral and dorsal are used in two distinct ways, (1) in referring to the upper and lower *surfaces* of flat, cladified appendages, and (2) in designating *parts* or sides of folded megasporophylls, viz. carpels. There are ontogenetic and phylogenetic implications in both usages.

We shall refer to the upper or morphologically adaxial surface of leaves and sporophylls as ventral, to the lower or morphologically abaxial surface as dorsal. In conduplicate ranalian carpels, the exposed outer surfaces are, therefore, dorsal and the internal ones ventral.

In dealing with conduplicate ranalian carpels, we shall refer to the primitively abaxial part of the sporophyll (the part vascularized by the median vein) as dorsal, to the primitively adaxial parts (those vascularized by the lateral veins) as ventral. In unmodified conduplicate carpels, the ventral parts are adaxially oriented, *Fig. 1,* whereas in certain specialized forms, *Figs. 20–23,* their actual orientation may be in part terminal or even abaxial.

branches of the median and lateral systems (*c* in *Figs. 17* and *18*). The details of the vascularization, both of the carpels and of the ovules, fluctuate considerably from carpel to carpel of the same species and of the same flower. Thus, the ovules may be vascularized at times largely by the median system, by the lateral systems, or by varying combinations of these systems.

As shown in *Fig. 12,* the free margins of the conduplicate megasporophylls are provided with conspicuous, glandular-appearing, papillate cells or hairs, which extend backward from the margins for varying distances over the exposed dorsal surfaces of the conduplicate megasporophylls. That the papillae are glandular and function as a stigmatic surface is demonstrated by adhering pollen at anthesis, *Fig. 2,* and by pollen-tubes which penetrate the mat of papillae. Thus, the carpels are provided with extensive stigmatic crests (actually double), which extend from the region of the stipe along the conduplicate adaxial parts of the sporophyll and slightly overtop its apex, *Figs. 1* and *2*.

The fertile carpels have a fundamentally similar conduplicate form, placentation, and vascularization throughout the 15 species of the *Tasmannia* section of *Drimys* that we have studied. There are variations in the length of the stipe, in the size and form of the conduplicate lamina, in the extension of the outer stigmatic surfaces, in the concrescence of the approximated ventral surfaces, in the number and form of the ovules, and in the details of the vascularization, but only in two of the investigated species are the deviations of considerable magnitude. The carpels of *D. stipitata* Vickery are characterized by their excessively elongated stipe; those of *D. lanceolata* (Poir.) Baill. by their unusually fleshy conduplicate lamina of nearly globular form, *Fig. 27*.

The sterile megasporophylls of staminate flowers usually are smaller, but they have a similar conduplicate, palmately 3-veined lamina, *Fig. 2*. Although no ovules are formed, the stigmatic surfaces are conspicuously developed and are encrusted with firmly adherent pollen at anthesis, *Fig. 2*. In the more rudimentary forms of sterile carpels, the branches of the median and lateral veins may be feebly developed or absent, thus resembling the venation of fertile carpels during the earlier stages of their ontogeny.

CARPELS OF THE WINTERA SECTION OF DRIMYS

In the *Tasmannia* section of *Drimys*, the carpels are adaxially folded or conduplicate and may be spread open into megasporophylls of but slightly modified form. When unfolded, *Fig. 17,* their venation resembles that of a palmately 3-veined appendage. The elongated locule of the folded carpel is oriented approximately parallel to the long axis of the megasporophyll, and the numerous ovules are attached to two placental ridges that are situated between the median and lateral veins.

The carpels throughout the *Wintera* section of *Drimys* have a fundamentally similar vascularization and placentation, but the external stigmatic surfaces are restricted to the adaxially projecting, subapical, ventral part of the carpels, *Fig. 6*. The approximated ventral surfaces of the conduplicate carpels are firmly concrescent, *Fig. 14,* except at the level of the stigmatic projection, *Fig. 13,* and therefore the megasporophylls cannot be unfolded as in the case of the more primitive sporophylls of the *Tasmannia* type. At the level of the stigmatic projection, *Fig. 13,* there is a cleft-like opening or a loose suture which extends outward from the locule as in *Drimys piperita, Fig. 12,* of the *Tasmannia* section of *Drimys.* Serial transverse sections indicate that the closure of the carpels progressed upward from the base and downward from the apex of the conduplicate lamina, and commonly also centripetally, since vestiges of the cleft-like opening tend to persist internally, *Fig. 14,* after they have been completely eliminated externally. These conclusions regarding closure may be verified by the serial sectioning of *Tasmannia* type carpels, many of which exhibit incipient stages of concrescence. With the closure of the cleft-like opening, the carpels retract, and eventually eliminate, the stigmatic crests from the sealed parts of the megasporophylls. Thus, the subapical projection of the *Wintera* type of carpel is not to be interpreted as a style-like outgrowth, but rather as a persistent remnant of the extensive adaxial stigmatic crests of *Tasmannia* type megasporophylls, *Fig. 19.*

CARPELS OF BUBBIA, BELLIOLUM, EXOSPERMUM, AND ZYGOGYNUM

Various transitional stages in the closure of conduplicate carpels and in the restriction of their stigmatic crests occur in the genus *Bubbia,* but in this genus, as in *Belliolum, Exospermum,* and *Zygogynum,* there is in addition a more or less pronounced abaxially directed deformation of the conduplicate megasporophylls.

The carpels of *Bubbia Archboldiana* A. C. Sm. (*Brass 12712*) resemble those of the *Tasmannia* section of *Drimys* in their vascularization, placentation, and in having extensive stigmatic surfaces, *Fig. 20.* They differ in their angular external form and in their conspicuously broadened and flattened apices. There are, however, no significant modifications in the longitudinal orientation of the locule, the placental ridges, or the median and lateral veins. The carpel of *Bubbia megacarpa* A. C. Sm. (*Brass 10249*) likewise has extensive stigmatic margins, *Fig. 21,* but it exhibits a profoundly modified form, due to the overtopping of the shortened dorsal side of the sporophyll by its over-extended, conduplicate, ventral side. In other words, there is an abaxially directed deformation of the megasporophyll which produces a short, apically much broadened carpel. The locule, the placental ridges, the lateral veins, and the stigmatic crests all show pronounced abaxial curvatures. Owing to these concomitant deformations from longitudinal to approximately transverse orientations, it is evident that the apparently terminal parts of the carpel, *Fig. 21,* actually are homologues of the ventral parts of the primitive carpels illustrated in *Fig. 1.* The true apex of the carpel is curved around onto the dorsal side of the megasporophyll. The massive median trace dissociates in the base of the carpel, *Fig. 21,* into numerous vascular strands, the majority of which extend upward toward the transversely oriented parts of the placental ridges. Their recurved ends either terminate in the placental ridges or anastomose with the short downwardly directed branches of the lateral veins. Comparatively few branches of the median vein are directed diagonally toward the longitudinally oriented basal parts of the placental ridges. Most of the ovules are vascularized by veinlets of the lateral systems.

The carpels of other species of *Bubbia*, as of *Belliolum* and *Zygogynum*, exhibit more or less conspicuous abaxially directed deformations and, in addition, much restricted stigmatic crests which tend to assume a transversely terminal orientation. Although the carpels of *Bubbia longifolia* A. C. Sm. (*Brass 13868*) have less exaggerated abaxial deformation, *Figs. 10* and *22*, and therefore a less modified median vein than that of *B. megacarpa, Fig. 21*, the stigmatic crests and the ovules are restricted to the diagonal upper part of the distorted megasporophylls. The approximated ventral surfaces in the lower ventral part of the conduplicate carpel are concrescent and there is no cleft-like opening extending outward from the locule except in the upper part of the megasporophyll which subtends the stigmatic crests. The placental ridges and ovules are likewise restricted to the upper part of the sporophyll. The ovules are vascularized in part by veinlets of the lateral systems and in part by extensions of the median system, *Fig. 22*. The single, terminal megasporophyll of *Bubbia monocarpa* A. C. Sm. (*Kanehira & Hatusima 12105*), *Fig. 9*, resembles the carpels of *B. longifolia* both in its abaxial deformation and its internal structure. It demonstrates, as does the single terminal carpel of *B. megacarpa*, that the distorted forms of the megasporophylls in polycarpellate species are not due solely to excessive compression of adjacent organs during ontogenetic development. The immature carpels, illustrated in *Figs. 7* and *8*, indicate furthermore that the abaxial deformations are of phylogenetic rather than purely ontogenetic development.

In *Bubbia Clemensiae* A. C. Sm. (*Clemens 5157* and *4596*), abaxial deformation coupled with concomitant modifications of the lower part of the megasporophylls have produced a more nearly symmetrical carpel, *Fig. 23*. Externally it is difficult to distinguish the sealed, crestless, adaxial side of the conduplicate sporophyll from its dorsal side. Furthermore, the lateral veins not infrequently are fused in the lower closed part of the carpel and separate at a higher level, thus simulating the bifurcation of the median vein. The transversely oriented placental ridges extend downward into the locule for a considerable distance, *Fig. 15*. Therefore, the attachment of the ovules is more remote from the stigmatic margins and the ovules are vascularized by more downwardly extended veinlets of the lateral and median systems.

The carpels of *Bubbia Whiteana* A. C. Sm. (*Brass 2278*), *Figs. 11* and *24*, resemble the megasporophylls of *B. Clemensiae* in their concealed abaxial deformation and in their much modified median and lateral vascular systems, but differ from them in having less extensive terminal stigmatic crests and ovules that are attached at a higher level of the locule. The ovules, as in *B. Clemensiae*, are vascularized by extensions of both the lateral and median systems.

Restriction of the stigmatic crests is carried to an extreme in the short, terminally broadened, fleshy carpels of *Bubbia auriculata* v. Tiegh. (*Vieillard 2280*) and *B. semecarpoides* (F. v. Muell.) Burtt (*Kajewski 1216*). There is a pronounced abaxially directed deformation in the ventral part of the conduplicate carpel, as indicated by the curvature of the lateral veins and the diagonal orientation of the placental ridges, *Fig. 25,* but the conduplicate ventral part of the carpel does not extend across the broad terminal face of the megasporophyll and does not overtop a shortened dorsal side as in *B. megacarpa, Fig. 21,* or *B. Clemensiae, Fig. 23.*

In most species of *Bubbia,* as in the *Tasmannia* section of *Drimys,* the placental ridges are closely correlated in orientation and extension with the stigmatic crests. In certain carpels, however, e.g. those of *B. pachyantha* A. C. Sm. (*Brass 4371*) and *B. isoneura* v. Tiegh. (*Vieillard 17*), there are more or less conspicuous unconformities, as in the megasporophylls of the *Wintera* section of *Drimys, Fig. 19.* In other words, the placental ridges persist for varying distances in the sealed, crestless, ventral part of the megasporophylls. Such unconformities between the orientation and extension of the placental ridges and the stigmatic crests occur at times in the carpels of *Belliolum, Fig. 26.* Although the carpels of *Belliolum* in general resemble those of the more highly specialized species of *Bubbia* (viz. those having more or less restricted, terminally oriented crests), the attachment of the ovules tends to be at lower levels and the branches of the lateral veins are more downwardly extended, as in *Bubbia Clemensiae, Fig. 23.*

The coriaceous megasporophylls of certain polycarpellate species of *Bubbia,* e.g. *B. pachyantha,* are closely crowded and firmly coherent both preceding and during anthesis. Thus, as stated by Smith (3), "the gynaecium has the appearance of a compound ovary with a 3- or 4-parted stellate stigma." Such gynaecia closely resemble that of *Exospermum stipitatum* (Baill.) v. Tiegh. (*Vieillard 2281*). There is, accordingly, no such sharply defined morphological distinction between coherent (*Exospermum*) and free (*Bubbia*) carpels as hypothesized by van Tieghem (6). The individual carpels may be readily separated after clearing treatments and each is provided with an independent epidermal layer. Only in the gynaecia of *Zygogynum* are the carpels fused into a concrescent mass without internal evidences of sutures, *Fig. 16.*

The ovules of *Exospermum stipitatum* are not restricted in their attachment to conspicuous stigmatic ridges, but are scattered over the walls of the locule, a modified type of placentation that is suggestive of certain Nymphaeaceae and Lardizabalaceae. The cleft-like opening at anthesis is partly closed externally and does not extend outward from the locule to the stigmatic surface as in *Zygogynum spathulatum* v. Tiegh. (*Vieillard 2266*), *Fig. 16.* In this, as in other species of *Zygogynum,* the shortened placental ridges, *Fig. 16,* are situated on the abaxial side of the locule. The ovules are not attached to the dorsal part of the carpel, however, as hypothesized by van Tieghem (6), but to a morphologically ventral part of the conduplicate megasporophylls that has been deflected into an abaxial orientation and thus overtops the much shortened morphologically dorsal part of the carpel.

The carpels of *Pseudowintera* fluctuate considerably in form. In general, those of *P. axillaris* var. *colorata* (Raoul) A. C. Sm., *Fig. 4,* tend to resemble the megasporophylls of the *Wintera* section of *Drimys,* whereas those of *P. axillaris* var. *typica* A. C. Sm., *Fig. 5,* exhibit more pronounced abaxially directed deformation as in certain species of *Bubbia.*

SIGNIFICANCE OF INTERNAL PAPILLATE SURFACES

The conduplicate megasporophylls of *Degeneria* (Bailey and Smith, 1) have more or less conspicuously flaring free margins and are characterized by having short, glandular-appearing hairs that are distributed inwardly from the margins along the approximated ventral surfaces as far as the flanks of the placental ridges. Thus, the cleft-like opening that extends outward from the locule is partly occluded by interlocking papillae, and pollen does not have direct access to the locule in most cases. The pollen grains become attached to the outer glandular projections and the pollen-tubes penetrate apparently through the mat of interlocking papillae.

In the Winteraceae, the free margins of the conduplicate lamina (in unsealed parts of the carpels) are more closely approximated and the stigmatic papillae extend backward from the margins over the exposed dorsal surfaces of the sporophylls, *Figs. 12* and *13.* There are, in addition, more or less numerous papillate cells along the ventral surfaces of the conduplicate megasporophylls, *Figs. 12* and *13.* These projecting cells commonly jacket both flanks of the placental ridges even in sealed parts of the carpels, *Fig. 14.* In regions of incipient closure (phylogenetic, not ontogenetic) the papillae not infrequently appear to enlarge and to interlock and possibly at times to play an initial role in the developing suture.

Unfortunately, herbarium specimens do not provide adequate material for studying the finer cytological and histological details of the closure of carpels or of the penetration of pollen-tubes. Such details can be clarified only by the study of living and adequately killed and fixed material. Furthermore, it is essential that the carpels of *Degeneria* and the Winteraceae be studied in all stages of their ontogenetic development and during the changes that they undergo subsequent to anthesis.

It should be emphasized in this connection that there is considerable variation in the form of winteraceous carpels, in the details of their vascularization, in the extent of their closure, etc., not only in material from different collections of the same species, but also in different carpels from the same flower. Therefore, our descriptions and illustrations represent average or typical conditions. Numerous variations in the structural details of particular genera and species may be anticipated when more abundant and complete collections of these remarkable plants become available.

DISCUSSION AND CONCLUSIONS

The carpels of the *Tasmannia* section of *Drimys* are conduplicate megasporophylls of but slightly modified form and closely resemble the megasporophyll of *Degeneria*. In both cases, the megasporophyll is clearly differentiated into stipe and adaxially folded lamina, *Figs. 1* and *2*. When spread open, the lamina exhibits a palmately 3-veined vascularization such as characterizes both the microsporophylls and the sterile sporophylls (staminodes) of the Degeneriaceae and Himantandraceae. The numerous anatropous ovules, *Fig. 18,* are attached to more or less conspicuous placental ridges that are situated between the median and the lateral veins, *Fig. 17*. The ovules are vascularized in part by short branches of the two lateral veins, in part by branches of the median vein, and in part by strands originating near anastomoses of the lateral and median vascular systems, the ratios of the three types of vascularization fluctuating from carpel to carpel. The conduplicate form, placentation, and vascularization of the megasporophyll do not conform with the classical interpretation of the angiosperm carpel as an involute megasporophyll bearing marginally attached ovules. In the Winteraceae and Degeneriaceae, the ovules are borne on the morphological upper surface of the megasporophyll, *between the lateral and median veins, Fig. 17,* and remote from the margins of the sporophyll, *Figs. 12, 13, 15,* and *16*. It should be noted in this connection that the broad, palmately 3-veined microsporophylls of the Degeneriaceae and Himantandraceae are not differentiated into filament, anther, and connective, and that they bear four slender elongated sporangia that are immersed beneath the dorsal surface of the sporophyll, *midway between the median and the lateral veins*. Thus, in these primitive ranalian carpels and stamens, neither the megasporangia nor the microsporangia are borne upon the margins of the sporophylls. It should be noted, in addition, that there is no conclusive evidence at present for inferring marginal attachments in ancestral angiosperms rather than ventral and dorsal ones as in certain of the Pteridospermae.

In the Winteraceae, the chief trends of specialization of the primitive ranalian megasporophyll lead toward closure of the conduplicate sporophyll (by concrescence of its approximated ventral surfaces) and concomitant restriction of its external stigmatic surfaces. In *Bubbia, Belliolum, Exospermum,* and *Zygogynum* these trends of specialization are complicated by more or less pronounced abaxially directed deformation which results in an apically much broadened carpel bearing more or less terminally or even abaxially (*Zygogynum*) oriented stigmatic crests. In the more specialized forms, the ovules tend to be attached to transversely or even abaxially oriented placental ridges in the upper part of the carpel.

On the contrary, in the Himantandraceae and Magnoliaceae (the closest relatives of the Degeneriaceae) the specializations of the primitive ranalian megasporophyll lead toward a pronounced constriction of the upper part of the conduplicate lamina. This constricted, sterilized, upper part, viz. style, has more or less extensively "decurrent" stigmatic surfaces and still exhibits a conduplicate structure. The few remaining ovules are thus confined to the fertile, lower, broader part of the conduplicate carpels, which may remain partly open (Himantandraceae) or be firmly sealed (Magnoliaceae).

Our detailed investigations of the numerous representatives of the Winteraceae support the suggestion (Bailey and Smith, 1) that the remarkable megasporophyll of *Degeneria* may afford significant clues for interpreting the diverse carpellary structures of the Ranales. The occurrence of fundamentally similar types of conduplicate megasporophylls throughout the *Tasmannia* section of *Drimys* provides a broad basis for comparative investigations of the various ranalian families. If the dicotyledons are monophyletic, the megasporophylls of the Degeneriaceae and Winteraceae should prove to be equally significant in studying the carpellary specializations of other orders.

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EXPLANATION OF PLATES

Plate I

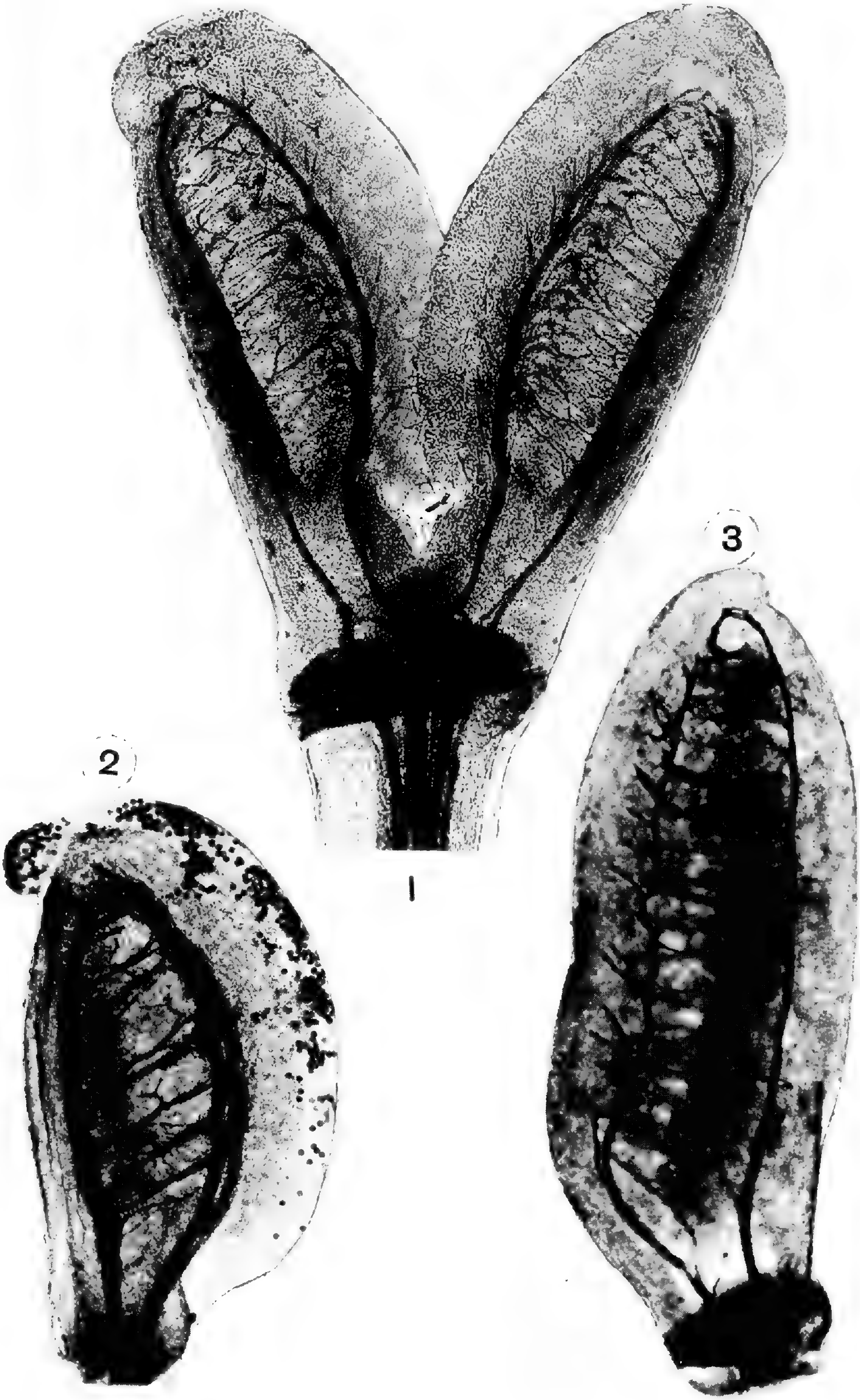
Carpels cleared in dilute NaOH and photographed unstained in 95% alcohol. Fig. 1. *Drimys piperita* Hook. f., *Ramos and Edaño 38897.* Two attached carpels, showing stipe and venation of conduplicate lamina, × 20. Fig. 2. *Drimys macrantha* A. C. Sm., *Brass 4519.* Detached sterile carpel, showing at right pollen attached to stigmatic surface, × 24. Fig. 3. *Drimys insipida* (R. Br.) Pilger, *Caley.* Detached young fruit, showing at left outwardly projecting branches of lateral vein, × 17.

Plate II

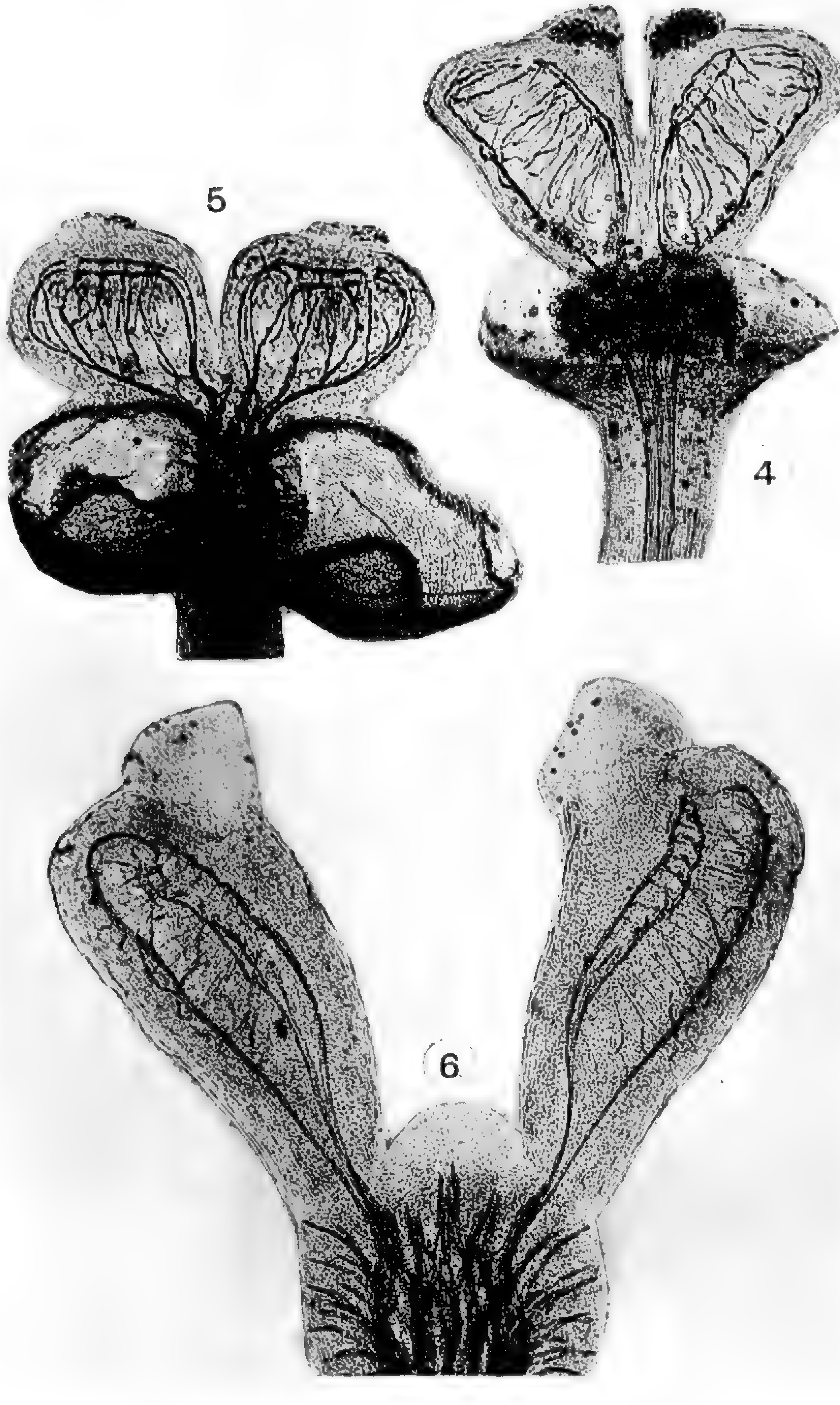
Carpels cleared in dilute NaOH and mounted unstained in diaphane. Fig. 4. *Pseudowintera axillaris* var. *colorata* (Raoul) A. C. Sm., *Kirk.* Two attached carpels, showing lateral view of vascularization, × 24. Fig. 5. *Pseudowintera axillaris* var. *typica* A. C. Sm., *Oliver.* Two attached carpels, showing lateral view of vascularization, × 20. Fig. 6. *Drimys confertifolia* Phil., *Moseley.* Two attached carpels, showing vascularization and apex of torus, × 20.

Plate III

Carpels cleared in dilute NaOH and photographed unstained in 95% alcohol. Fig. 7. *Bubbia monocarpa* A. C. Sm., *Kanehira and Hatusima 12105.* Young carpel, showing early stage in the development of median and lateral veins, × 24. Fig. 8. *The same.* Somewhat older carpel, showing extensions of the vascularization, × 24. Fig. 9. *The same.* Carpel showing vascularization at anthesis, × 24. Fig. 10. *Bubbia longifolia* A. C. Sm., *Brass 13868.* Mature detached carpel, showing vascularization, × 24. Fig. 11. *Bubbia Whiteana* A. C. Sm., *Brass 2278.* Two somewhat coherent carpels, showing vascularization, × 17.



Comparative Morphology of the Winteraceae



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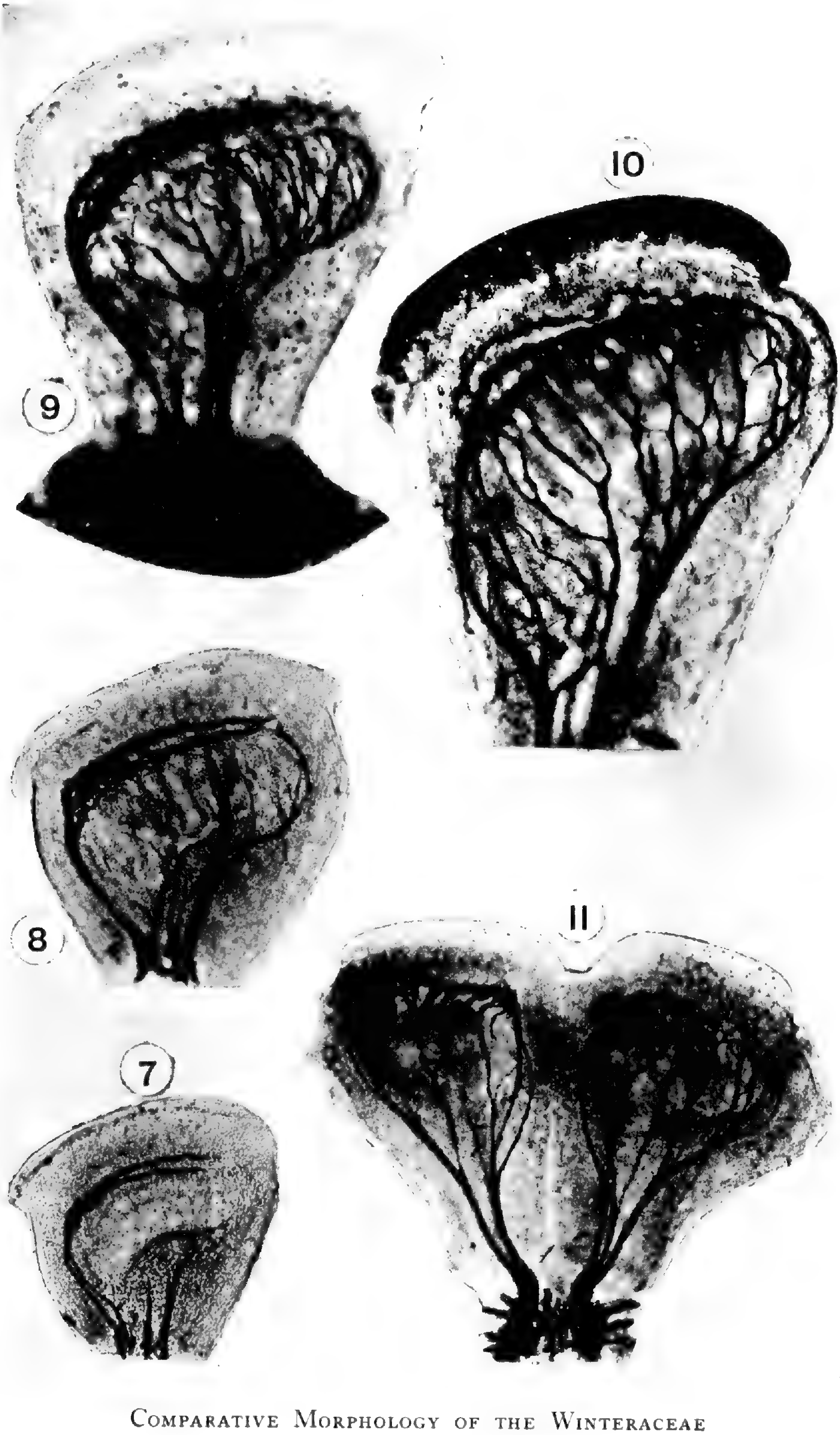

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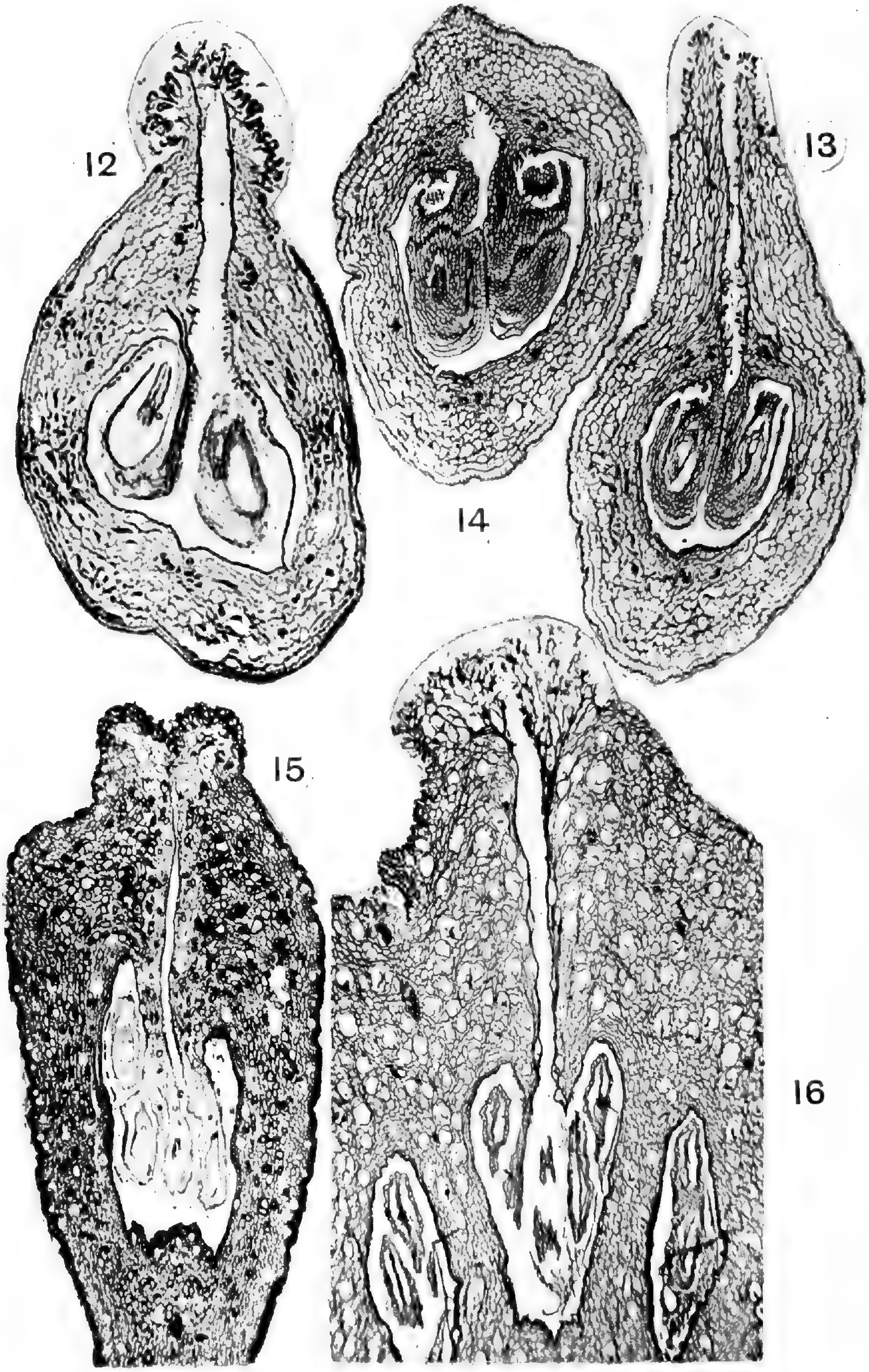

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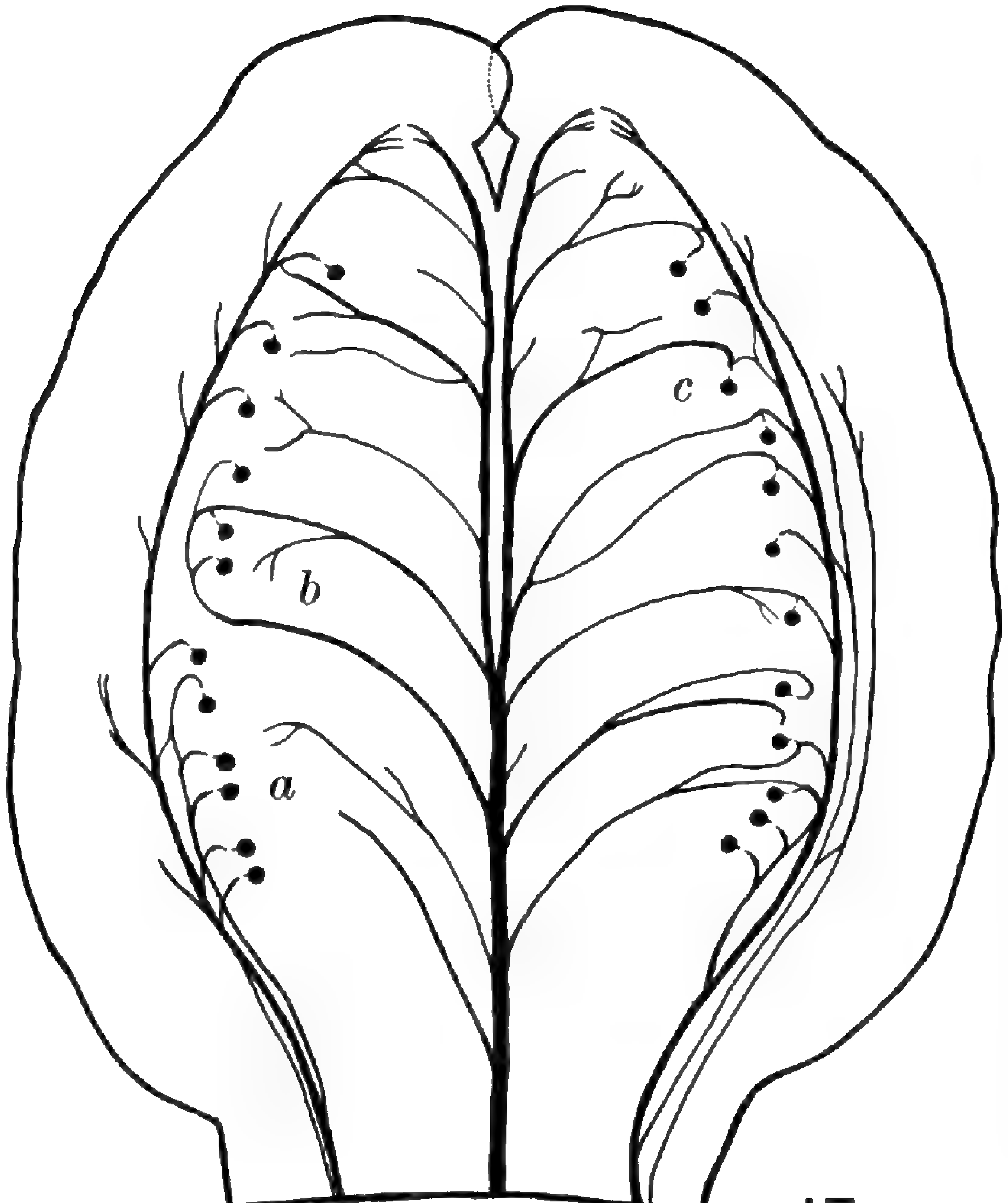

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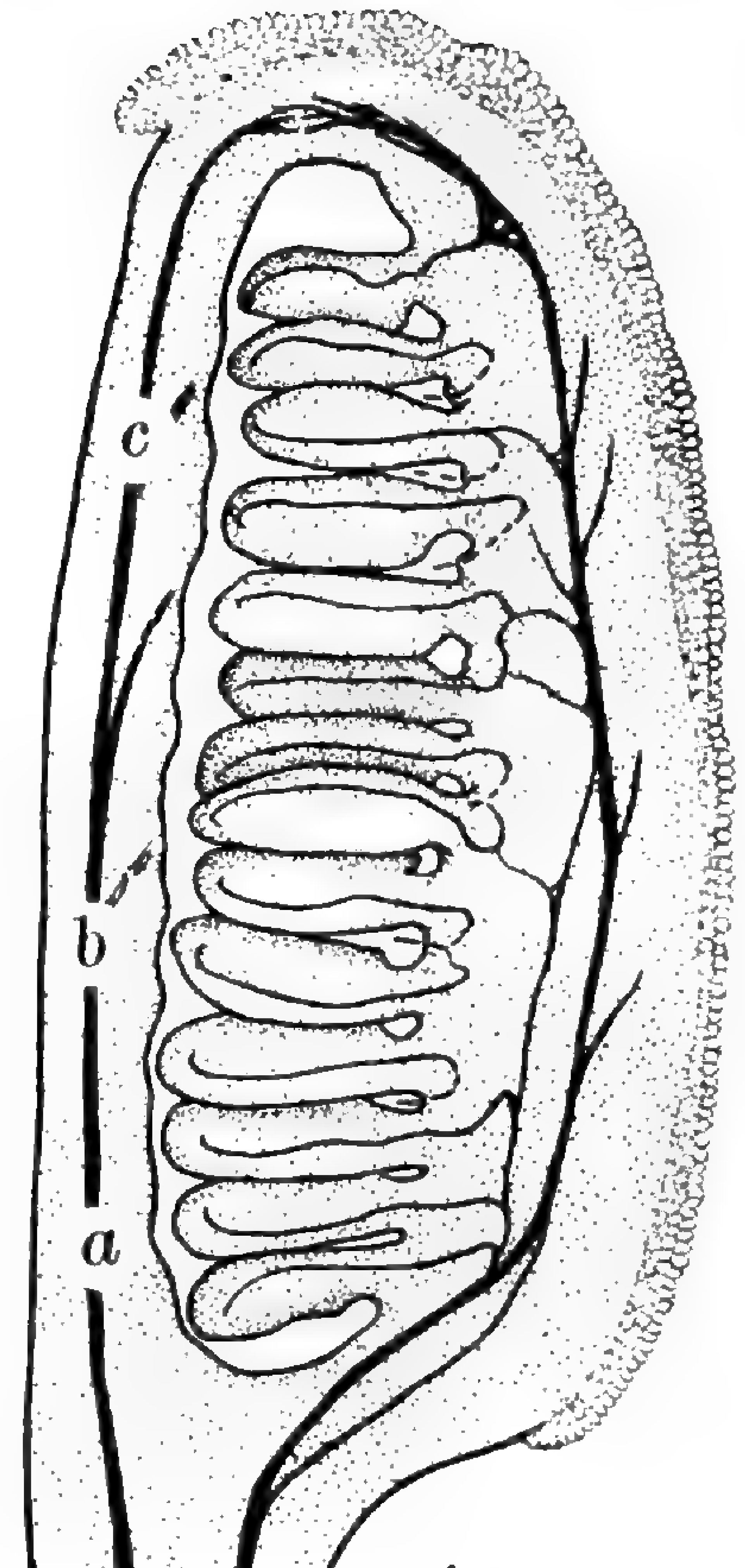

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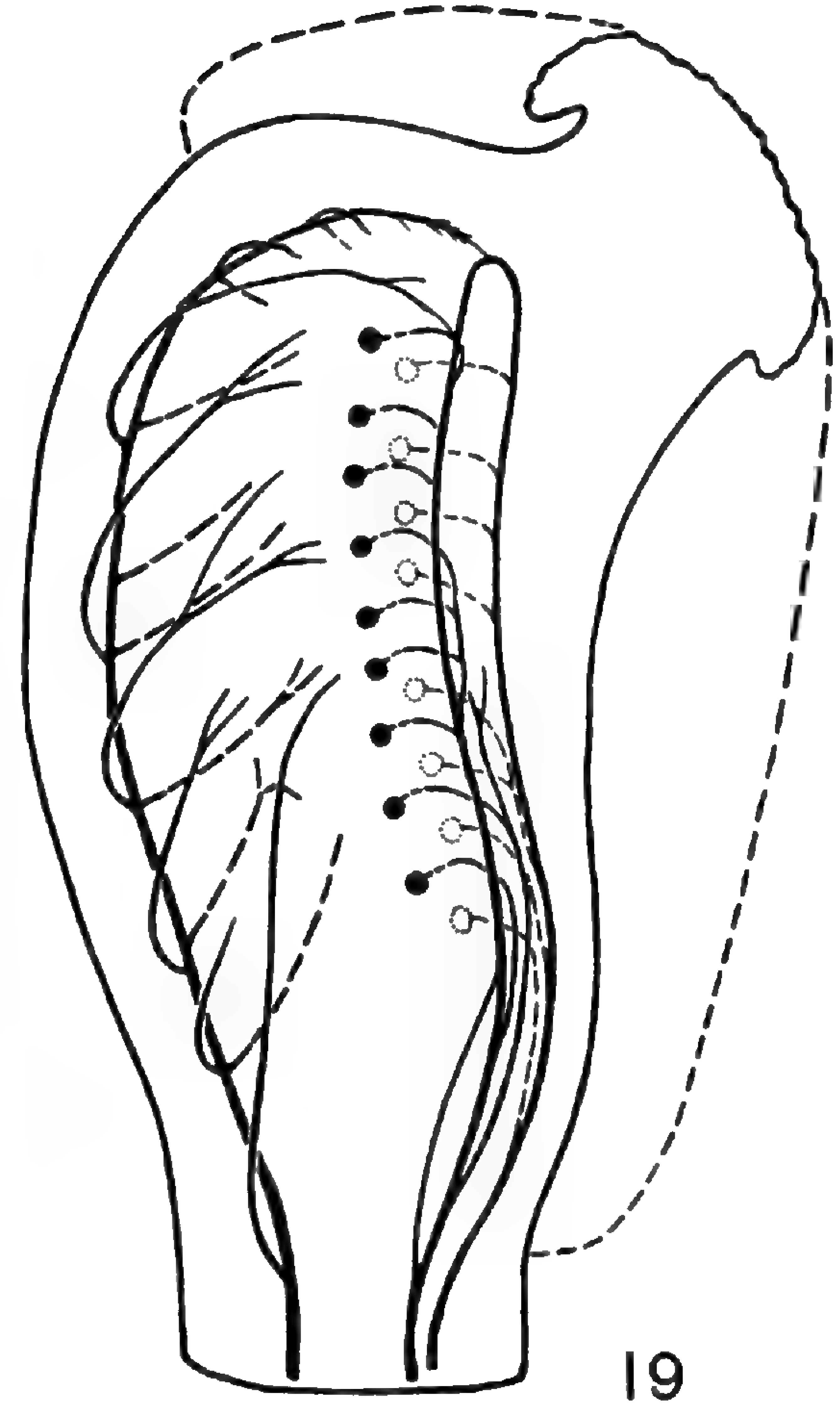

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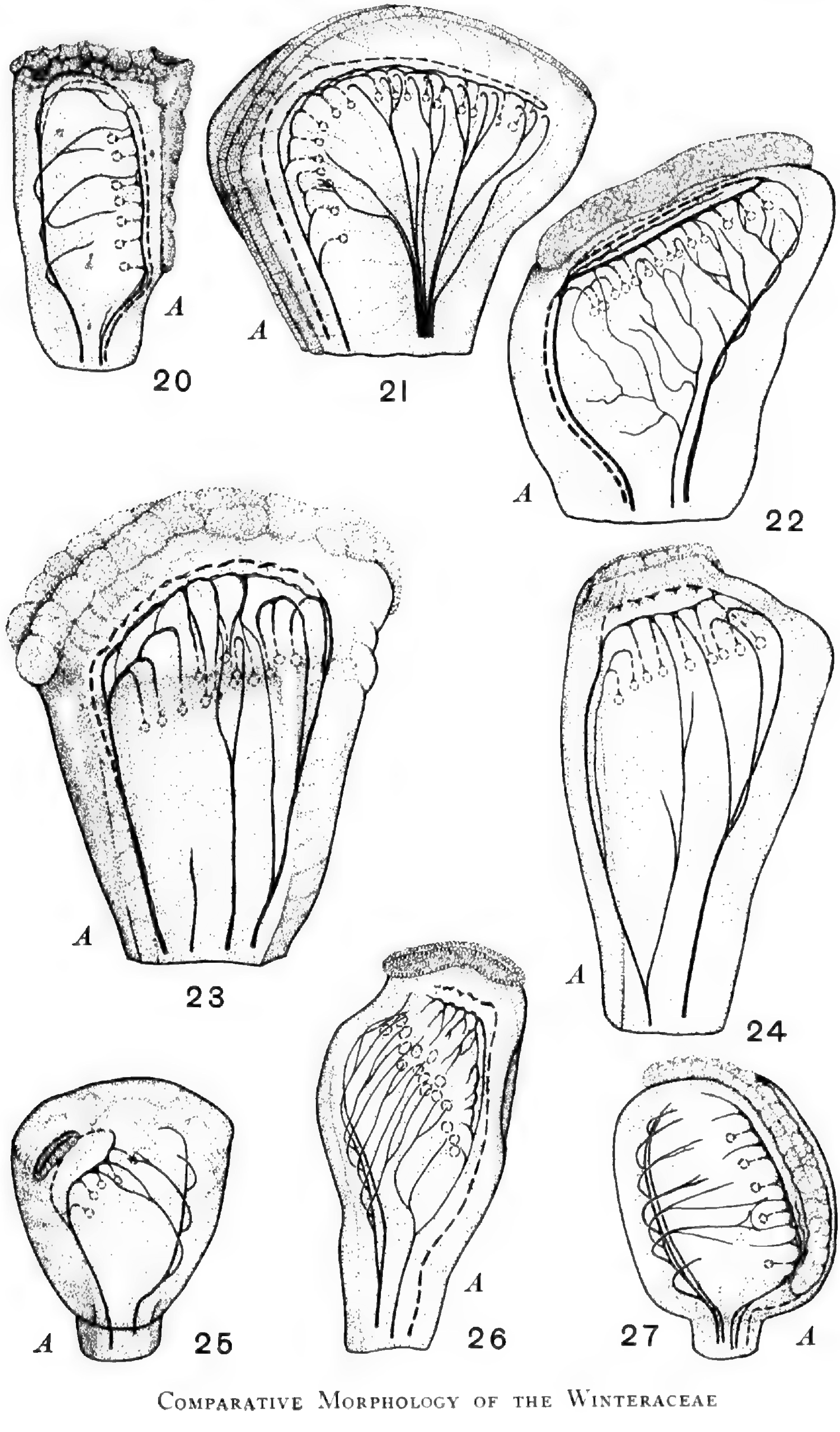
Comparative Morphology of the Winteraceae



COMPARATIVE MORPHOLOGY OF THE WINTERACEAE

Plate IV

Sections of partly re-expanded carpels, stained in Haidenhain's haematoxylin and safranin. Fig. 12. ***Drimys piperita*** Hook. f., ***Ramos and Edaño*** *38897*. Transverse section of conduplicate carpel, showing stigmatic surfaces and ovules, × 50. Fig. 13. ***Drimys granadensis*** var. ***mexicana*** (DC.) A. C. Sm., ***Tonduz*** *7342*. Transverse section of conduplicate, open, upper part of carpel, showing stigmatic surfaces and attachment of ovules, × 50. Fig. 14. ***The same.*** Lower sealed part of carpel, showing internal vestige of cleft and internal papillae, × 50. Fig. 15. ***Bubbia Clemensiae*** A. C. Sm., ***Clemens*** *4596*. Longitudinal section, showing cleft-like opening, downwardly projecting stigmatic ridges, and ovules, × 24. Fig. 16. ***Zygogynum spathulatum*** v. Tiegh., ***Vieillard*** *2266*. Transverse section of gynaecium, showing parts of three concrescent carpels, × 40.

Plate V

Fig. 17. Composite diagram of opened ***Tasmannia*** type carpels, showing typical palmately 3-veined vascularizations. Black dots show the approximate position of the micropyles of the elongated anatropous ovules (compare ***Fig.*** *18*). *a*. ovules vascularized by the lateral system; *b*. ovules vascularized by the median system; *c*. ovules vascularized by strands from anastomosed branches of the median and lateral systems. Fig. 18. Internal view of one half of a ***Tasmannia*** type carpel, showing form, orientation, and attachment of the anatropous ovules, *a, b,* and *c* as in ***Fig.*** *17*. Fig. 19. Form, placentation, and vascularization of a cleared ***Wintera*** type carpel, showing restriction of the stigmatic crests to a subapical projection. Broken lines indicate the extent of the stigmatic crests in primitive ***Tasmannia*** type carpels.

Plate VI

Diagrams of cleared carpels, showing the extent and orientation of the stigmatic crests and the details of vascularization and placentation in half of each conduplicate megasporophyll. Circles represent the approximate position of the micropyles of the anatropous ovules. The vascular strands of the ovules are represented by solid lines in placental tissue and by broken lines as they enter the funicles. *A*. adaxial side of carpel. Magnification × 18. Fig. 20. ***Bubbia Archboldiana*** A. C. Sm., ***Brass*** *12712*. Fig. 21. ***Bubbia megacarpa*** A. C. Sm., ***Brass*** *10249*. Fig. 22. ***Bubbia longifolia*** A. C. Sm., ***Brass*** *13868*. Fig. 23. ***Bubbia Clemensiae*** A. C. Sm., ***Clemens*** *4596*. Fig. 24. ***Bubbia Whiteana*** A. C. Sm., ***Brass*** *2278*. Fig. 25. ***Bubbia auriculata*** v. Tiegh., ***Vieillard*** *2280*. Fig. 26. ***Belliolum haplopus*** (Burtt) A. C. Sm., ***Brass*** *2959*. Immature carpel with incomplete vascularization. Fig. 27. ***Drimys lanceolata*** (Poir.) Baill., ***Boorman.***

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FORSYTHIA VAHL, NOMEN GENERICUM CONSERVANDUM

ALFRED REHDER

THE fact that *Forsythia* Vahl needs conservation, on account of the older homonym *Forsythia* Walter of 1788, seems so far to have been overlooked; at least, no proposal for its conservation has been put forward, which is probably not strange, since up to 1930 there was no necessity to conserve the name, because Walter's name is a clear synonym of the older *Decumaria* L. (1762) and the so-called homonym rule (Internat. Rules Bot. Nomencl. ed. 3, p. 19, Art. 61. 1935) was not adopted until 1930.

There can be no doubt that the name should be conserved, for the genus contains some of the best known ornamental shrubs brightening in early spring the gardens in temperate America and Europe, and the name is well known in botanical and horticultural and even general literature. Though not a large genus, containing only six or seven species, it includes a considerable number of named varieties of spontaneous as well as garden origin, the latter partly hybrids. The name will certainly be accepted by a large majority as a *nomen conservandum,* when proposed for conservation at the next International Botanical Congress. It seems, therefore, advisable to make herewith a formal proposal which should prevent the taking up the next oldest name, *Rangium* Jussieu, by some author, and the creation of a number of new combinations which can with certainty be expected to be relegated to synonymy by the next Botanical Congress. So far, only one author, namely Ohwi in 1932, seems to have taken up Jussieu's name and made a number of combinations.

Forsythia Vahl, Enum. Pl. **1**: 39 (1805)
versus
Forsythia Walter, Fl. Carol. 154 (1788).
Rangium Jussieu in Dict. Sci. Nat. **24**: 200 (1822).
Type species: *F. suspensa* (Thunb.) Vahl (*Ligustrum suspensum* Thunberg).

Forsythia Vahl has been accepted by all later authors up to 1932, when Ohwi (in Act. Phytotax. Geobot. **1**: 140) took up *Rangium.*

Forsythia Walter has not been accepted by any author and has always been treated as a synonym of *Decumaria* Linnaeus (Sp. Pl. ed. 2, 1663. 1762).

Rangium Jussieu, based on the monotypic *Forsythia* Vahl, remained without specific epithet until Ohwi (l. c.), in 1932, took up the name and made the following combinations:

Rangium suspensum (Thunb.) Ohwi, l. c. = **Forsythia suspensa** Vahl, l. c.
Rangium viridissimum (Lindl.) Ohwi, l. c. = **Forsythia viridissima** Lindl. in Jour. Hort. Soc. Lond. **1**: 226 (1846).
Rangium koreanum [Rehd.] Ohwi, l. c. = **Forsythia viridissima** var. **koreana** Rehder in Jour. Arnold Arb. **5**: 134 (1924).—Syn.: *F. koreana* (Rehd.) Nakai in Bot. Mag. Tokyo, **40**: 471 (1926).

Rangium ovatum (Nakai) Ohwi, l. c. = **Forsythia ovata** Nakai in Bot. Mag. Tokyo, **31**: 104 (1917).

Rangium japonicum (Mak.) Ohwi, l. c. = **Forsythia japonica** Makino in Bot. Mag. Tokyo, **28**: 105, *fig. 4* (1914).

Arnold Arboretum,
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ROYLE'S "ILLUSTRATIONS OF THE BOTANY OF THE HIMALAYAN MOUNTAINS"

WILLIAM T. STEARN

THE "Illustrations of the Botany and other Branches of the Natural History of the Himalayan Mountains, and of the Flora of Cashmere" (2 vols. quarto; London) by John Forbes Royle (1799–1858) stands with Roxburgh's "Plants of the Coast of Coromandel" (1795–1819), Wallich's "Plantae Asiaticae rariores" (1830–1832), Wight's "Icones Plantarum Indiae Orientalis" (1838–1853),[1] and Wight's "Illustrations of Indian Botany" (1840–1850) as one of the most important illustrated works on the flora of India. Royle was a pioneer economic botanist. His work is not so much a descriptive systematic flora as an attempt to reveal "the immense resources of British India, both as regards whatever is necessary for the Agriculture, Manufactures, and Internal trade of the people, as for the supply of a much extended External Commerce." In it "the Geographical Distribution of Plants, as connected with Climate, is considered, their Useful Properties detailed, and the principles which should guide their culture in new situations deduced." Medicinal plants receive special attention. Many new species came to light during the preparation of the work and are concisely described in its pages. It was issued in eleven parts, costing £1. each, between 1833 and 1840. An unnumbered page of the Introduction states the text-content of each part and its date of issue but gives no information about the plates. This is an omission of some importance. The plates illustrate in colour many of the new species described in the text; they sometimes appeared before the corresponding descriptions and, because they contain figures of floral dissections, the valid publication of certain botanical names dates not from the text but from the earlier issued plates.[2] As Dr. T. A. Sprague remarks, the most satisfactory way to determine the details of issue of a work of this kind is to examine a copy still in the original wrappers. No such copy of Royle's work being known, he endeavoured to ascertain the issue of the plates by a survey of contemporary journals. Notices in Loudon's Gardeners' Magazine, vols. 9–16 (London, 1833–1840), enabled him to fix with precision the issue of 30 out of a total 100 plates. He assumed that the remaining 70 plates were issued in numerical sequence. Since the publication of

[1]For dates of publication of Wight's "Icones" see Merrill in Jour. Arnold Arb. **22**: 222–224. 1941.

[2]In this respect Royle's "Illustrations" is by no means unique. Webb and Berthelot's "Histoire naturelle des Iles Canaries" (1835–1850) is another important work in which a number of names were first published on the plates; for fuller details see Stearn in Jour. Soc. Bibl. Nat. Hist. **1**: 58–59. 1937.

Sprague's paper ("The Dates of Publication of Royle's Illustrations," in Kew Bull. **1933:** 378–390. 1933), parts 1–10 in wrappers as issued have come into the present writer's hands. They show that *the plates were not issued in numerical sequence.* This find necessitates some modification, fortunately not extensive, of Sprague's account.

The *contents and dates of publication of the parts* are as follows:

Part I.	(Sept. 1833): pp. 1–40; pls. 4, 11–18, 22.
Part II.	(March, 1834): pp. v–xii, 41–72; pls. 1, 19–21, 23–28.
Part III.	(June, 1834): pp. xiii–xx, 73–104; pls. 2, 5, 29, 31–35, 37, 38.
Part IV.	(Sept. 1834): pp. 105–136; pls. 30, 39, 40, 42, 44–46, 64, 76 as 75 (*Primula*), 78.
Part V.	(Jan. 1835): pp. 137–176; pls. 3, 41, 48–51, 57, 62, 63, 74.
Part VI.	(April, 1835): pp. 177–216; pls. 7, 36, 43, 55, 56, 58, 60, 61, 75 as 75a (*Phlomis, Salvia*), and View of the Himalayan Mountains (Frontispiece to Vol. 1).
Part VII.	(Aug. 1835): pp. 217–248; pls. 8, 9, 47, 52, 59, 65, 67–69, 71, 77.
Part VIII.	(Dec. 1835): pp. 249–288; pls. 53, 54, 66, 70, 72, 73, 79 (63a), 80, 87, 88.
Part IX.	(May, 1836): pp. 289–336; pls. 10, 81, 82, 83 (*Procris*), 84–86, 90, 100 (83, *Putranjiva*).
Part X.	(Feb. 1839): pp. 337–384; pls. 89, 91–96, 98 (84a), 99 (78a), and Plan of the H.E.I.C. Botanic Garden at Saharunpore (Frontispiece to Vol. 2).
Part XI.	(1840, before July): pp. xxi–lxxx, 385–472, title-pages, dedications, preface, synoptic table of contents, list of plates, list of plants figured; pls. 6, 97 [details of this part obtained from Loudon, Gard. Mag. **16:** 348. 1840 (July), Sprague in Kew Bull. **1933:** 382. 1933].

Hence the *dates of the publication of the plates and the parts* in which they were contained are as follows:

Plate 1 (II, March, 1834), 2 (III, June, 1834), 3 (V, Jan. 1835), 4 (I, Sept. 1833), 5 (III, June, 1834), 6 (XI, 1840), 7 (VI, April, 1835), 8–9 (VII, Aug. 1835), 10 (IX, May, 1836), 11–18 (I, Sept. 1833), 19–21 (II, March, 1834), 22 (I, Sept. 1833), 23–28 (II, March, 1834), 29 (III, June, 1834), 30 (IV, Sept. 1834), 31–35 (III, June, 1834), 36 (VI, April, 1835), 37–38 (III, June, 1834), 39–40 (IV, Sept. 1834), 41 (V, Jan. 1835), 42 (IV, Sept. 1834), 43 (VI, April, 1835), 44–46 (IV, Sept. 1834), 47 (VII, Aug. 1835), 48–51 (V, Jan. 1835), 52 (VII, Aug. 1835), 53–54 (VIII, Dec. 1835), 55–56 (VI, April, 1835), 57 (V, Jan. 1835), 58 (VI, April, 1835), 59 (VII, Aug. 1835), 60–61 (VI, April, 1835), 62–63 (V, Jan. 1835), 64 (IV, Sept. 1834), 65 (VII, Aug. 1835), 66 (VIII, Dec. 1835), 67–69 (VII, Aug. 1835), 70 (VIII, Dec. 1835), 71 (VII, Aug. 1835), 72–73 (VIII, Dec. 1835), 74 (V, Jan. 1835), 75 as 75a (VI, April, 1835), 76 as 75 (IV, Sept. 1834), 77 (VII, Aug. 1835), 78 (IV, Sept. 1834), 79–80 (VIII, Dec. 1835), 81–86 (IX, May, 1836), 87–88 (VIII, Dec. 1835), 89 (X, Feb. 1839), 90 (IX, May, 1836), 91–96 (X, Feb. 1839), 97 (XI, 1840), 98 as 84a, 99 (X, Feb. 1839), 100 as 83 (IX, May, 1836).

The *dates of publication of Royle's new species* can be readily ascertained from the above. As Sprague points out, the new species figured by Royle "fall into two categories: (1) those with figures accompanied by analyses, which date from the publication of the plate, where this is earlier than the corresponding text; (2) those without analyses, which date from the publication of the description (if any) in the text." Of the dates which Sprague gives for the 134 new species figured by Royle, only 24 need amendment. The following are corrected citations for these:

Aplotaxis gnaphaloides DC. ex Royle, t. 59, sine anal. (Aug. 1835), p. 251, nomen (Dec. 1835); DC. Prodr. **6**: 542 (Jan. 1837),[3] as *A. gnaphalodes.*
Astragalus Grahamianus Royle, p. 199, t. 36 (April, 1835).
Campanula cashmeriana Royle, t. 62 (Jan. 1835), pp. 253–254 (Dec. 1835).
Cerasus cornuta Wall. ex Royle, t. 38 (June, 1834), pp. 205, 207 (April, 1835).
Chaptalia gossypina Royle, p. 18, nomen (Sept. 1833), p. 246, t. 59 (Aug. 1835), pp. 250, 251 (Dec. 1835).
Circaea cordata Royle, p. 211, t. 43 (April, 1835).
Codonopsis rotundifolia Royle, t. 62 (Jan. 1835), pp. 253–254 (Dec. 1835).
Cucumis pseudo-Colocynthis Royle, pp. 218, 220, t. 47 (Aug. 1835).
Cyanathus lobatus Royle, t. 69 (Aug. 1835), p. 309 (May, 1836).
Dendrobium alpestre Lindley ex Royle, pp. 362, 365, t. 88 (Dec. 1835), p. 370 (Feb. 1839), non Swartz (1799).
Deutzia corymbosa R. Brown ex Royle, t. 46 (Sept. 1834), p. 216 (April, 1835).
Gaultheria trichophylla Royle, t. 63 (Jan. 1835), pp. 257–260 (Dec. 1835).
Holostemma Brunonianum Royle, p. 276, nomen, t. 66, sine anal. (Dec. 1835), Decaisne in DC. Prodr. **8**: 533 (March, 1844).
Kohautia coccinea Royle, p. 241 (Aug. 1835), t. 53 (Dec. 1835).
Lonicera bracteata Royle, pp. 236–237 (Aug. 1835), t. 53 (Dec. 1835).
Osmorrhiza laxa Royle, p. 233, t. 52 (Aug. 1835).
Picrorhiza Kurroa Bentham in Royle, t. 71 (Aug. 1835), p. 291 (May, 1836); Bentham, Scroph. Ind. p. 47 (? Aug. 1835).
Primula elliptica Royle, t. 76 as t. 75 (Sept. 1834), pp. 310, 311 (May, 1836).
Primula rosea Royle, t. 76 as t. 75 (Sept. 1834), p. 311 (May, 1836).
Prinsepia utilis Royle, t. 38 (June, 1834), pp. 202, 206 (April, 1835).
Rheum spiciforme Royle, p. 37, nomen (Sept. 1833), t. 78 (Sept. 1834), pp. 315, 316, 318 (May, 1836).
Roscoea alpina Royle, p. 19, nomen (Sept. 1833), pp. 357, 361, t. 89 (Feb. 1839).
Roscoea lutea Royle, p. 361, t. 89, "named *R. spicata* in plate, by inadvertence" (Feb. 1839).
"*Roscoea purpurea*" Royle, pp. 357, 361, t. 89 (Feb. 1839), non Smith (1806).

Plate 92 exists in three states. One has the name *Lilium Thomsonianum* in lithographed lettering (e.g. at Royal Botanic Gardens, Kew; Arnold Arboretum). Another has the name *Fritillaria Thomsoniana* instead, the word *Fritillaria* and the final *a* of *Thomsoniana* being handwritten but *Thomsonian* lithographed (e.g. at Lindley Library of Royal Horticultural Society; Linnean Society of London; British Museum, Bloomsbury; British Museum [Natural History], S. Kensington; University Library, Cambridge, England; Royal Botanic Garden, Edinburgh; Bodleian Library, Oxford). A third state has the name *Fritillaria Thomsoniana* lithographed throughout and the letters more evenly spaced than in the second state (e.g. at British Museum [Natural History]; Botany School, Cambridge, England; Cornell University). This plate was issued in February, 1839, in part 10, on the back wrapper of which it is listed as *Fritillaria Thomsoniana;* the corresponding letter-press (under the name *Fritillaria Thomsoniana*) was issued in 1840 in part 11. It would appear that the plate was originally lettered *Lilium Thomsonianum;* then, following David Don's decision that the plant depicted belonged to the genus *Fritillaria,* the word *Lilium* was erased from the plates already printed and

[3]For dates of publication of De Candolle's "Prodromus," see Stearn in Candollea **8**: 1–4. 1939, and in Jour. Bot. **79**: 27. 1941.

coloured and the word *Fritillaria* was written in its place, the final *m* of *Thomsonianum* being likewise erased and the *u* converted into an *a;* for later issues the name *Fritillaria Thomsoniana* was completely lithographed anew. The copies at Kew and the Arnold Arboretum seem to have escaped correction. The plant is now referred to *Notholirion,* a genus intermediate between *Lilium* and *Fritillaria;* see Grove and Cotton, Suppl. to Elwes, Mon. Lilium, p. 129. 1940.

Royle was born at Cawnpore in 1799 and educated at Edinburgh. He was appointed assistant surgeon on the Hon. East India Company's Bengal establishment in March, 1820, became curator of the Saharunpur Botanic Garden in 1823, and retired to England in 1831. From 1837 to 1856 he was professor of materia medica at King's College, London. Economic Botany, as the pages of his "Illustrations" abundantly testify, was his ruling interest, and he played a part in extending the cultivation of tea and cotton in India. Bentham, de Candolle, David Don, Hooker, and Lindley helped him with the classification and naming of his material. From 1851 until his death in 1858 he was secretary of the Horticultural Society of London.

LINDLEY LIBRARY,
ROYAL HORTICULTURAL SOCIETY,
LONDON, ENGLAND.

THE ARNOLD ARBORETUM DURING THE FISCAL YEAR ENDED JUNE 30, 1943

As in the preceding two years, because of war conditions and the concomitant unsettled economic situation, no special appeal was made for extra-budgetary support; yet the total gifts to the Arboretum were impressive, including $925.00 for publication, $2346.27 for general unrestricted purposes, $1050.00 from the Committee for Inter-American Artistic and Intellectual Relations, to cover the expenses and emolument of Dr. Armando Dugand, Director of the Instituto Biologico of Bogotá, and a grant of $500.00 from the American Philosophical Society for my use in connection with the study of our accumulated collections of Chinese material. In connection with the botanical survey of the Alcan Highway, discussed below, Dr. H. M. Raup received a grant of $1500.00 from the Milton Fund of Harvard University, supplemented by a grant of $500.00 from the Bache Fund of the National Academy of Sciences and one of $600.00 from the General Purpose Fund of the American Academy of Arts and Sciences. The latter organization also granted $150.00 to Professor Rehder for his use in connection with the completion of his bibliographic index. Five hundred dollars was received from the War Department to enable us to prepare the necessary illustrations for a treatise on emergency food plants for the Old World Tropics. An important gift to endowment was the receipt of $50,000.00 in December from Miss Louisa W. Case of Weston, together with her estate in Weston, consisting of 59 acres of land with the buildings thereon, assessed at $84,000.00, but actually valued in excess of that figure, for the buildings alone are insured on their appraised value of $114,450.00. This gift is a memorial to her father, Mr. James B. Case. While under the terms of gift the Weston property may be sold after a period of three years and the proceeds added to the James B. Case fund, it is our hope and desire that the Case estate be developed and maintained as an adjunct to the Arnold Arboretum. The annual accretions to capital under the terms of gift of the James Arnold and Charles Sprague Sargent funds were credited to these funds as usual. The James R. Jewett and the Vieno T. Johnson prizes were awarded in August in accordance with the terms of gift.

In passing, the badly overcrowded condition of the library, and especially of the herbarium, is again mentioned, although the library situation has been somewhat alleviated through the transfer of certain forestry periodicals to the Harvard Forest at Petersham on deposit. The overcrowded herbarium situation can be alleviated only by additional construction, and even if funds were available for this purpose, which is not the case, an addition to the Administration Building could not be accomplished at this time because of the present restrictions on building material.

Staff. — The staff remains about the same as in the preceding year, only one member of the technical staff having been drafted for military service, this being Dr. C. E. Kobuski, who was granted leave of absence when he was inducted into the service in October. Dr. F. P. Metcalf resigned in April, 1942, when he was commissioned in the United States Army. Dr. Armando Dugand, Director of the Instituto Biologico of Bogotá, Colombia, was appointed Research Associate during the period that he was in the United States under the auspices of the Committee for Inter-American Artistic and Intellectual Relations, September 1, 1942 to March 1, 1943.

Instruction. — Several staff members continue to coöperate with the Division of Biology of Harvard University in offering undergraduate and graduate courses and in supervising the research work of candidates for advanced degrees. The number of graduate students has decreased because of war conditions, but the demand for certain types of undergraduate instruction has increased to provide for the needs of special groups of students in residence at Harvard under the auspices of the Army and the Navy. To meet this situation we have waived the condition of a half-unit course every other year on the part of our staff members, and for the duration of the present emergency our staff members may be called upon for more course work supervision than would normally be the case.

Buildings and grounds, including horticulture. — Normal maintenance of all buildings has been provided for, the most important items being essential furnace repairs and the installation of a new pipe line from the water main on the Arborway to the Administration Building.

In assimilating large collections of living plants from various parts of the world, it becomes necessary from time to time to re-check the living plants already in cultivation to detect duplications, as well as those which are incorrectly named. This was done with the lilacs last year, and this year the difficult genera *Weigela, Philadelphus, Deutzia,* and *Rosa* were carefully examined. In many cases it was found that we were growing far too many duplicates, and in an equally large number of cases it was found that, on examining and comparing the horticultural varieties in flower, many supposedly different varieties were identical, even though they had been received from widely separated sources and had been growing here for many years under different names. The checking and re-identification of these groups took considerable time, but it is necessarily one of the important functions of an arboretum. At present the number of species and varieties of these groups represented in the living collections is *Deutzia* 63, *Philadelphus* 103, *Rosa* 241, and *Weigela* 56.

During the past year, 576 different kinds of plants were transferred from the nursery to the living collections, many of these being entirely new accessions. Including desirable duplicates, a total of 826 living plants was added during the current year. In addition, approximately 300 crab apple and oriental cherry seedlings were planted in the field near the Palmer house and in the Walter Street tract.

Included among the many new plants added to the collections this year was a collection of *Clematis* hybrids, the gift of Mr. Louis Vasseur of Milton, Massachusetts. Mr. Vasseur has specialized in the growing of *Clematis* hybrids for years and gave the Arboretum sixty of these in the fall of 1942. These were planted on the six-foot woven wire fence at the rear of the *Aesculus* collection. Another large collection of named varieties of *Clematis* was given by the James I. George Company of Fairport, New York, specialists in *Clematis*. These were planted in the nursery in the fall of 1942 and came through the cold winter remarkably well, but since that time many of them have unfortunately become seriously infected with disease.

The past winter was unusually severe, with temperatures at times well below zero. While there were only six days when the temperature fell below zero, as registered at the Arboretum greenhouses, more winter injury occurred to plants than at any other time since the severe winter of 1933–34. A detailed discussion of the winter injury and the species and varieties injured is included in Arnoldia **3:** 25–36. 1943.

A survey was made of all the crab apples being grown in North America at the present time, in conjunction with a committee of the American Association of Botanical Gardens and Arboretums, of which Dr. Wyman was chairman. The study had as its objective the collecting of all available information about the crab apples being grown today and listing this information in convenient form together with complete bibliographical and source data. A greater part of the work was done in the collections of the Arnold Arboretum, and the report will be published in July, 1943.

During the year a total of 1713 living plants was received, chiefly from various parts of the United States, but including a few from Canada, and even three from England. In addition, 171 lots of scions and 59 packets of seeds were received. Distribution of material to other institutions and to individuals totaled 1542 living plants, 94 lots of scions, and an unrecorded number of seeds.

Under a policy inaugurated last year, approximately twenty of the larger nurseries in the United States and Canada were selected which were interested in new and rare plants and which were listed to receive living specimens of new and rare varieties grown by the Arboretum. These plants were not to be sold by the nurseries but were to be used as stock plants. This arrangement was enthusiastically accepted by the nurseries, thus insuring a properly controlled outlet for new or rare shrubs and trees of ornamental value. The first year of operation proved to be highly satisfactory to everyone concerned.

Due to the seriousness of the food situation, some of the experimental land and some of the nursery space was assigned for garden work to twenty-seven staff members and to individuals working in neighboring institutions, and one area to a Boy Scout troop.

At the James B. Case estate in Weston, mentioned above, one hundred and thirty crab apples and oriental cherries were planted late in 1942 in one of the large fields and over 200 trees and shrubs were established in a nursery. The grounds are being maintained in good condition, and it is hoped that this estate may be maintained and developed as a permanent adjunct to the Arboretum, near the city, yet remote enough to enable us to accomplish various types of work without interruptions entailed because of the urban location of the Arboretum proper.

The Arboretum has had its share of "war troubles," but the staff is trying to carry on as well as it can under the circumstances. The curtailment in gasolene and labor and inability to obtain new mechanical equipment and repair parts for old machines are the chief causes for conditions noted by the public. We are trying to maintain the grounds and the collections in good condition with the equipment and help available. At the present time there is no one in the mapping and labeling department, both the young men formerly employed for this work having left, one to engage in war work, and the other to join the Army. Because the actual mapping work was completed, it is possible to let some of the routine remain dormant a year, but it does create many difficulties, some of which are unforeseen. However, the difficulties encountered in the maintenance of the living collections, though very real to us, are of the general type encountered everywhere during these unsettled times.

The War Effort. — This is not a discussion of war problems that the institution faces because of shortages in labor and materials due to war conditions. At first sight it would seem that a botanical institution could contribute little to war purposes, and yet what we have been able to accomplish is of considerable significance. Staff members have been at the service of both State and Federal governments in supplying horticultural and botanical information on camouflage problems, and a joint Camouflage Research Committee was set up consisting of staff members of the Arboretum, the Maria Moors Cabot Foundation for Botanical Research, the Harvard Forest, and the Biological Laboratories of Harvard University. The investigations undertaken by this group, in association with the United States Army Engineer Board at Fort Belvoir, were not competitive, but were coöperative, in that our investigations were supplementary to those prosecuted elsewhere. In addition to supplying special lists of plants suitable for camouflage purposes to the Army officials, a series of experimental studies on methods of prolonging the life of cut branches was initiated, and this was done with both native and exotic (European and Asiatic) species. Dr. Wyman has been a member of the Camouflage Committee of the Massachusetts Committee on Public Safety since its inception.

In addition to the camouflage investigation work, much time has been given to various emergency matters. Data have been freely supplied to officials in various branches of the armed services regarding poisonous plants and emergency food plants. In September, through the National Research Council, because so many conflicting agencies were becoming interested in the problem, I was drafted to prepare for the Quartermaster's Department, United States Army, a treatise on the potential food and poisonous plants of the Old World Tropics. Work was commenced on this about September 15, 1942, and the completed copy, with illustrations, was sent to Washington on January 15, 1943. It was issued April 15, 1943, in a very large edition, as Technical Manual 10–420, under the title "Emergency Food Plants and Poisonous Plants of the Islands of the Pacific," pp. 1–149. *fig. 1–113.* It covers all of Polynesia, Melanesia, Malaysia, and the Philippines, and for all practical purposes all of tropical Asia. In addition to special work in this field I have had to go to Washington every two months to lecture on the same subject to each incoming group of trainees in the intensive course on tropical medicine at the Army Medical School.

Botanical Survey of the Alcan Highway. — In the early part of 1943, with the announcement of the opening of the Alcan Highway, it occurred to me that here was a real opportunity to accomplish some productive field work in a hitherto little known area. I accordingly suggested to Dr. H. M. Raup, who had conducted eight botanical field trips in northern Canada, that it would be a good idea to plan for a trip along the Alcan Highway perhaps in 1944 or 1945. In preparation for such a trip Dr. Raup applied for a grant from the Milton Fund of Harvard University. After the application was made it developed that the Joint Economic Committee, Canada-United States, was much interested in having the botanical survey made at once, because certain data were needed by the local authorities now. The Committee took up the matter with the military authorities and secured not only the necessary permission but also their coöperation. The National Museum of Canada is also coöperating. As noted earlier in this report, the Milton Fund grant of $1500.00 was made and $1100.00 was received from other sources. It was then decided to add a glacial geologist to the group, and Dr. Charles S. Denny of Wesleyan University was selected. He secured the necessary permit to be absent from the University for the summer and further secured a grant of $900.00 from the Penrose Fund of the American Geological Society to cover his traveling expenses. Still later the services of Dr. Donovan S. Correll were secured as assistant botanist, by providing funds to reimburse the Botanical Museum for his salary during the time he would be in the field. The party, consisting of Dr. and Mrs. Raup, their two sons, Dr. Correll, and Dr. Denny, left Boston on May 31, and is expected to return about the middle of September. Meagre reports received from the field indicate a most successful summer campaign.

Cytogenetics. — The plant breeding work has resulted in new and interesting types of *Forsythia,* lilacs, roses, and ornamental apples and cherries. Several dwarf or compact types of *Forsythia* appear to be of particular interest. Among the hybrid cherries, one of the segregates is a semi-double-flowered form of the *Prunus subhirtella* type which is very hardy and which remains in flower for two weeks. Of the several hundred apple hybrids which have flowered, six have been selected for propagation and further testing. Polyploid forms of *Forsythia* and *Philadelphus* have been produced. One of the polyploid forsythias bloomed freely after the severe winter, which destroyed the flowers of most species. This plant has large flowers which are darker than those of the diploid species. The polyploid *Philadelphus* has large flowers but the petals are thick and they fall quickly. Seedlings of this plant may prove to be of value. Cytological work has been limited to the continued study of X-ray effects on chromosomes and on the viability of seeds and seedlings.

Wood Anatomy. — Professor Bailey and Dr. Nast have continued their collaboration with Dr. Smith in the study of woody ranalian families. Intensive investigations of the floral and vegetative organs of the Degeneriaceae and Himantandraceae have shown that these families are closely related to the Magnoliaceae. The three families form a compact group within the Ranales, being more closely related to each other, on the basis of important morphological details, than any one of them is to other families. On the contrary, the Winteraceae exhibit no close relationship to the Magnoliaceae either florally or vegetatively. Nor do they exhibit close affinities to the Schizandraceae, Trochodendraceae, or other specific ranalian families. The remarkable carpels of the Winteraceae rival their vesselless wood in morphological significance. The palmately 3-veined megasporophylls are adaxially folded or conduplicate and bear numerous ovules on their morphological upper surface. In other words, the ovules are not attached to the margins of a classical, involute, sealed sporophyll. The conduplicate, open carpels of *Degeneria* and of the Section *Tasmannia* of *Drimys* afford significant clues for re-interpreting the carpellary structures of the Ranales, and in all probability of the angiosperms as a whole.

The Herbarium. — A total of 20,050 specimens was mounted during the year, and of these 16,476 were inserted into the herbarium; the remaining were herbaceous specimens not kept in the Arboretum collections. The herbarium now includes a total of 608,732 specimens.

The number of specimens received by exchange, gift, subsidy, purchase, or for identification was 22,585. The greater part of these — 17,519 specimens — was from North and South America, while the remainder may be broken down geographically as follows: from Polynesia, 3,477; from India, 976; from Australia, 314; from Africa, eastern Asia, and Europe, 299. Important acquisitions include about 3,000 specimens, mostly from Hawaii, collected and given by Mr. Otto Degener, 2,807 specimens collected in Cuba by Dr. Richard A. Howard, about 1,300 specimens collected in Idaho by Mr. Arthur Cronquist, 1,047 specimens collected in Mexico by Dr. C. H. Muller, 750 numbers, with duplicates, collected in Mexico by Mr. Robert Stewart, and 2,734 specimens obtained over a period of several years by

Mr. E. J. Palmer, representing cultivated plants growing in the Arboretum.

To other institutions the Arboretum distributed 36,152 specimens; these were necessarily all sent to American institutions this year. Of this number, 26,925 specimens were sent in exchange, while 8,896 specimens were transferred to the Gray Herbarium; the remaining specimens were sent out either as gifts or for identification by specialists. A total of 410 mounted illustrations was transferred to the Gray Herbarium and the Ames Orchid Herbarium at the Botanical Museum. Microfilm to the equivalent value of 1,916 specimens was distributed under a special exchange arrangement. The total number of specimens or their equivalent in mounted illustrations and microfilm distributed by the Arboretum, therefore, was 38,478. Additional thousands of specimens were set aside for shipment to European herbaria after the war.

Twenty-three loans, totaling 2,003 specimens, were made for study by specialists in 15 American institutions. For study by members of the Arboretum staff, 31 loans consisting of 2,280 specimens were borrowed from 12 institutions.

A total of 2,037 cards was added to the catalogue of references to new species and other important literature appertaining to woody plants, this catalogue now consisting of 133,732 cards. The collection of negatives representing types and other critical specimens now totals 4,211, as 73 negatives were added during the year.

Routine herbarium work has been continued under crowded conditions, only the most essential specimens being added to the general herbarium, and the less necessary material being stored in generic order in cardboard cases. Although this material is thus available to students, the need for additional steel cases and space to place them becomes more acute each year. Our accessions show a decrease from the figures of normal years, as expected under the present international conditions. Because of this decrease, the mounting department is now practically up to date. Herbarium work has included routine incorporation of clippings, typed descriptions, and illustrations.

Members of the herbarium staff continued their special studies, with the result that numerous technical papers were prepared for publication, while many identifications were made and various parts of the herbarium were better organized. Professor Rehder brought the bibliographical supplement to his Manual of Cultivated Trees and Shrubs nearly to completion, this comprehensive work so far based on the library resources of the Arnold Arboretum. There remain to be checked a number of references to literature not available here, to be searched for in other libraries. Dr. Smith, in collaboration with Professor Bailey and Dr. Nast, continued his study of ranalian families, also working on special groups of Papuasian, Polynesian, and tropical American plants. Dr. Johnston has continued his work on the flora of the intermontane plateau of northern Mexico, the first part of his report being published, the second part in press, and the third part now being prepared for the printer. Dr. Raup devoted much time to the completion of a report on his Mackenzie Mountain Expedition collections of 1939, which is nearly ready for publication, and to a study of *Salix* from the Hudson Bay and Labrador Peninsula regions. The latter is in press, but, because it became necessary for him to devote much time late in the year to preparation for the Alcan Highway trip, mentioned above, completion of the former must await his return from the field. Dr. Kobuski brought to completion his study of the tropical American members of the genus *Ternstroemia,* and was granted leave of absence for military service in October. Mr. Palmer continued to collect specimens of plants cultivated in the Arboretum, also carrying on his studies of *Quercus* and *Crataegus.* Dr. Allen's studies of the American Lauraceae were extended, especially of Mexico and Central America, and she continued her work on the genus *Halenia.* Dr. Perry has further studied the Papuasian collections assembled by the Richard Archbold Expeditions, and the greater part of this valuable material has now been determined and reported on in this Journal, although certain important groups are still under study. Dr. Croizat continued his studies of the families Cactaceae and Euphorbiaceae, giving special attention to the genus *Croton* in North and South America. Dr. Li studied and identified the material of many families of the large Chinese and Indo-Chinese collections accumulated at the Arboretum, preparing several papers for publication. My own work has been largely in connection with Rafinesque problems, especially the preparation of a comprehensive Index Rafinesquianus, now in rough draft stage and to be checked before the final copy is prepared. I have also supplied data on economic plants to various representatives of our armed forces and have worked with Dr. Li and Dr. Perry on Chinese and Papuasian botanical problems.

Linnaean microfilms. — A most important accession received in 1942 was a complete microfilm record of the Linnaean herbarium specimens and other natural history collections of Linnaeus, together with records of his manuscripts and of all books, including his own volumes, in which he had made marginal annotations. This important record, in the form of a positive microfilm, came as a gift from the Linnaean Society of London. I took some part in the negotiations with the Carnegie Corporation which resulted in a special grant to the Linnaean Society for the purpose of defraying the cost of making this record. The Council of the Linnaean Society, in applying for the grant, offered to deposit a complete microfilm record in some American institution. As a matter of fact, it generously sent two complete sets and later directed me to transmit one set to the Smithsonian Institution in Washington. There are about 160,000 exposures in each set.

For those parts appertaining to the herbarium material, we have had a new negative film prepared from the positive and have arranged to have enlarged prints made so as to have a graphic representation of each herbarium specimen. When the task is completed we will then be able to provide prints at cost to workers in other American institutions who may have problems to solve in reference to the identity of Linnaean types. The films appertaining to the Linnaean types of shells, insects, fishes, and other animals have been deposited in the Museum of Comparative Zoology in Cambridge.

Bibliography. — Dr. Verdoorn edited volumes 8, 9, 10, and 11 of his new series of plant science books and vol. 7 of Chronica Botanica. As he has been in touch with the Botanical Garden at Buitenzorg, Java, since 1930, he has been giving part time service to the Board for the Netherlands East Indies, Surinam and Curaçao in Washington as botanical advisor, and in that capacity he organized the Central Depositary Library for the Netherlands East Indies in New York. The objective here is to assemble all foreign publications that normally would have been received by scientific and technical libraries in the Netherlands East Indies, the plan being to ship these to Java when conditions permit. In connection with the preparation of the Index Botanicorum, card indices to all literature dealing with botanical and horticultural history, bibliography, general biology, and the history of botanical gardens are being prepared. Some ten thousand references have been added to the standard forms on which information regarding individuals is being compiled, and these data have been carefully arranged for ready reference. Chiefly with the objective of gaining more time for historico-botanical investigations, Chronica Botanica will be discontinued as a serial and beginning with volume 8 will appear in book form. The first issue of a new series devoted to the history and methodology of botany and zoology is in press.

The Library. — At the end of the fiscal year the library contained 45,313 bound volumes, 13,322 pamphlets, and approximately 18,900 photographs. Accessions amounted to 191 volumes and 139 pamphlets. The cards added to the periodical and author catalogue numbered 550, of which 150 contained bibliographical information, and 700 slips were added to the files which supplement the printed author and subject catalogues of the library. About 250 volumes have been loaned to other libraries and many have been borrowed for use here, the University messenger service helping greatly in such exchanges. The demand for photostats and microfilms continued to be large, and prints of two of E. H. Wilson's collections of photographs numbering about 300 were made to order and sold. Exchanges of periodicals with foreign countries were even further curtailed due to the risks of shipping.

Atkins Institution of the Arnold Arboretum, Soledad, Cienfuegos, Cuba. — Because of war conditions and restrictions on travel this unit has been operated on a routine basis. It was not possible to assign graduate students to the Atkins Institution for tropical experience even on a fellowship or scholarship basis, partly because of the reduction in the number of graduate students at Harvard University, partly because of restrictions on travel. During the summer and autumn of 1942, further transplantings were made in the palm section, and the temporary foot bridge across the stream was replaced by a more permanent causeway. Because of the unusually dry autumn and early winter, the reservoirs became dry, and advantage was taken of this to remove the accumulated silt. There was at this season an acute shortage of water, the small stream from which water is pumped becoming almost dry. Two springs in the newer parts of the garden were investigated, and this resulted in the development of excellent wells of clear water sufficient for the garden and house requirements. This, however, made it necessary to reorganize the pipe lines throughout the garden, which was in part accomplished. It is indeed fortunate that this additional source of water could be developed within the garden area. In the early spring some of the larger trees were transferred from the nursery to their permanent sites in the garden. Maintenance has been hampered because of lack of gasolene for the power mower. At the request of the United States Department of Agriculture, a nursery plot for *Hevea brasiliensis* was prepared and one shipment of 200 budded stumps was received from Costa Rica. This shipment was unfortunately delayed in transit, the resulting growth being poor. Over 400 pounds of *Cryptostegia grandiflora* seeds were supplied to the same organization and to the Bureau of Economic Warfare. Conditions being what they are, only 174 packets of seeds were shipped in exchange and 79 packets were received. The rainfall for the year was 49.29 inches, and the lowest temperature recorded was 45°, on February 24, 1943.

Publications. — The usual numbers of the Journal were published, the new and more compact format adopted at the beginning of 1942 permitting the publication of more material per number. The new publication Sargentia, the name honoring Dr. Charles Sprague Sargent, continuing the Contributions from the Arnold Arboretum, received an auspicious beginning with three numbers. The first of these, published in July, included Dr. Smith's study of the important Fijian collections assembled in 1940–41 by Mr. Otto Degener, on the Pacific cruise of the "Cheng Ho," sponsored by Mrs. Anne Archbold. In October Dr. Li's comprehensive monograph of the family Araliaceae in China was published. Number three, appearing in January, contained a revision of the genus *Sabia*, by Dr. Luetta Chen, and an extended discussion of the genus *Ormosia* in China and Indo-China, by Dr. Chen and myself. A fourth number of Sargentia, with articles by Dr. Raup and Dr. A. E. Porsild, is now in press. Arnoldia was issued as usual, and its mailing list was revised. A bibliography of the published papers by staff members and students follows.

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Staff of the Arnold Arboretum, 1942–43

Elmer Drew Merrill, S.D., LL.D., Arnold Professor of Botany and Director.

John George Jack, Assistant Professor of Dendrology, Emeritus.

Alfred Rehder, A.M., Associate Professor of Dendrology and Curator of the Herbarium, Emeritus.

Joseph Horace Faull, Ph.D., Professor of Forest Pathology, Emeritus.

Irving Widmer Bailey, S.D., Professor of Plant Anatomy.

Karl Sax, Ph.D., Professor of Cytology.

Paul Christoph Mangelsdorf, S.D., Professor of Botany.

Albert Charles Smith, Ph.D., Curator of the Herbarium.

Ivan Murray Johnston, Ph.D., Associate Professor of Botany.

Hugh Miller Raup, Ph.D., Assistant Professor of Plant Ecology.

Clarence Emmeren Kobuski, Ph.D.,* Assistant Curator of the Herbarium.

Donald Wyman, Ph.D., Horticulturist.

Ernest Jesse Palmer, Collector and Research Assistant.

Caroline Kathryn Allen, Ph.D., Assistant in the Herbarium.

Lily May Perry, Ph.D., Technical Assistant.

Leon Croizat, J.D., Technical Assistant.

Frans Verdoorn, Ph.D., Bibliographer.

Armando Dugand, Ph.D., Research Associate.

Charlotte Georgia Nast, Ph.D., Curator of Wood Collections.

Hui-Lin Li, Ph.D., Technical Assistant.

Janet Ryther Sellars, A.B., Librarian.

Vladimir Constantin Asmous, A.B., Assistant Librarian.

Susan Delano McKelvey, A.B., Research Assistant.

Constance Mansfield Gilman, Business Secretary.

Louis Victor Schmitt, Superintendent.

William Henry Judd, Propagator.

* On leave of absence for service in the U. S. Army.

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Synonyms are printed in *italics;* new names in **bold-face** type.