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JOURNAL
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A SYNOPSIS OF ACMENA DC., A VALID GENUS OF THE MYRTACEAE[1]

E. D. MERRILL AND L. M. PERRY

THE GENERIC NAME *Acmena*, first appeared in Dict. Class. Hist. Nat. **11:** 401 (repr. 5. 1826). 1827, as a *nomen nudum*, "*Acmena*, D.C. (*Metrosideros floribunda*, Smith.)." One year later it was adequately described in the Prodromus, **3:** 262. 1828, together with two species and one variety. The deCandollean concept was generally accepted until 1841 when Wight, Ill. **2:** 10–12, in a synopsis of the Indian Myrtaceae of the tribe Myrteae, reduced *Acmena* DC. to a subgenus of *Eugenia* Linn. Unfortunately he misinterpreted its characters, assigning to it certain Asiatic clavate-flowered species of *Eugenia* Linn., *sensu latiore*, so that *Acmena, sensu* Wight, is distinctly different from *Acmena* DC. Although in his remarks on genera and species he gave no reason for this interpretation, he later (p. 15) explained under *Eugenia zeylanica*: "This plant agrees so well with the character of *Acmena parviflora* (DC.) that I have no hesitation in quoting that as a synonym, a view in which I am further confirmed by the character of the fruit of *A. floribunda, β, elliptica* — viz. 'bacca globosa alba' which accurately describes that of E. (*A.*) *Zeylanica.*" However, Wight apparently based his conclusion on external fruit-characters for he regarded the significant character of the fruit as described by de Candolle "cotyledonibus conferruminatis" as unsatisfactory; this character did not at all apply to the fruits of the Asiatic clavate-flowered species that Wight erroneously placed under *Acmena*. Attention is called to the fact that *Acmena* ? *parviflora* DC. cannot possibly represent the type of the genus *Acmena* for de Candolle placed it here with doubt; it is a flowering specimen and probably represents a species of *Syzygium*.

[1]Prepared under a grant from the William F. Milton Fund and the Joseph H. Clark bequest, Harvard University.

De Candolle's work on this complex group of closely associated genera was remarkably well done, considering the comparatively little material that was available to him. Yet in his diagnosis of *Acmena* the floral elements are not sufficiently defined, for he overlooked the striking anther-characters although he did note and indicate the one other character, the "cotyledonibus conferruminatis" by which *Acmena* is distinguished from other types that have been placed under *Eugenia, sensu latiore.*

Walpers, Repert. **2:** 181. 1843, accepted Wight's erroneous interpretation of *Acmena* treating it as a genus rather than as a subgenus and in the relatively few times it has appeared since (Bentham, Jour. Bot. Kew Gard. Miscel. **4:** 118. 1852, Fl. Hongk. 119. 1861; Thwaites, Enum. Pl. Zeyl. 118. 1859, Harvey, Gen. S. Afr. Pl. ed. 2, 112. 1868), it carries this concept except in Hook. Bot. Mag. **90:** *t. 5480.* 1864. Bentham, Fl. Hongk. l. c. characterized *Acmena* DC. as having the "characters of *Syzygium*, except that the calyx-tube is elongated and tapers to the base," and added, "A genus which, if limited as proposed by Wight (as a section of *Eugenia*) comprises several Asiatic species, besides one or two Australian ones, to which last others would confine the group. It is probable, however, that most of the species should be united with *Syzygium.*" Five years later, Fl. Austral. **3:** 280. 1866, he included *Acmena* DC. in the synonymy of *Eugenia* Linn.

Bentham's comment on this small genus, Jour. Linn. Soc. **10:** 162, 163. 1869, is helpful in establishing the identity of de Candolle's first species and also in directing attention to the *original concept* of the genus. He states: "*Acmena,* DC., was founded upon what was supposed to be the *Metrosideros floribunda,* Sm., with a *Syzygium* calyx and fruit, but with 5 very small free petals; but, owing to the imperfect materials he possessed, and the deficiency of authentic specimens, DeCandolle had confounded three very different plants: — 1. The true *Metrosideros floribunda* of Smith, with really 5-merous flowers, which has a capsular fruit, and is the *Angophora intermedia,* DC. 2. The plant figured by Ventenat as Smith's *M. floribunda,* which is a true *Eugenia* of the section *Syzygium* (that is to say, it has the *Syzygium* inflorescence and calyx) . . . : in reducing it, with other *Syzygia,* to *Eugenia,* I have not been able to keep up the specific name of *floribunda,* preoccupied in the larger genus, and I have entered it in the 'Flora Australiensis' under that of *E. Ventenatii.* 3. *Eugenia elliptica,* Sm., which is *Acmena floribunda β. elliptica,* DC., and is in every respect a *Syzygium* with the petals always united in a small flat calyptra. This species, with very much the habit of *E. Ventenatii, is remarkable for its*

anthers with divaricate cells — a solitary exception, as far as hitherto observed, in the whole vast genus Eugenia, and which in this instance appears to have been overlooked by all botanists except F. Mueller (Italics ours). Here, again, I have been unable to keep up the original specific name, which was preoccupied, and have given it that of *E. Smithii.*" Dr. W. R. Philipson of the British Museum has most kindly checked *Metrosideros floribunda* Sm. recently for us and finds it to agree with their specimens of *Angophora intermedia* DC. We have no authentic material of the plant figured by Ventenat as *Metrosideros floribunda* Sm. and are thus not in a position to say what is its true identity; certainly the plate (Vent. Jard. Malm. *t. 75*) closely resembles material collected from plants of *Eugenia elliptica* Sm. cultivated in European gardens, and Sir William J. Hooker evidently thought likewise, for, Bot. Mag. **90:** *t. 5480,* he comments on the fact that "*Eugenia elliptica* . . . figured by Sims . . . is destitute of flowers, while, on the other hand, the fruit was unknown to Ventenat, who has well represented a flowering specimen." One statement from Ventenat's description in favor of Bentham's interpretation is "Anthères . . . s'ouvrant latéralement." The third plant mentioned in Bentham's discussion of *Acmena* DC., *Eugenia elliptica* Sm., undoubtedly belongs to de Candolle's genus.

In view of the evidence pointing to the fact that de Candolle associated non-congeneric materials in *Acmena* DC., we appealed to Professor B. G. P. Hochreutiner, Director of the Botanic Garden at Geneva for assistance. He graciously loaned us fragments of the three specimens representing *Acmena floribunda* DC. in the Prodromus Herbarium: 1. Jardin de Mr. Fulchiron (or Fulchiton), 1827; 2. Jardin des Plantes, h. pl. prair. XII, i. e. Prairal, ann. XII, Prairal being one of the months of the French republican calendar established in 1793, the date corresponding to April-May, 1804; and 3. *Sieber 598.* All of these unquestionably represent a single species and are readily identifiable. Possibly they are varietally distinct from *Eugenia elliptica* Sm. but we strongly doubt it. De Candolle separated the species and the variety on leaf-outline which we have found to be a fickle character at times. Unfortunately, even though his material and his descriptions all may be embodied in a single concept, the binomial *Acmena floribunda* DC. will have to be excluded because it was based nomenclaturally on *Metrosideros floribunda* Sm. = *Angophora intermedia* DC. The plant which de Candolle erroneously accepted as *Metrosideros floribunda* Sm., not being specifically distinct from *Acmena floribunda β. elliptica* DC. we have no choice but to accept the latter as actually typifying the genus. The second species, *A. ? parviflora* DC., manifestly cannot be the type as

de Candolle was not certain that it belonged in *Acmena;* it is probably a *Syzygium.*

Two other names, *Lomastelma* Raf. and *Xenodendron* Laut. & K. Schum., have been proposed for the genus. Owing to the rarity of Rafinesque's publications, we quote below the entire paragraph, Sylva Telluriana, 107. 1838, devoted to this particular entity. Article "657. LOMASTELMA Raf. (edge crown) diff. Eugenia, cal. integro repando non 4fido, bacca globosa monosp. — Type *L. elliptica* Raf. Eug. do Sm. & c. Australian Shrub." Apart from the cross-references to this genus as a synonym of *Eugenia* Linn. in Dalla Torre & Harms, Genera Siphonogamarum, and in Index Kewensis where also *Lomastelma elliptica* Raf. is listed as "= E. venosa?", we have been unable to find any further consideration of the name. Rafinesque's treatment is a purely bibliographic one, as there is no reason to believe that he saw any material representing Smith's species. *Lomastelma* Raf. is antedated by *Acmena* DC. by ten years.

The genus *Xenodendron* with the type-species *X. polyanthum* was independently described by Lauterbach and K. Schumann, Fl. Deutsch. Schutzgeb. Südsee, 461. *t. 16.* 1901, and because of their erroneous interpretation of certain morphological characters it was placed in the Sonneratiaceae (Crypteroniaceae). The proposed new genus attracted no attention until Professor L. Diels, Director of the Botanic Garden at Berlin, in a very illuminating paragraph, Bot. Jahrb. **57:** 414. 1922, emending both the original description and the errors of the plate, removed it from obscurity and re-established it with clearly defined characters in the Myrtaceae (its true alliance being with *Eugenia* Linn. *sensu latiore*). The genus, as originally described, was characterized by polygamous flowers with cupulate or scarcely dentate calyx, stamens (see *t. 16*) indefinite and in an interrupted row before the petals, filaments short, anthers minute, *anther-sacs orbicular* and *extrorsely dehiscent by a central pore,* and a rudimentary narrowly pyriform pistil. With Schlechter's better material for study and with access to the type of *Xenodendron,* Professor Diels has noted that the flowers are hermaphroditic, whether or not polygamous is questionable, very small calyx-lobes are present (not shown in *t. 16*), the stamens are not interrupted but are equally distributed on the calyx-tube just inside the calyx-lobes and the petals, and the central part of the figure of the flower (*t. 16*) is not a rudimentary pistil but rather the style of the gynoecium. Although at the time Professor Diels' paper was published the fruit was still unknown, the character of *Xenodendron* are so clearly defined that we can only consider it to be a synonym of *Acmena* DC. as we interpret the latter.

Just as the distinctive characters of the anthers together with the other floral features, as assigned to the genus by Professor Diels, correcting the erroneous original description, gave *Xenodendron* some significance; likewise, in our study of the Chinese and the Bornean species of *Eugenia* Linn., *sensu latiore*, the characters of the anthers and the puzzling structure of the fruits of *Eugenia subdecurrens* (Miq.) Merr. & Chun were our clues when searching for a group to which it seemed expedient to transfer this species. Beginning our work with the broader concept of *Eugenia* Linn., along with our revision of the Bornean species, we hoped to discover what, if any, segregate genera were tenable. A number of these were proposed long ago and later reduced, but in a few cases these generic names now tend to appear rather frequently in some contemporary studies. In previous discussions of the differences (or the lack of them) between these genera, such as *Syzygium* Gaertn. *Jambosa* DC., and *Eugenia* Linn., much has been said concerning the weakness of the calyptrate character of the corolla; yet, only a few workers have mentioned, even incidentally, the oriental group characterized by strictly calyptrate calyces. For this group we have reinstated the generic name *Cleistocalyx* Blume.[1]

Again, owing to the paucity of fruiting collections complementary to the relative abundance of flowering material in herbaria, little attention has been given to the fruit characters. It has been our good fortune to have at hand enough specimens with sufficiently mature fruits to compare the structure of the developed embryos in at least half the species represented. This character, with correlative ones, seems to provide a reasonably good basis for generic segregation. To be sure, very often more collections are desirable to confirm our deductions; nevertheless, when one is sufficiently familiar with the group, in some instances at least, it is possible to predict within definite limits the type of embryo which will develop within the seed from a certain type of flower. In most fruits the embryo readily separates into two cotyledons revealing a minute or an elongated hypocotyl concealed between them; but, in the fruits of *Eugenia subdecurrens* (Miq.) Merr. & Chun we were greatly puzzled by its structure. We scanned the descriptions of the species under its various names hoping to find some explanation of this particular kind of embryo and incidentally searching for some clue to its relatives and to its position within the genus. Most authors have been content to leave it in *Eugenia, sensu latiore*, but de Candolle, Wallich,

[1] **Merrill, E. D.** and **Perry, L. M.** Reinstatement and revision of Cleistocalyx Blume (including Acicalyptus A. Gray), a valid genus of the Myrtaceae, Jour. Arn. Arb. **18:** 322-343. *t. 215*. 1937.

Miquel, and Gibbs, under one name or another placed it in *Syzygium;* and yet it utterly lacks the calyptrate petals, the most emphasized distinguishing character of *Syzygium, sensu strictiore.*

We found that Koorders & Valeton, Meded. Lands Plant. **40:** 158. 1900 (Bijdr. Boomsoort. Java, **6:** 158), after describing the fruit continued as follows, "Semen immaturum magnum, structura singulari, placenta arboriformi-ramosa ex apice (hilo) ad medium usque intrusa, cotyledonibus conferruminatis intus multilobatis arcte accreta." This is an adequate word-picture of the structure of the young embryo, although, without some knowledge of its mode of growth and development, or a morphological study based on fresh material, it is rather difficult to interpret in modern morphological terms. We suggest that the part which is designated as placenta is possibly hypocotyl; yet, we cannot be sure whether the many-lobed structures extending forward from this are primordial leaves infolded in cotyledonary tissue or cotyledons imbedded in "endosperm" or whether the true explanation is widely at variance with both of these suggestions. The first interpretation is more in keeping with the accepted idea of endosperm lacking (in this group of genera) and cotyledons conferruminate or cotyledons closely combined, as given in descriptions where cotyledons are mentioned at all. In the young embryo, the outer surface is chiefly smooth and shows an apparent line of division ordinarily to be interpreted as the commissure of the cotyledons; inside a much branched structure extends more or less irregularly in all directions, the cotyledons in turn being lobed within to dovetail with this making in all usually a compact body in which the parts may be recognized by the differences in color (dried embryo soaked in water to examine the structure). As the embryo approaches maturity the lobes tend to separate leaving open spaces within. The older embyros, at least after drying, are somewhat wrinkled, sometimes outwardly appearing as if a line of cleavage were present; still, in cross section, the cotyledons apparently are grown together. The seed-coat seems to adhere very closely to the pericarp; or, if this thin layer is not the seed-coat, it has disappeared, since the naked embryo falls out when the outer or fleshy portion is cut open; we know that it was present on the campylotropous ovule. Although Koorders and Valeton gave a full description of this fruit under *Eugenia acuminatissima* Kurz, they figured, Atlas Baumart. Java, **3:** *f. 507.* 1915, that of another very closely related species, *E. melanosticta* (Miq.) Koord. & Val. An examination of the figure of the latter shows such marked resemblance in so many details that it is impossible to doubt their close relationship and the fact that they should be treated as congeneric.

Granting then that in *Eugenia acuminatissima* Kurz and *E. melanosticta* Koord. & Val. this distinctive structure of the embryo is sufficient for generic segregation and realizing the precariousness of genera not characterized by habit or floral structure, we carefully examined the flowers for correlative characters and found that the anthers were also unique within the genus *Eugenia*. In those species having the peculiar embryo-characters above mentioned, *the anther-sacs are almost globose, somewhat divaricate and open by a terminal slit or pore;* whereas, in other species of *Eugenia* (including *Syzygium* and *Jambosa*) *the anther-sacs are parallel and open longitudinally*. Our Bornean material contains a third species with immature flowers but with habit so characteristic that we dissected a bud fully expecting to find subglobose anthers with divaricate anther-sacs and terminal dehiscence and our expectations were verified.

Three Australian species also appear to be congeneric. One wide-ranging species of that continent, *Eugenia Smithii* Poir. (*Eugenia elliptica* Sm.), fairly well represented in our herbarium by both flowering and fruiting specimens has attracted some attention. Bentham, Fl. Austral. **3:** 282. 1866, described the anthers as "small, with distinct globular divaricate cells" and added: "The anthers with divaricate cells are, so far as hitherto observed, exceptional in the genus." This comment has been repeated in other publications, and when F. M. Bailey, Queensl. Fl. **2:** 657. 1900, described the flowers of *E. hemilampra* F. v. Muell. ex Bail., he observed, "Anthers with globular divaricate cells, as in *E. Smithii*." *Eugenia Smithii* Poir. was originally characterized as *E. elliptica* by Sir J. E. Smith, Trans. Linn. Soc. **3:** 281. 1797, who, on account of the structure of the fruit, remarked, "No plant in this order has given me so much trouble, to determine its genus, as this." The structure of the fruit of the Australian material is, we believe, comparable to that of *E. subdecurrens* (Miq.) Merr. & Chun, although there is a more definite cleavage between the lobed structures and the cotyledons outside; then too, in the former, at least in the dried material of what seems to be fairly mature fruit, is an apparent line of division which perhaps is fair evidence that these are cotyledons; at any rate it explains why the cotyledons have been described as closely combined. Baron von Mueller published an excellent illustration of the habit, flower, stamens and fruit of this species under the name *Syzygium brachynemum* F. v. Muell. Pl. Colony Victoria, Lithograms, Suppl. *t. 18*. 1864–65; this and the plates of *E. melanosticta* (Miq.) Koord. & Val. and *E. brachyandra* Maiden & Betche, Fl. N. S. Wales, **8:** *t. 275*. 1923, are the only pictorial representations in which the structure of the fruit is shown.

Here then are six apparently congeneric species belonging to the tribe Myrteae and closely associated with *Eugenia Linn.* sensu latiore, which, if considered as a unit, range from Burma, southern China, Hainan, Siam and the Malay Peninsula to Sumatra, Java, Timor, Borneo, the Philippines, New Guinea, the Solomon Islands and Australia. Holding these in reserve while continuing the main course of our work scrutinizing specimens and scanning various publications on the Myrtaceae for synonyms, noting remarks on generic differences, and comments on species, we located the three generic names discussed above, *Acmena* DC., *Lomastelma* Raf. and *Xenodendron* Laut. and K. Schum., which we interpret as applying to the same natural group, and one readily distinguished from *Eugenia, sensu latiore*, by both seed and floral characters. We accept *Acmena* DC. as the oldest valid name for this genus, and reduce the other two to synonymy.

The summary given below includes eleven species which have come to our attention at this time; doubtless there are more masquerading under *Eugenia*. We have examined the collections of the New York Botanical Garden, the Bornean material and some Javan specimens in the Buitenzorg Herbarium, United States National Herbarium, Gray Herbarium and Arnold Arboretum, also a few unnamed Bornean specimens from the Rijks Herbarium. We have scanned Ridley's descriptions of *Eugenia* based on the Wollaston New Guinea Expedition material for possible *Acmena* species. Through the courtesy of Dr. J. Ramsbottom, Keeper of Botany, British Museum, Mr. C. A. Weatherby, Senior Curator of the Gray Herbarium, obtained for us one flower of each of six species collected on this trip and described by Ridley as having globose or subglobose anthers. Two of these, which we had strongly suspected to belong in *Acmena* DC. prove to represent the genus. Others suggesting the genus, but known to us only by the original description, are omitted owing to their imperfect characterizations. No natural sequence of the species can be given until more is known of the structure of the fruits of the various species; further, until more material is available to show variable as well as constant features, the key must necessarily be drawn up on superficial characters shown in the few collections we have representing eight species and such distinctive characters as we could find in the descriptions of the other three.

Acmena DC. Prodr. **3:** 262. 1828; Reichenbach, Consp. 176. 1828; Bartling, Ordin. 332. 1830; Don, Gen. Syst. **2:** 851. 1832; Spach, Vég. Phan. **4:** 173. 1835; Meisner, Gen. 108 (77). 1837; Endlicher, Ench. Bot. 651. 1841; Brongniart, Enum. Gen. 123. 1843; Lindl. Veg. Kingd. 738. 1847; Hook. Bot. Mag. **90:** *t. 5480*. 1864.

Lomastelma Raf. Sylv. Tellur. 107. 1838.
Xenodendron Laut. & K. Schum. Fl. Deutsch. Schutzgeb. Südsee, 461, *t. 16.* 1901; Engler & Prantl, Nat. Pflanzenfam. Ergänzungsh. **2**: 239 *f. 33.* 1907; Diels, Bot. Jahrb. **57**: 414. 1922.

Flores parvi, hermaphroditi, saepius quinquepartiti; calyce turbinato, tubo ovario adnato, limbo truncato-undulato vel in lobos brevissimos latos in alabastro subinvolutos diviso. Petala minutissima, libera, vel in calyptram subdepressam deciduam connata. Stamina indefinita, saepius in seriebus paucis disposita; filamentis brevibus, flexuosis; antheris minutis, loculis subglobosis, divaricatis, *rima vel poro apicali dehiscentibus*. Ovarium inferum, *2–3*-loculare; ovulis paucis, campylotropis; stylo cylindrico-pyriformi vel subcylindrico deorsum paullo incrassato. Bacca subglobosa, calycis limbo plus minusve orbiculari coronata, monosperma, testa pericarpio adnata; *cotyledonibus conferruminatis intus plurilobis* (de quo cf. notas in praefatione). Arbores glabrae vel parce puberulae. Folia integra, opposita, vel subopposita, vel ad rationem revera alternatam vergentia; glandulis oleiferis conspicuis vel obscuris. Inflorescentia terminalis vel axillaris; floribus paniculatis, in ramulis ultimis in triadibus dispositis.

Although in general appearance the several representatives of this genus strongly suggest the small-flowered species of *Syzygium* Gaertn. as we interpret it (including *Jambosa* DC., and *Eugenia* Linn., *pro parte*, as to most of the Old World species) the group is sharply delimited by the distinctive characters of the anther-sacs (subglobose, divaricate, opening by a terminal pore or slit) and the singular character of the embryo, the conferruminate cotyledons being very distinctive. The genus is thus readily recognizable from both flowering and fruiting material. In *Syzygium* Gaertn. as we have interpreted it, to include *Jambosa* DC. and most of the Old World species that have been placed in *Eugenia* Linn. the anthers open by lateral valves, and the cotyledons are not coherent. Because of the imperfect characterization of *Acmena* DC. (the conferruminate cotyledons stressed but the striking anther characters not mentioned), the very sketchy characterization of the genus *Lomastelma* Raf., in which no really striking differential character is indicated, and the very erroneous original description of *Xenodendron* Laut. & K. Schum., we have considered it expedient to prepare the new generic description as given above.

The eleven recognized species extend from the Andaman Islands, Tenasserim, Siam, and southeastern China through Malaysia, including the Philippines, to the Solomon Islands, and northern, eastern and southern Australia.

KEY TO THE SPECIES

A. Rachis and branches of the inflorescence finely puberulent.
  B. Leaves subcoriaceous; acumen about one-fourth as long as the blade; base acute; petiole and midrib beneath minutely puberulent (Papua) .....1. *A. polyantha.*
  B. Leaves coriaceous; acumen about one-third as long as the blade; base obtuse; petiole and midrib glabrous beneath (Borneo). *2. A. caudata.*

A. All parts glabrous.
  C. Leaves with a long slender acumen; pericarp hard when dry.
    D. Branchlets 4-angled and strongly marginate; calyx definitely pustulate (Java) .....3. *A. melanosticta.*
    D. Branchlets compressed or if occasionally 4-angled not at all marginate; calyx not pustulate (Indo-Malaysia). 4. *A. acuminatissima.*
  C. Leaves short-acuminate; pericarp usually easily broken when dry, hard in *A. brachyandra* (Australia; fruit unknown in Papuan species).
    E. Stamens twice as long as the petals.
      F. Leaves chiefly with a slender cuneate base; primary veins ascending.
        G. Branchlets terete or slightly compressed; leaves with a secondary submarginal vein, not glandular-punctate (Australia) .....8. *A. divaricata.*
        G. Branchlets sulcate or 4-angled with lines running down from the base of the petioles; leaves with a single submarginal vein, glandular-punctate.
          H. Leaves thick-coriaceous, up to 11 cm. long; fruit crimson (fide Bailey) (Australia) 5. *A. hemilampra.*
          H. Leaves coriaceous, up to 5 cm. long; fruit purplish (Australia) .....6A. *A. Smithii* var. *minor.*
      F. Leaves with an acute or obtuse base; primary veins somewhat spreading; branchlets terete, often glandular-pustulate (Australia) .....6. *A. Smithii.*
    E. Stamens about as long as the petals.
      I. Leaves cuneate or acute at the base; venation obvious.
        J. Leaves lanceolate to lance-elliptic; oil-dots obscure or wanting.
          K. Flowers sessile.
            L. Branchlets angled, with raised lines running down from the base of the petioles; leaves lanceolate, with primary veins spreading-ascending and impressed above, often forking before joining the submarginal vein; secondary veins almost as obvious as the primary ones (Australia). *7. A. brachyandra.*

L. Branchlets compressed or terete; leaves oblong to lance-elliptic, venation open; primary veins arcuate-ascending and not impressed above; secondary venation inconspicuous (Australia). 8. *A. divaricata.*

K. Flowers pedicellate (Papua) .....9. *A. dispansa.*

J. Leaves broadly elliptic, sprinkled with minute oil-dots (Papua) .....10. *A. Dielsii.*

I. Leaves rounded at the base; venation obscure (Papua). 11. *A. laevifolia.*

1. **Acmena polyantha** (Laut. & K. Schum.) comb. nov.

Xenodendron polyanthum Laut. & K. Schum. Fl. Deutsch. Schutzgeb. Südsee, 461, *t. 16.* 1901; Engler & Prantl, Nat. Pflanzenfam. Ergänzungsh. **2**: 239, *f. 33.* 1907; Diels, Bot. Jahrb. **57**: 415. 1922.

New Guinea, Sattelburg, *Bamler 5* (fragm., type of *Xenodendron polyanthum,* Berlin Bot. Gard.); Mount Kani, *Schlechter 16736* (fragm., Berlin Bot. Gard.).

Through the courtesy of Professor Diels, Director of the Botanic Garden at Berlin, we have been enabled to examine a fragment of the type material of *Xenodendron* of which *X. polyanthum* Laut. & K. Schum. is the type-species. The plant unquestionably belongs to the genus *Acmena* DC. The leaves closely resemble those of *A. acuminatissima* (Blume) but are somewhat thinner in texture; the petiole and the midrib on the lower surface of the blade as well as the branchlets of the inflorescence are finely puberulent; probably the branchlets are also puberulent; this is true in *A. caudata* Merr. & Perry, a Bornean species with glabrous leaves but with puberulent branchlets and axes of the inflorescences; this same type of puberulence is also found in some species of *Syzygium.*

2. **Acmena caudata** sp. nov.

Arbuscula ± 6 m. alta; ramis teretibus, plerumque glabris; ramulis ultimis teretibus vel leviter compressis, minute puberulis, circiter 1 mm. diametro; foliis lanceolatis vel anguste ovatis, 4.5–9 cm. longis, 1.5–3 cm. latis, apice anguste obtuseque acuminatis, acumine ± 2 cm. longo, basi obtusis vel subrotundatis, supra olivaceo-viridibus, costa impressa, venis venulisque vix perspicuis, subtus pallidioribus, nigro-punctatis, costa elevata, venis primariis inconspicuis 2–4 mm. remotis, venulis ± obscuris; petiolo ± 3 mm. longo, graciliter ruguloso; inflorescentiis axillaribus terminalibusque, late ramosis, usque ad 11 cm. longis, rachi puberulo atque etiam ramis ramulisque gracilibus; alabastris sessilibus, obconicis, deorsum gradatim valde attenuatis, 3.5(–4.5) mm. longis, calycis lobis minutis vel tubo truncato.

DUTCH BORNEO, Western Koetai, near Kemoel, *Endert 3922* (type, Herb. Buitenzorg), at ± 1600 m. alt.

This species strongly resembles *A. acuminatissima* (Blume) both in habit and in technical characters; yet, it is readily distinguished by the finely puberulent branchlets and inflorescence; the leaves are somewhat more closely veined and less tapering at the base than in the latter species and the slender branches of the inflorescence tend to be divaricate. None of the flowers are in full anthesis, nevertheless, a dissection of the bud shows the stamens with the anthers typical of this genus.

3. **Acmena melanosticta** (Miq.) comb. nov.

Jambosa melanosticta Miq. Fl. Ind. Bat. **1**(1): 432. 1855.
Eugenia melanosticta Koord. & Val. Meded. Lands Plant. **40**: 159. 1900 (Bijdr. Boomsoort. Java, **6**: 159); Koord. Exkursionsfl. Java, **2**: 683. 1912; Koord.-Schumach. Syst. Verzeichn. **1**(1^{222}): 56. 1913; Koord. & Val. Atlas Baumart. Java, **3**: *f. 507*. 1915.

WESTERN JAVA, Preanger, Pangentjongan, *Koorders 5700β, 5671β, 13960β, 14072β, 30251β*, herb. Buitenzorg.

A species closely related to *A. acuminatissima* (Blume), but differing in the strongly margined 4-angled branchlets, the shorter petioles, the more or less obscure submarginal vein very close to the margin, and the profusely but minutely pustulate calyx.

4. **Acmena acuminatissima** (Blume) comb. nov.

Myrtus acuminatissima Blume, Bijdr. 1088. 1826.
Syzygium ? acuminatissimum DC. *Prodr.* **3**: 261. 1828.
Syzygium altissimum Wall. List, no. 3588. 1831, *nomen nudum*, fide Kurz et Duthie.
Jambosa acuminatissima Hassk. Cat. Hort. Bogor. Alt. 262. 1844; Miq. Fl. Ind. Bat. **1**(1): 438. 1855.
Syzygium subdecurrens Miq. Fl. Ind. Bat. **1**(1): 449. 1855.
Eugenia acuminatissima Kurz, Rep. Pegu, App. A. lxiii. 1875, Jour. As. Soc. Bengal, **46**(*2*): 67. 1877, For. Fl. Brit. Burma, **1**: 487. 1877; Duthie in Hook. f. Fl. Brit. Ind. **2**: 483. 1878; Forbes & Hemsl. Jour. Linn. Soc. Bot. **23**: 296. 1887; Koord. & Val. Meded. Lands Plant. **40**: 155. 1900 (Bijdr. Boomsoort. Java, **6**: 155); King, Jour. As. Soc. Bengal, **70**(*2*): 126. 1901 (Mater. Fl. Malay. Pen. **3**: 556); Dunn & Tutcher, Kew Bull. Add. Ser. **10**: 105. 1912; Koord. Exkursionsfl. Java, **2**: 683. 1912; Koord.-Schumach. Syst. Verzeichn. **1**(1^{222}): 39. 1913; Koord. & Val. Atlas Baumart. Java, **3**: *f. 506*. 1915; Ridl. Fl. Malay Pen. **1**: 747. 1922, Jour. Bot. **68**: 34. 1930; non Miq. (1847), nec Berg (1857–59).
Eugenia Cumingiana Vidal, Phan. Cuming. Philip. 173. 1885; Craib, Fl. Siam. Enum. **1**: 636. 1931.
Eugenia saligna sensu C. B. Rob. Philip. Jour. Sci. Bot. **4**: 392. 1909; Merr. Jour. Str. Branch Roy. As. Soc. **77**: 224. 1917, **79**: 20. 1918,

Enum. Born. Pl. 433. 1921, Enum. Philip. Pl. **3**: 176. 1923, Lingnan Sci. Jour. **5**: 137. 1927, Univ. Calif. Pub. Bot. **15**: 216. 1929; non *Jambosa saligna* Miq.

Syzygium Cumingianum Gibbs, Jour. Linn. Soc. Bot. **42**: 76. 1914.

Eugenia attenuatifolia Merr. Philip. Jour. Sci. **18**: 299. 1921.

Eugenia eucaudata Elm. in Merr. Enum. Philip. Pl. **3**: 176. 1923, in syn.

Eugenia subdecurrens Merr. & Chun, Sunyat. **2**: 289. 1935.

SOUTH ANDAMAN, Bumlitan, *King's collector s. n.*: TENASSERIM, *Helfer 2393*: SIAM (fide Craib): SOUTHERN CHINA, Kwangtung, Shi-wan-da-shan, *Tso 23424;* Ting Wu Shan, *Tsiang 1530, 1565, Chun 6379, Liang 60316;* Sunyi District, *Wang 31838;* Hongkong, *Ford 21* (phot. of spec. in Kew Hb.); Kwangsi, Seh-feng, Dar Shan, South Nanning, *Ching 8266;* HAINAN, *Liang 63367, 63371, 63438, 63692, 64736, 65256, 65331, Wang 33232, 34486;* Yaichow, *Liang 62212, 63277, How 70354;* Po-ting, *How 73046, 73405;* Five Finger Mountain, *McClure 2141 (C. C. C. 8682)*; Ka Chik Shan and vicinity, Ch'ang-kiang District, *Lau 2910;* Ue Lung Shan, *Lau 3165;* Lin Fa Shan, Lam Ko District, *Tsang 381 (L. U. 15880)*: MALAY PENINSULA, Gopeng, *King's collector 4331;* Pulau Boetong, *Curtis 654*: SUMATRA, *Forbes s. n., 1662, 2848a, 2872*: BANCA, *Horsfield s. n.*: BORNEO, British North Borneo, Upper Kinabalu, Gurulau Spur, *Clemens 59878;* Penibukan, *Clemens 50269;* Tenompok, *Clemens 26865, 28369, 29346, 29773, 29942, 29942a, 29991, 29995;* Tawao, *Elmer 21723;* Karukan, *Goklin (B. N. B. Forestry Dept. 3024)*; Sarawak, near Kuching, *Haviland 2931;* Mattang, *Beccari 1547;* Baram District, Miri River, *Hose 533;* Samatan, *Foxworthy 143;* Cotta di Santubong, *Beccari 2177;* Dutch Borneo, Balikpapan, Mentawir, *Atjil 34 (Boschproefstation bb 13926)*; Asem-Asem, near Pleihari, *Dachlan 1176, Delmaar 1147, Verkenner s. n.;* West Koetai, near Tg. Gsoei, *Endert 1938;* near L. Petah, *Endert 3472;* near M. Moentai, *Endert 2007*: PHILIPPINE ISLANDS, Luzon, Bataan Province, Lamao River, Mt. Mariveles, *Whitford 1198, 1228, Borden (For. Bur. 811, 2385), Meyer (For. Bur. 2406, 2628, 2801, 2807, 3004)*; Lamao Forest Reserve, *Curran (For. Bur. 6248, 6269)*; Batangas Province, *Ramos (Bur. Sci. 22456)*; Benguet Province, Baguio, *Elmer 8748;* Camarines Province, Paracale, *Alambra (For. Bur. 34336)*; Ilocos Province, *Paraiso (For. Bur. 23607)*; Isabela Province, *Barros (For. Bur. 26099)*; Laguna Province, *Ramos (Bur. Sci. 20411), McGregor (Bur. Sci. 23034), Mabesa (For. Bur. 23790)*; Los Baños (Mt. Maquiling), *Elmer 17802;* Pampanga Province, Mount Arayat, *Ramos (Bur. Sci. 22443)*; Principe-Tayabas Province, Baler, *Merrill 1064;* Rizal Province, *Ahern's collector (For. Bur. 475, 2896), Maneja (For.*

Bur. 23957), *Loher 13888;* Bosoboso, *Ramos* (*Bur. Sci. 1494*); Sorsogon Province, *Ramos* (*Bur. Sci. 23578*); Irosin (Mt. Bulusan), *Elmer 14491, 15233, 15433, 15764, 17299;* Tayabas Province, Pagbalao, *Merrill 1930;* Zambales Province, *Curran & Merritt* (*For. Bur. 8104*); Alabat Island, *Ramos & Edano* (*Bur. Sci. 48203*); Cantanduanes, *Ramos* (*Bur. Sci. 30314*, type of *E. attenuatifolia*); Sibuyan, Capiz Province, Magallanes (Mt. Giting-Giting), *Elmer 12353;* Mindoro, Mount Calavite, *Ramos* (*Bur. Sci. 39386*); Paluan, *Ramos* (*Bur. Sci. 39594*); Leyte, *Rosenbluth* (*For. Bur. 12725*), *Wenzel 1097, 1121, 1492, 1540, 1578, 1728, Phasis* (*For. Bur. 25781*); Bohol, *Ramos* (*Bur. Sci. 43258*); Negros, *Santos* (*For. Bur. 23495*); Mindanao, Bukidnon Subprovince, *Rola* (*For. Bur. 26528*); Misamis Province, *Miranda* (*For. Bur. 20271*); Mount Malindang, *Mearns & Hutchinson* (*For. Bur. 4771*); Davao District, Todaya (Mount Apo), *Elmer 11904;* Zamboanga District, *Villamil* (*For. Bur. 21878*); Agusan Province, Cabadbaran (Mount Urdaneta), *Elmer 14209;* Basilan, *Reillo* (*Bur. Sci. 16295*), *Miranda* (*For. Bur. 18931*): JAVA, without definite locality, *Zollinger s. n., Teysmann s. n., Blume s. n.* (isotype of *Myrtus acuminatissima* Blume); Semarang, Tolomojo, *Koorders 5813β*; Batavia, Gunong Liiang, *van Steenis 2356;* Madiun, Ngebel, *Koorders 38613β*: TIMOR, without locality, *Forbes 3847*: SOLOMON ISLANDS, Guadalcanal Island, *Kajewski 2553.*

After critically examining the material above cited, we fail to find any combination of characters or any single character strong enough to enable us to distinguish more than one species. The synonymy is sufficient to indicate something of the variation present. In the leaves of some of the dried specimens, e. g. *Kajewski 2553* and part of the Philippine collections, apparently resinous dots or glands are lacking, in others they are so small as to be found only by scrutiny with a hand lens, but there are all gradations from these to glands large enough to be seen with the naked eye. Another variation is the presence of very definitely 4-angled branchlets in *King's collector 4331, Forbes s. n., 2872, Koorders 5813β, Clemens 26865, 29991, 29942, Endert 3472, Elmer 11904, 14491, 15764, Merrill 1064, Ramos* (*Bur. Sci. 23578, 30314, 43258*), *Wenzel 1097, 1121, 1492, 1540, 1578, 1728,* and *Mearns & Hutchinson, Curran & Merritt, Miranda, Villamil, Phasis* with *For. Bur. 4771, 8104, 18931, 21878, 25781* numbers respectively. The remaining collections cited have either terete or slightly compressed or sulcate branchlets. Forbes' specimen from Timor has smaller leaves and somewhat prominent secondary venation; possibly it is not conspecific. *Eugenia attenuatifolia* Merr. is represented in our herbarium only by the type-collection in

young fruit; the infructescences are somewhat more compact with stouter branches than usual in the typical form of *Acmena acuminatissima* (Blume), but since the rachis and its branchlets show a tendency to thicken as the fruits develop, it seems best at present to regard this as a slight variant within the species. *Haviland 2931* is deserving of further comment. Ridley, Jour. Bot. **68:** 35. 1930, writes, "The plant from Sarawak (*Haviland 2931*) referred by Merrill to this species (*E. acuminatissima* Kurz.) is certainly *E. subdecussata*." Perhaps this is a mixed collection; but the specimen of *Haviland 2931* we have borrowed from the Botanic Garden at Buitenzorg, although superficially suggesting *E. subdecussata* Duthie, does not match our material of that species in any significant detail. Without question, *A. acuminatissima* (Blume) is its closest affinity. Although the leaves are more rounded at the base than in most of the material referred to this species, it is difficult to distinguish them from those in some of the Philippine specimens.

In many collections of this species it is to be noted that the leaves are not always strictly opposite, often one leaf of a "pair" being attached 4 to 8 mm. above the other; in other cases they are strictly opposite. It is suspected that the leaf position may have been one of the reasons why Lauterbach and K. Schumann placed *Xenodendron* in the Sonneratiaceae rather than in the Myrtaceae. They described *X. polyanthum*, the type of the genus, as having "folia nunc manifeste decussata nunc alternantia."

5. **Acmena hemilampra** (F. v. Muell. ex F. M. Bail.) comb. nov.

Eugenia hemilampra F. v. Muell. Fragm. Phyt. Austr. **9:** 145. 1875 (name proposed); F. M. Bail. Synop. Queensl. Fl. Suppl. **1:** 23. 1886; Moore & Betche, Handbk. Fl. N. S. Wales, 207. 1893; F. M. Bail. Bot. Bull. **9:** 8. 1894 (first descr. fls., fr.), Queensl. Fl. **2:** 657. 1900.
Eugenia Smithii Poir. var. *coriacea* Domin, Bibl. Bot. **22:** 1031. 1928.

AUSTRALIA, Queensland, Thornton Peak, *Brass 2285;* Mount Alexander, Daintree River, *Kajewski 1494;* Blunder Creek, near Brisbane, *White 7153;* Frazer Island, *Kajewski 43;* Mount Bartle Frere, *Johnson s. n.;* Stradbrooke Island, southern end of Moreton Bay, *White 3374;* Cairns, *White s. n.;* Tallebudgera Creek, *White 1873, 6406;* Coalstoun Lakes at base of Coongarra Rock, *White 7702;* between Currumbin and Burleigh Heads, *White s. n.;* Lismore, *Cheel s. n.*

Bailey, Syn. Queensl. Fl. Suppl. **1:** 23, says, "This tree is separated from *E. Smithii* by Baron von Mueller on account of its thicker and more blunt leaves which are more dull on the under side, and also the less divergent veins."

The epithet *hemilampra* was inconclusively published by F. v. Mueller

either as a variety of *Eugenia Smithii* (i. e. *Acmena Smithii*) or as a new species, with a Latin description. After working with the meagre collections available, we can quite understand why Baron von Mueller could not decide whether he had a variety or a species. The species is variable, some specimens being undoubtedly distinct, others scarcely separable from *Acmena Smithii* (Poir.) except in the lines running down the branchlets and the paucity of glands on the under surface of the leaves and on the branchlets.

6. **Acmena Smithii** (Poir.) comb. nov.

Eugenia Smithii Poir. Encyc. Suppl. **3**: 126. 1813; Benth. & Muell. Fl. Austr. **3**: 282. 1866; F. v. Muell. Fragm. Phyt. Austr. **9**: 145. 1875; F. M. Bail. Syn. Queensl. Fl. 189. 1883; F. v. Muell. Key Syst. Victor. Pl. **1**: 232. 1887–88, **2**: *f. 60*. 1885; Moore & Betche, Handbk. Fl. N. S. Wales, 207. 1893; F. M. Bail. Queensl. Fl. **2**: 657. 1900, Comprehens. Cat. Queensl. Pl. 208. 1913; Ewart & Davis, Fl. North. Terr. Austr. 201. 1917; Maiden, For. Fl. N. S. Wales, **8**: 427, *t. 264*. 1921; Domin, Bibl. Bot. **22**: 1031. 1928; Ewart, Fl. Vict. 795, *f. 295*. 1930.

Eugenia elliptica Smith, Trans. Linn. Soc. **3**: 281. 1797; Sims, Bot. Mag. **44**: *t. 1872*. 1817; non Lam.

Myrtus Smithii Spreng. Syst. Veg. **2**: 487. 1825.

Acmena floribunda DC. *β. elliptica* DC. Prodr. **3**: 262. 1828.

Acmena floribunda DC. Prodr. **3**: 262. 1828, quoad desc., excl. syn.; Hook. Bot. Mag. **90**: *t. 5480*. 1864.

Lomastelma elliptica Raf. Sylv. Tellur. 107. 1838.

Syzygium brachynemum F. v. Muell. Fragm. Phyt. Austr. **4**: 59. 1864, Pl. Colony Victor. Lithograms, Suppl. *t. 18*. 1864–65.

Eugenia brachynema F. v. Muell. Fragm. Phyt. Austr. **4**: 59. 1864, in syn.

Syzygium Smithii Ndz. in Engler & Prantl, Nat. Pflanzenfam. **3**(7): 85. 1893.

Australia, Victoria, New South Wales, Queensland and Northern Territory (fide Maiden).

AUSTRALIA, Victoria, eastern Gippsland, *F. v. Mueller s. n.*: New South Wales, without definite locality, *Caley s. n., Oldfield s. n.;* Sydney, *U. S. Expl. Exped. s. n.;* Eden, comm. *Maiden;* near Sydney, *Anderson 121;* Sealers Cove, *Walters s. n., Wilhelm s. n.;* Hastings River, *Beckler s. n.;* Brisbane River, *F. v. Mueller s. n.;* Sussex Inlet Heads, *Maiden s. n.;* Chambers gulla via Wyong, *Helms 890;* Tuggerah via Wyong, *Helms 938* (fruit abnormal).

6A. **Acmena Smithii** var. **minor** (Maiden) comb. nov.

Eugenia Smithii var. *minor* Maiden, Agric. Gaz. N. S. Wales, **9**: 581. 1898, For. Fl. N. S. W. **7**: 431. 1921.

Queensland, Upper Albert River, *White s. n.;* Gadgarra, Atherton, *Kajewski 1092;* Roberts Plateau, *White 6075;* Goodna, Brisbane District, *White & Francis s. n.*: New South Wales, Coramba, *Boorman s. n.;* Upper Hastings River, *Maiden s. n.;* Byron Bay, *Maiden & Boorman s. n.*

Maiden, op. cit., notes "Leaves, flowers and fruits are alike smaller than those of the normal species," he also quotes Boorman's field-note, "A very distinct plant from the normal species, being of a more tapering growth, and grows to a slender tree of 10–20 feet or more high, much after the style of *Myrtus fragrantissima.*" This variety seems to us practically as distinct from *Acmena Smithii* (Poir.) as is *A. hemilampra* (F. v. Muell. ex Bail.). The young branchlets are somewhat 4-angled or sulcate with elevated lines or very narrow wings extending down from the petioles. In this character, as well as in a tendency for the leaves to be broader above the middle, the variety more nearly approaches *A. hemilampra* (F. v. Muell. ex Bail.) than *A. Smithii* (Poir.); however, in the scanty material which we have of each of these, some collections so nearly combine the characters of all that we prefer to leave them in *status quo* merely noting that they belong to the genus *Acmena.*

7. **Acmena brachyandra** (Maiden & Betche) comb. nov.

Eugenia brachyandra Maiden & Betche, Proc. Linn. Soc. N. S. Wales, **23**: 15. 1898; Maiden, For. Fl. N. S. Wales, **8**: 31. *t. 275.* 1923.

AUSTRALIA, Queensland, Mount Glorious, *White 1948.*

Acmena brachyandra (Maiden & Betche) has longer leaves and much larger fruit than *A. Smithii* (Poir.) and its allies. It is readily separated from *A. divaricata* Merr. & Perry by the close and impressed (above) venation of the leaves and by the angled branchlets.

8. **Acmena divaricata** sp. nov.

Arbor usque ad 20 m. alta; ramulis compressis vel teretibus ± cinereo-brunneis; foliis suboppositis vel alternis, anguste oblongis vel lanceolato-ellipticis, breviter acuminatis, basi acutis vel acuminatis, 11–18 cm. longis, 3–5.5 cm. latis, coriaceis, minutissime vel vix punctatis, costa supra impressa subtus elevata, venis primariis supra inconspicuis, subtus perspicuis, saepe arcuato-anastomosantibus vel in venam intramarginalem nunc duplicem confluentibus; petiolo 9–13 mm. longo, transverse ruguloso; inflorescentiis paniculatis, terminalibus axillaribusque, 5–16 cm. longis, solitariis vel trinis, aliquando e basi ramosis, rachi compressa, ramulis divaricatis ± angulatis; alabastris 4–5 mm. longis, apice 2.5–3 mm. diametro, sessilibus, turbinatis, basi stipitatis;

calycis lobis minutis, petalis singillatim deciduis, staminibus vix 2 mm. longis, filamentis flexuosis; fructibus ignotis.

AUSTRALIA, North Queensland, Daintree River, *Kajewski 1479*, holotype in Arnold Arboretum, isotype in the New York Botanical Garden Herbarium: CEYLON, Peradeniya Gardens (planted), *Alston 146*.

This species is perhaps most nearly related to *A. brachyandra* (Maiden & Betche) but differs in the compressed branchlets, the much more open panicle, the longer stamens, the slightly longer petioles and the more open and unimpressed venation of the leaves.

9. **Acmena dispansa** (Ridl.) comb. nov.

Eugenia dispansa Ridl. Trans. Linn. Soc. II, 9: 47. 1916.

PAPUA, *Wollaston Exped. to Dutch New Guinea*, one flower from type seen.

The short stamens with subglobose anthers, the calyx and the spreading panicle suggested that this species might belong to the genus *Acmena*, and now as noted in the introduction, we have had the privilege of examining a flower, hence, place the species in this genus without hesitancy.

10. **Acmena Dielsii** sp. nov.

Arbuscula 8–10 m. alta; ramulis compressis vel obscure angulatis; foliis suboppositis, late ellipticis, apice acutis vel breviter acuminatis, basi acutis, 10–17 cm. longis, 4.5–8 cm. latis, pergamaceis, subtus minutissime nigro-punctatis, costa supra impressa subtus elevata, venis primariis utrinque aequaliter manifestis, oblique patulis, 5–10 mm. remotis, irregulariter intra marginem in venam intramarginalem nunc duplicem confluentibus, venulis laxe reticulatis, ± obscuris; petiolo 7–8 mm. longo, ruguloso, fusco; inflorescentiis terminalibus, a basi ramosis, rachi compressa, ramulis divaricatis, ultimis angustissime alatis, alabastris ± 3 mm. longis, apice 2 mm. diametro, sessilibus vel breviter pedicellatis, turbinatis, basi stipitatis; calycis lobis minutis vel tubo truncato, petalis singillatim deciduis, staminibus circiter 0.6 mm. longis; fructibus ignotis.

PAPUA, Gawarere, *Brass 675* (type, Arn. Arb. Herb.), November 22, 1925, rain forest at about 300 m. alt.

Acmena Dielsii appears to be more like the Australian *A. brachyandra* (Maiden & Betche) than any of the other known species of the genus, but the leaves are much broader and elliptic with more divergent venation and with minute dark glands sprinkled over the lower surface.

11. **Acmena laevifolia** (Ridl.) comb. nov.

Eugenia laevifolia Ridl. Trans. Linn. Soc. II, 9: 48. 1916.

PAPUA, *Wollaston Exped. to Dutch New Guinea,* one flower of the type seen.

Said by Ridley to be allied to *Acmena acuminatissima* (Blume) (under *Eugenia*) and *A. dispansa* (Ridl.) (as *Eugenia*). The gray-green color of the leaves is fairly characteristic of this genus.

DOUBTFUL AND EXCLUDED SPECIES

ACMENA ACUMINATA Walp. Repert. **2:** 181. 1843 = *Eugenia acuminata* Roxb. Fl. Ind. ed. 2, **2:** 492; attributed by Walpers to Wight, Ic. **2:** t. 607. 1843, and later transferred by Miquel to *Syzygium acuminatum* Miq. Fl. Ind. Bat. **1**(1)**:** 452. 1855.

ACMENA BRACTEOLATA Walp. Repert. l. c. = *Eugenia bracteolata* Wight.

ACMENA CHAMPIONII Benth. Jour. Bot. Kew Gard. Miscel. **4:** 118. 1852 = *Eugenia Championii* Hemsl.

ACMENA ? CHINENSIS Planch. Hort. Donat. 84. 1854–58.

Jambosa chinensis Hort. ex Planch. l. c. in syn.

The description was based on specimens cultivated in Europe, presumably in the garden at San Donato, near Florence, Italy. To it Planchon referred a sterile specimen collected by Callery at Macao. He says that its facies is entirely that of *Acmena floribunda* DC. He had only flowering material and the sterile Callery sheet. We have been unable to place this among the known Chinese species of *Eugenia* from the description alone. We are convinced, however, that it cannot possibly be an *Acmena*. There is no direct evidence that the European cultivated plant came from China. Dr. Pellegrin failed to find the Callery specimen in the Paris herbarium under Planchon's binomial or under *Eugenia floribunda* and *E. Smithii.*

ACMENA CLAVIFLORA Walp. Repert. **2:** 181. 1843 = *Syzygium claviflorum* Wall.

ACMENA FLORIBUNDA DC. Prodr. **3:** 262. 1828 = *Angophora intermedia* DC.

Probably owing to misnamed cultivated material, de Candolle received a wrong impression of *Metrosideros floribunda* Sm. which he cited as the basis of his species; since the true identity of the latter is *Angophora intermedia* DC., the species *Acmena floribunda* must be excluded from the genus *Acmena.*

ACMENA GERRARDI Harvey, Gen. S. Afr. Pl. ed. 2: 112. 1868 = *Syzygium Gerrardi* Burtt-Davy.

ACMENA GRATA Walp. Repert. **2:** 181. 1843 = *Syzygium gratum* Wall.

ACMENA LANCEOLATA Thw. Enum. Pl. Zeyl. 119. 1859 = *Syzygium lanceolatum* Wight & Arn.

ACMENA LEPTANTHA Walp. Rep. l. c. = *Syzygium leptanthum* Ndz.

ACMENA OBLATA Walp. Rep. l. c. = *Syzygium oblatum* Wall.

ACMENA ? PARVIFLORA DC. Prodr. **3:** 262. 1828.

This species is known to us only through the original description which lacks definite diagnostic characters. Doubtless *Syzygium* is represented.

ACMENA WIGHTIANA Walp. Repert. **2:** 181. 1843 = *Syzygium Wightianum* Wight & Arn.

ACMENA ZEYLANICA Thw. Enum. Pl. Zeyl. 118. 1859 = *Syzygium zeylanicum* DC.

ARNOLD ARBORETUM,
HARVARD UNIVERSITY.

NEW OR NOTEWORTHY INDO-CHINESE PLANTS

E. D. MERRILL

With three text illustrations

SOME YEARS ago I published two papers on the Indo-Chinese flora,[1] the types of the various species therein described being deposited in the University of California herbarium. Although important additional Indo-Chinese collections were received while I was associated with that institution up to the end of 1929, little time was available to me to study this material. These collections included supplementary specimens from Dr. A. Petelot, and important collections made in the vicinity of Hue by R. W. Squires of Shanghai in 1927, and the more extensive collections made by Chaplain and Mrs. Joseph C. Clemens near Hue and Tourane, during the same year. In 1931 Mr. Squires made an important second collection in the vicinity of Dalat, southern Annam, the duplicates of which were distributed from the New York Botanical Garden. The preliminary identifications were made by me, as was the case with the first Squires collection and the Clemens material.

After my transfer to New York in January, 1930, Dr. Petelot continued to send material from time to time for identification. At intervals some of the specimens were more intensively studied, and a part of the general results are embodied in this paper, which is largely, but not entirely, based on his material. The actual types of the new species herein described are thus in part deposited in the Britton Herbarium, New York Botanical Garden, in part in the Herbarium of the Arnold Arboretum.

Attention is called to one rather important contribution that, because of its rather obscure place of publication, tends to be overlooked by botanists who are concerned with a study of the rich flora of Indo-China. This is the enumeration of the Boden Kloss[2] collection from southern Annam, published in 1921. In this paper 191 species are enumerated, 2 genera and 39 species being described as new.

There are naturally many additions to the list of species recognized in those parts of the "Flore générale de l'Indo-Chine" issued previous

[1] **Merrill, E. D.** New species of plants from Indo-China. Univ. Calif. Publ. Bot. **10**: 423-430. 1924; (II) **12**: 127-143. 1926.

[2] **Rendle, A. B.** *et al.* On plants from South Annam by Messrs. E. G. Baker, S. Moore, A. B. Rendle, H. N. Ridley, and H. F. Wernham, with an introduction by the collector, Mr. C. Boden Kloss. Jour. Nat. Hist. Soc. Siam **4**: 109-160. 1921.

to 1921, while in those parts issued since that date, various species proposed by the British botanists have been overlooked. Thus in the treatment of the Compositae (1932–34) the new species of *Vernonia, Blumea, Wedelia, Gynura,* and *Lactuca* are not accounted for; in the Rubiaceae (1922–23) no mention is made of the new species of *Hedyotis, Oldenlandia, Mussaenda, Psychotria,* and *Lasianthus;* in the Labiatae (1936) the new species of *Acrocephalus* and *Scutellaria* are lacking, and in the treatment of other families issued in 1921 or later one fails to find *Begonia langbianensis* Baker f. and *Melastoma Klossii* Baker f.

In the present paper forty-two new species are described, and about seventy-five previously described ones are for the first time accredited to Indo-China. Of these about twenty represent genera hitherto not recorded from that country. These genera are *Amentotaxus, Platycarya, Champereia, Holboellia, Pseuduvaria, Pileostegia* (*Schizophragma*), *Boenninghausenia, Pentaphylax, Turpinia, Platea, Bretschneidera, Tilia, Craigia, Hartia, Huodendron, Trigonotus, Elsholtzia, Wightia, Nertera,* and *Hymenopogon.* All but one are in groups that have been covered by published parts of the "Flore générale."

Supplementing these records notes on the nomenclature of certain species are included, some new names are proposed, and a few previously described species are reduced to synonymy. Here, as in other cases where comprehensive "floras" have been published, their parts appearing over a long period of time, it is found that the earlier parts, issued before many regions have even been visited by a botanist or a collector, are now inadequate as a guide to the actual flora. In most tropical countries vast accretions are to be expected to the list of known species as explorations progress and as the resulting collections are studied, and Indo-China is no exception to this observation.

TAXACEAE

Amentotaxus argotaenia (Hance) Pilger, Bot. Jahrb. **54:** 41. 1916.

Podocarpus argotaenia Hance, Jour. Bot. **21:** 357. 1883.
Podocarpus insignis Hemsl. Jour. Bot. **23:** 287. 1885.
Cephalotaxus argotaenia Pilger, Pflanzenreich **18(IV-5):** 104. 1903.

INDO-CHINA, Tonkin, Chapa, *Petelot 3897,* August, 1933, alt. 1500 m. A monotypic genus, new to Indo-China, previously known from Formosa, Kwangtung, Hupeh, and Szechuan.

JUGLANDACEAE

Platycarya strobilacea Sieb. & Zucc. Abh. Akad. Münch. **3:** 742. *t. 5, f. 1.* 1843; Rehd. & Wils. in Sargent, Pl. Wils. **3:** 180. 1916.

INDO-CHINA, Tonkin, Chapa, *Petelot 4794*, August, 1933, alt. 1700 m. Japan, through central China to Kwangtung and Yunnan; the genus is new to Indo-China.

MORACEAE

Ficus cardiophylla Merr. Univ. Calif. Publ. Bot. **13:** 129. 1926.

Ficus Bonii Gagnep. Not. Syst. **4:** 86. 1927, Lecomte, Fl. Gén. Indo-Chine **5:** 767. 1928.

The type of *Ficus cardiophylla* Merr. is *Petelot 1291*, from Cho Ganh, Tonkin, and that of *F. Bonii* Gagnep. was from Lang-he, Mount Den, near Ninh-binh, Tonkin. I see no differences between the two. I have seen no specimens of *Bon 4045*, but *Balansa 741*, identified by Gagnepain as representing his species, safely represents *F. cardiophylla* Merr.

Ficus Tikoua Bureau, Jour. Bot. Morot **2:** 213. *t. 7.* 1888; Rehder, Jour. Arnold Arb. **17:** 76. 1936.

INDO-CHINA, Tonkin, route from Chapa to Lo Qui Ho, *Petelot 5981*, July, 1928.

The Indo-Chinese form differs somewhat from the Chinese one but I believe it represents the same species. *Ficus Bonatii* Lév. is a synonym. Yunnan, Szechuan, Kweichow, Kwangsi, Hunan, and Hupeh.

Ficus Cavaleriei Lév. Mém. Acad. Cienc. Barcelona III, **6:** 148. 1907, Repert. Sp. Nov. **4:** 83. 1907; Rehd. Jour. Arnold Arb. **10:** 128. 1929, **17:** 78. 1936.

INDO-CHINA, Tonkin, Chapa, *Petelot 5978*, April, 1930, alt. about 1400 m. Kweichow, Kwangsi (*Tsang 21962*), and Kiangsi (*Wang 464*).

URTICACEAE

Oreocnide obovata (C. H. Wright) Merr. Sunyatsenia **3:** 250. 1937.

Debregeasia obovata C. H. Wright in Forbes & Hemsl. Jour. Linn. Soc. Bot. **26:** 492. 1899.

Villebrunea paradoxa Gagnep. Not. Syst. **4:** 130. 1928, in Lecomte, Fl Gén. Indo-Chine **5:** 881. *f. 103, 22–23, f. 104, 2–3.* 1929.

Wright's species of 1899 is manifestly the same as the one described by Gagnepain in 1928, and clearly *Oreocnide* (*Villebrunea*) is represented rather than a *Debregeasia*. The species occurs in Indo-China, Yunnan, and Kwangsi.

PROTEACEAE

Helicia annularis W. W. Sm. Notes Bot. Gard. Edinb. **10:** 178. 1918.

INDO-CHINA, Tonkin, Chapa, *Petelot 1626,* July, 1924, alt. about 1500 m. Yunnan.

The specimen is incomplete, the flowers fallen. It conforms closely to some of the Yunnan material referred to Smith's species. New to Indo-China.

Helicia cauliflora sp. nov.

Arbor parva, 5–6 m. alta, inflorescentiis exceptis glabra, ramis teretibus, ramulis ultimis 1.5–2 mm. diametro; foliis lanceolatis vel anguste oblongo-lanceolatis, integris, coriaceis, 8–12 cm. longis, 2–3 cm. latis, utrinque angustatis, basi cuneatis, apice obtusis vel obscure breviter obtuse acuminatis, margine integerrimis, supra in sicco viridibus, nitidis, subtus pallide brunneis, nervis primariis utrinque circiter 8, distantibus, gracilibus, manifestis, subtus leviter elevatis, arcuato-anastomosantibus, reticulis primariis sublaxis, manifestis; petiolo 6–10 mm. longo, glabro; racemis 12–15 cm. longis, solitariis vel depauperato-fasciculatis, in trunco vel ramis vetustioribus e tuberculis lignosis usque ad 2.5 cm. diametro orientibus; rhachi consperse breviter adpresse brunneo-pubescente, pedicellis leviter pubescentibus, subcrassis, 5–7 mm. longis, in paribus dispositis sed ad basin vix connatis; floribus 3–3.5 cm. longis, ovario oblongo-ovoideo vel anguste oblongo, glabro, glandulis hypogynis discum 4-lobatum formantibus.

INDO-CHINA, Tonkin, route from Vinh Yen to Tam Dao, *A. Petelot 5684,* May, 1935, in savannas.

A species essentially characterized by its lanceolate, entire, relatively narrow leaves and particularly by its racemes being borne on woody tubercles on the trunk or main branches.

Helicia Petelotii sp. nov.

Arbor circiter 10 m. alta, ramulis ultimis circiter 7 mm. diametro, decidue subcastaneo-pubescentibus; foliis coriaceis, late oblongo-oblanceolatis, usque ad 30 cm. longis et 9 cm. latis, integris, basi abrupte acutis, utrinque glabris vel subtus secus costam leviter pubescentibus, nervis primariis utrinque circiter 20, subtus elevatis, distinctis, curvatis, haud vel obscure anastomosantibus; petiolis circiter 2 cm. longis, subdecidue castaneo-pubescentibus, vetustioribus glabris; racemis saltem 25 cm. longis, in trunco vel in ramis vetustioribus, perspicue ferrugineo-pubescentibus; floribus circiter 3 cm. longis, pedicellis crassis, ad basin vix vel obscure connatis, 6–7 mm. longis, ferrugineo-pubescentibus; antheris 4 mm. longis; ovario glabro, glandulis hypogynis in disco annulato obscure 4-lobato connatis.

INDO-CHINA, Tonkin, slope west of the first ridge, Massif du Fan Tre

Pan, near Chapa, *A. Petelot 5721*, July, 1931, alt. about 1400 m.

In general, well characterized by its elongated, many-nerved, entire, and essentially glabrous leaves as well as by its racemes being borne on the trunk and larger branches.

Helicia stenophylla sp. nov.

Arbor parva, ramulis novellis et inflorescentiis obscure consperse adpresse pubescentibus exceptis glabra, ramulis ultimis elongatis; foliis lanceolatis vel anguste lanceolatis, coriaceis, 9–11 cm. longis, 1–1.5 cm. latis, supra nitidis, in sicco plerumque viridibus, subtus brunneis, integris vel in parte quarta superiore remote pauceque serratis, utrinque angustatis, basi acutis, apice obtuse acuminatis, nervis primariis utrinque circiter 8, distantibus, subtus perspicuis, arcuato-anastomosantibus; petiolo 8–10 mm. longo; racemis gracilibus, axillaribus, solitariis, quam foliis multo longioribus, usque ad 25 cm. longis, obscure consperse adpresse cupreo- vel brunneo-pubescentibus, indumento subdeciduo; floribus parvis, extus parcissime adpresse pubescentibus, circiter 1.2 cm. longis, gracilibus, pedicellis circiter 4 mm. longis, ad basin in paribus leviter (ca. 1 mm.) connatis, bracteis anguste lanceolatis, acute acuminatis, 1–1.5 mm. longis, bracteolis solitariis, vix 1 mm. longis; ovario glabro, anguste ovoideo; glandulis hypogynis 4, pallidis, haud 1 mm. longis, subliberis vel leviter connatis.

INDO-CHINA, Annam, near Tourane, *J. & M. S. Clemens 3487*, May-July, 1927, a small tree along river margins.

A species strikingly characterized by its slender, slightly appressed-pubescent racemes which are much longer than the leaves, the latter being very narrow, lanceolate, gradually narrowed upward to the blunt acumen, and entire or with a very few widely scattered small teeth in the upper one-fourth.

OPILIACEAE

Champereia manillana (Blume) Merr. Philip. Jour. Sci. Bot. **7**: 233. 1912, Enum. Philip. Fl. Pl. **2**: 116. 1923.

Cansjera manillana Blume, Mus. Bot. Lugd.-Bat. **1**: 246. 1850.
Champereia Griffithiana Planch. ex Kurz, Jour. As. Soc. Bengal **44**(2): 154. 1875; Gamble, Jour. As. Soc. Bengal **75**(2): 277. 1912 (Mater. Fl. Malay. Penin. **5**: 277).

INDO-CHINA, Tonkin, Vinh Yen Province, route from Vinh Yen to Tam Dao, alt. 100 m., *Petelot 4822*, April, 1933.

Including *Champereia Griffithiana* Planch. (1875) and *C. Griffithii* Kurz (1877) this species extends from Tenasserim and the Malay Peninsula, to Formosa, and through the Philippines to the Moluccas.

The Indo-Chinese form has cauline inflorescences, these sometimes also on the branches, but in other characters does not appear to be different from Blume's Philippine type. In the Philippine form the inflorescences are sometimes on the branches below the leaves. The genus is new to Indo-China.

OLACACEAE

Schoepfia fragrans Wall. Tent. Fl. Nepal. 18, *pl. 9.* 1824; Mast. in Hook. f. Fl. Brit. Ind. **1:** 581. 1875.

INDO-CHINA, Laos, Tranninh Province, *Petelot 444,* July, 1931. India to western China.

CARYOPHYLLACEAE

Stellaria paniculata Edgw. Trans. Linn. Soc. **20:** 35. 1846; Edgw. & Hook. f. in Hook. f. Fl. Brit. Ind. **1:** 229. 1874.

INDO-CHINA, Tonkin, route from Lo Qui Ho to Ta Phinh, near Chapa, alt. 1700 m., *Petelot 4761,* October, 1933. Western Himalayan region and the Khasia Mountains to Siam and Yunnan.

Stellaria aquatica (L.) Scop. Fl. Carn. ed. 2, **1:** 319. 1772.

Cerastium aquaticum Linn. Sp. Pl. 439. 1753.

INDO-CHINA, Tonkin, Chapa, *Petelot 5716,* April, 1936, along roads, alt. 1500 m. Widely distributed in Europe and Asia, introduced in North America.

Cerastium vulgatum Linn. Sp. Pl. ed. 2, 627. 1762; Edgew. & Hook. f. in Hook. f. Fl. Brit. Ind. **1:** 228. 1874.

INDO-CHINA, Tonkin, Chapa, *Petelot 5717,* April, 1936, along roads. Widely distributed in Europe and temperate Asia, introduced in North America.

This is the Linnaean species *sensu latiore,* and is probably referable to the var. *trivialis* Link as defined by Edgeworth and Hooker f. The species is new to Indo-China.

RANUNCULACEAE

Clematis Buchananiana DC. Syst. **1:** 140. 1818; Hook. f. Fl. Brit. Ind. **1:** 6. 1872.

INDO-CHINA, Tonkin, Chapa, *Petelot 5248,* October, 1933, in thickets, alt. 1500 m. Eastern Himalayan region.

The specimen, with immature buds, is a much better match for Indian material, *Wallich, Hooker & Thomson,* than it is for Chinese material referred to de Candolle's species by Finet & Gagnepain, Bull.

Soc. Bot. France **50:** 541. 1904, which Rehder & Wilson, Sargent Pl. Wils. **1:** 324. 1913, refer to *Clematis nutans* Royle var. *thyrsoidea* Rehd. & Wils.

LARDIZABALACEAE

Holboellia grandiflora Réaub. Bull. Soc. Bot. France **53:** 453. 1906; Gagnep. Bull. Mus. Hist. Nat. Paris **14:** 67. 1908; Rehder & Wils. in Sargent Pl. Wils. **1:** 346. 1913.

INDO-CHINA, Tonkin, Chapa, Massif du Song Ta Van, *Petelot 5935*, April, 1936, alt. about 1500 m. Szechuan. The genus is new to Indo-China.

The flowers are not quite mature, the staminate ones being about 1.2 cm. long, and the stamens 8 mm. long. Gagnepain indicates the stamens as 9 mm. and the sepals as 16 to 20 cm. long; the leaves on the specimen cited are 4-foliolate, and the leaflets very closely match Wilson's material on which the species was based.

Stauntonia Brunoniana Wall. List no. 4952. 1832, *nomen nudum;* Hemsl. in Hook. Ic. **29:** *t. 2843.* 1907; Wu, Notizbl. Bot. Gart. Berlin **13:** 367. 1936.

Parvatia Brunoniana Decne. Arch. Mus. Hist. Nat. Paris **1:** 190. *t. 12A.* 1837; Hook. f. Fl. Brit. Ind. **1:** 108. 1872; Gagnep. Bull. Mus. Hist. Nat. Paris **14:** 66. 1908.

Stauntonia trifoliata Griff. Notul. **4:** 330. 1854, Ic. Pl. As. *t. 495. f. 2–3.* 1854.

INDO-CHINA, Tonkin, Chapa, Massif du Song Ta Van, *Petelot 5933*, July, 1935, alt. about 1600 m. Yunnan and Assam. The second species of the genus to be recorded from Indo-China.

SCHISANDRACEAE

Illicium parvifolium sp. nov.

Arbor parva, glabra, ramis teretibus, ramulis ultimis circiter 1.5 mm. diametro; foliis verticillatis, oblongo-ellipticis vel ellipticis, subcoriaceis, 2.5–6 cm. longis, 1.5–2.5 cm. latis, apice obtusis vel late acutis vel subrotundatis, basi late acutis, in sicco supra viridibus, subtus pallide brunneis, nervis primariis utrinque 5–6, obscuris, obscure anastomosantibus, interdum subobsoletis; petiolo 5–10 mm. longo; floribus pro genere inter minores, axillaribus, solitariis, pedicellis circiter 1 cm. longis, perianthii segmentis majoribus orbiculari-ellipticis, concavis, rotundatis, circiter 1 cm. longis et 8 mm. latis, exterioribus multo minoribus; staminibus circiter 15, 4 mm. longis, filamentis crassis, 1.5–2 mm.

latis, antheris usque ad 2 mm. longis; carpellis circiter 10, anguste lanceolatis, longe acuminatis, glabris, acumine patulo vel subrefracto.

INDO-CHINA, Annam, Mount Bana, *J. & M. Clemens 4192*, May-July, 1927, in forests, a small tree near the summit of the mountain, flowers white, pink outside.

A species in facies closely approximating the Hainan *Illicium oliganthum* Merr. & Chun, characterized by its small, obtuse, obscurely nerved, verticillate leaves and its small flowers. It differs from *I. oliganthum* Merr. & Chun in its somewhat larger, more numerous, longer, long and slenderly acuminate carpels, their tips spreading or refracted.

Schisandra grandiflora (Wall.) Hook. f. Fl. Brit. Ind. **1**: 44. 1872.

Kadsura grandiflora Wall. Tent. Fl. Nepal. 10, *t. 14*. 1824.

INDO-CHINA, Tonkin, Chapa, *Petelot 4768, 4788*, August, 1933, alt. 1500 to 2000 m. India to Yunnan, Szechuan, and Hupeh.

ANNONACEAE

Pseuduvaria indochinensis sp. nov.

Arbor 8–10 m. alta, dioica, ramis glabris, ramulis ultimis 1 mm. diametro, breviter pubescentibus; foliis oblongis, chartaceis 15–20 cm. longis, 5–6 cm. latis, acuminatis, basi late acutis vel subrotundatis, supra costa excepta glabris, pallide olivaceis, nitidis, subtus paullo pallidioribus, ad costam nervosque breviter pubescentibus glabrescentibus, nervis primariis utrinque 10–12, subtus elevatis, perspicuis, sub marginem arcuato-anastomosantibus; petiolo breviter pubescente, 3 mm. longo; floribus ♂ axillaribus et in axillis defoliatis, fasciculatis, pubescentibus, flavidis, pedicellis breviter pubescentibus 10–12 mm. longis, infra medio 1-bracteolatis, bracteolis orbiculari-reniformibus, 1 mm. longis, 1.5 mm. latis, late rotundatis; sepalis orbiculari-ovatis, rotundatis, 1.5–2 mm. longis, pubescentibus; petalis exterioribus reniformi-ovatis, rotundatis, pubescentibus, 2 mm. longis, 2.6 mm. latis, interioribus arcuatis, stipitatis, stipite 3 mm. longo, lamina triangulari-ovata, 4 mm. longa et lata, extus pubescente, intus glabra, margine ciliata; antheris circiter 30, 0.8 mm. longis, connectivo truncato.

INDO-CHINA, Tonkin, Hoa Binh Province, near Muong Thon, route from Hanoi to Hoa Binh, *A. Petelot 4698*, March, 1933.

The first representative of the genus to be recorded from Indo-China. Most botanists place *Pseuduvaria* under *Mitrephora*, but the genus is clearly more closely allied to *Orophea*, differing from both *Mitrephora* and *Orophea* in being strictly dioecious.

Fissistigma Petelotii sp. nov.

Frutex scandens, floribus exceptis glaber vel subglaber, ramis teretibus, subatris, in sicco plus minusve corrugatis; foliis coriaceis, oblongis vel oblongo-ellipticis, 20–26 cm. longis, 9–10 cm. latis, apice rotundatis vel late obtusis, basi late rotundatis, supra pallide olivaceis, nitidis, glaberrimis, subtus glaucis vel subglaucis, obscure breviter adpresse pubescentibus, nervis primariis utrinque circiter 15, subtus perspicuis, elevatis, patulo-curvatis, arcuato-anastomosantibus, reticulis gracilibus, laxis; petiolo 1–1.5 cm. longo, atro, glabro; floribus axillaribus, alabastro subgloboso, pedicellis circiter 1.5 cm. longis, sursum incrassatis, breviter adpresse subferrugineo-pubescentibus; calycis lobis subtriangularibus, coriaceis, circiter 1 cm. latis, glabris vel leviter pubescentibus, in sicco verruculosis; petalis exterioribus late ovatis, acutis, 12 mm. longis, coriaceis, concavis, extus dense breviter ferrugineo-pubescentibus, intus sursum cinereo-pubescentibus, deorsum glabris, interioribus paullo brevioribus quam exterioribus, intus glabris, extus breviter pubescentibus; staminibus numerosis, antheris 2.2 mm. longis; carpellis paucis, lanceolatis, sursum leviter pubescentibus, cum stylis 5 mm. longis, ovulis numerosis.

Indo-China, Tonkin, Province of Hoa Binh, near Muong Thon, route from Hanoi to Hoa Binh, *Petelot 4862*, March, 1933.

Characterized by being nearly glabrous, except for the subglobose flowers, as well as by its elliptic to oblong-elliptic, ample leaves which are broadly rounded at their bases and rounded or broadly acute at apices.

Fissistigma acuminatissimum sp. nov.

Frutex scandens, ramis teretibus, glabris, ramulis breviter adpresse pubescentibus, circiter 1 mm. diametro; foliis lanceolatis vel oblongo-lanceolatis, graciliter acuminatis, basi late acutis, 8–14 cm. longis, 2–4 cm. latis, chartaceis vel subcoriaceis, in sicco supra pallide olivaceis, glabris vel parcissime adpresse ciliatis, subtus brunneis, consperse breviter adpresse pubescentibus; nervis primariis utrinque circiter 20, subtus perspicuis, elevatis; petiolo 6–10 mm. longo, breviter adpresse pubescente; floribus terminalibus axillaribusque, solitariis vel binis vel trinis, circiter 2 cm. longis, pedicellis circiter 1.5 cm. longis, breviter pubescentibus, bracteolis lanceolatis, acuminatis, circiter 4 mm. longis; sepalis lanceolatis vel oblongo-lanceolatis, perspicue acuminatis, intus glabris, extus adpresse pubescentibus, 8 mm. longis, deorsum circiter 3.5 mm. latis; petalis exterioribus oblongo-lanceolatis, acuminatis, 2 cm. longis, deorsum 8 mm. latis, extus dense adpresse pubescentibus, intus puberu-

lis; sepalis interioribus quam exterioribus paullo minoribus, circiter 1.6 cm. longis, extus pubescentibus, intus in parte inferiore glabris, sursum puberulis; staminibus numerosis, multiseriatis, 2 mm. longis, connectivo crasso, obtuso; ovario cum stylo 3.5 mm. longo, adpresse hirsuto, stylis hirsutis, cylindraceis; ovulis circiter 6.

INDO-CHINA, Tonkin, Chapa, Massif du Song Ta Van, *A. Petelot 5797* (type), April, 1936, in forests, alt. about 1500 m. The same species is apparently represented by *Petelot 4864*, from Lo Qui Ho, Chapa, a specimen with very immature 3-flowered inflorescences with young buds only.

This seems to be allied to *Fissistigma chrysosericeum* (Finet & Gagnep.) Merr., but the leaves have twice as many lateral nerves as does that species.

LAURACEAE

Beilschmiedia foveolata sp. nov.

Arbor glabra, circiter 10 m. alta, ramis ramulisque teretibus, laevis; foliis chartaceis vel subcoriaceis, 10–15 cm. longis, 3.5–5 cm. latis, basi acutis, apice caudato-acuminatis, acumine 1.5–2 cm. longo, recto vel falcato, in sicco utrinque subconcoloribus, pallide olivaceo-viridibus, subnitidis, nervis primariis utrinque circiter 7, subcurvato-adscendentibus, arcuatis, in utraque pagina dense manifesteque foveolato-reticulatis, costa supra plana, subtus elevata; petiolo 2–3 cm. longo; floribus ignotis; infructescentiis in axillis superioribus, brevibus, pedicellis 8–15 mm. longis, paullo incrassatis, siccis sursum circiter 5 mm. diametro; fructibus globosis, 2 cm. diametro.

INDO-CHINA, Tonkin, Chapa, alt. 1700 m., *Petelot 5380*, August, 1930.

In spite of the fact that the flowers are unknown, I judge this to be a *Beilschmiedia* in the alliance with *B. Foxiana* Gamble of the Malay Peninsula, another species characterized by its densely subfoveolate-reticulate leaves. *B. foveolata* differs in its caudate-acuminate leaves, apparently shorter inflorescences, and in its globose not ellipsoid, smooth or somewhat wrinkled, not pustular fruits.

Beilschmiedia Roxburghiana Nees in Wall. Pl. As. Rar. **2:** 69. 1831; Liou, Laur. Ch. Indoch. 110. 1933.

Laurus bilocularis Roxb. Fl. Ind. ed. 2, **2**: 311. 1832.

INDO-CHINA, Tonkin, Chapa, along the Ngoi Bo stream, alt. 1200 m., *Petelot 5379, 5379 bis*, February and July, 1931, the former in flower, the latter in fruit. Assam to Tenasserim, Yunnan and Kwangsi.

Chun's record of this as occurring in Kwangtung was based on a

reduction of *Beilschmiedia fagifolia* Nees which may or may not be correct. I have seen no Kwangtung material that I would refer to *B. Roxburghiana* Nees. The species is new to Indo-China.

Lindera Chunii Merr. Lingnan Sci. Jour. **7:** 307. 1931; Liou, Laur. Ch. Indoch. 133. 1933.

INDO-CHINA, Tonkin, Province of Thai Nguyen, route from Hanoi to Thai Nguyen, *Petelot 4751, 4752,* February, 1933. Kwangsi, Kwangtung, and Hainan. The species has already been recorded from Indo-China by Liou, on the basis of *Poilane 10289* from Quang-tri, Annam.

Machilus oreophila Hance, Ann. Sci. Nat. IV Bot. **18:** 227. 1862; Liou, Laur. Ch. Indoch. 51. 1933.

INDO-CHINA, Tonkin, route from Tam Dao to Vinh Yen, *Petelot 4680,* April, 1931. Fukien, Yunnan.

The type was from Fukien; Liou credits the species to Yunnan, but gives no other range. The inflorescences are longer peduncled than in *6789 Herb. Hance,* the type collection by De Grijs, herb. British Museum.

Litsea verticillata Hance, Jour. Bot. **21:** 356. 1883; Liou, Laur. Ch. Indoch. 171. 1933; Allen, Ann. Missouri Bot. Gard. **25:** 373. 1937.

Litsea multiumbellata Lecomte, Nouv. Arch. Mus. (Paris) V. **5:** 85. 1913, Fl. Gén. Indo-Chine **5:** 133. 1914; Liou, l. c.

INDO-CHINA, Tonkin, Thai Nguyen, *Petelot 4888,* October, 1933, in open forests. Kwangsi, Kwangtung, and Hainan.

Liou thought that both *Litsea multiumbellata* Lecomte and *L. brevipetiolata* Lecomte might prove to be but forms of Hance's species. He further notes the close resemblance of all three to *Actinodaphne glomerata* Nees. Dr. Allen placed *L. multiumbellata* Lecomte as a synonym of *Litsea verticillata* Hance and *L. brevipetiolata* Lecomte as a variety of the same species. I judge that with almost equal propriety one might place the species in either *Litsea* or in *Actinodaphne.*

Litsea euosma W. W. Sm. in Notes Bot. Gard. Edinb. **13:** 166. 1921; Allen, Ann. Missouri Bot. Gard. **25:** 368. 1937.

INDO-CHINA, Tonkin, route from Laokay to Chapa, alt. 1000 to 1300 m., *Petelot 3381,* February, 1929. Yunnan, Burma, Indo-China.

This is apparently distinct from *Litsea cubeba* (Lour.) Pers. It may not, however, be distinct from *L. mollis* Hemsl., the type of the latter being a specimen with immature flowers. *L. mollifolia* Chun (1934) is

a synonym of Hemsley's species, and is an unnecessary name as *Litsea mollis* Hemsl. (1891) is older than *L. mollis* Boerl. (1900).

Cryptocarya hainanensis Merr. Philip. Jour. Sci. **21:** 343. 1922; Liou, Laur. Ch. Indoch. 100. 1933.

INDO-CHINA, Tonkin, Province of Bac Giang, route from Hanoi to Langson, near Song Cau, *Petelot 5245*, March, 1933. Hainan.

This has already been recorded from Indo-China by Liou, l. c., on the basis of specimens collected in Annam by Poilane.

PAPAVERACEAE

Corydalis temulifolia Franch. Jour. Bot. Morot **8:** 291. 1894; Repert. Sp. Nov. **20:** 288. 1924.

INDO-CHINA, Tonkin, Chapa, *Petelot, s. n.*, February, 1930, on rocks in a cascade, route from Lo Qui Ho to Ta Phinh, alt. 1700 m. Hupeh, Szechuan, Kwangsi, and Yunnan; new to Indo-China.

SAXIFRAGACEAE

Polyosma dolichocarpa sp. nov.

Arbor circiter 10 m. alta, perspicue villosa, ramis ramulisque dense pubescentibus; foliis coriaceis, oblongo-ellipticis vel anguste oblongo-obovatis, integerrimis, graciliter acute acuminatis, basi acutis, 7–10 cm. longis, 3–4 cm. latis, supra glabris, olivaceis, nitidis, subtus pallidioribus, perspicue subvillosis; nervis primariis utrinque 8–10, supra subimpressis, subtus elevatis, manifestis, arcuato-anastomosantibus; petiolo 1–1.5 cm. longo, dense villoso; racemis terminalibus, solitariis, sub fructu 10–12 cm. longis, perspicue pubescentibus, pedunculatis; pedicellis circiter 5 mm. longis, villosis; bracteolis villosis, lineari-lanceolatis, 2–4 mm. longis; fructibus anguste oblongis, 13 mm. longis, circiter 4 mm. diametro, sursum leviter angustatis, in sicco perspicue longitudinaliter sulcatis, consperse pubescentibus, sepalis persistentibus oblongo-ovatis vel triangulari-ovatis, acutis, 1.5–2 mm. longis.

INDO-CHINA, Annam, Mount Bana, near Tourane, *J. & M. S. Clemens 4221*, May-July, 1927, a slender tree up to 40 ft. high, in forests, the fruits purple.

A species strongly characterized by its indumentum, its acutely acuminate, prominently nerved leaves, and especially by its greatly elongated, prominently sulcate fruits.

Pileostegia viburnoides Hook. f. & Th. Jour. Linn. Soc. Bot. **2:** 76. *t. 2.* 1857; C. B. Clarke, Hook. f. Fl. Brit. Ind. **2:** 405. 1878.

Schizophragma viburnoides Stapf, Bot. Mag. **155:** *t. 9262.* 1931.

INDO-CHINA, Tonkin, near Chapa, *Petelot 1465*, August, 1932, alt. about 1500 m. Liu Kiu Islands and Formosa to Kwangtung, Kiangsi, Kwangsi, Kweichow, Hupeh, and Szechuan. The genus is new to Indo-China, whether this species be considered as a *Pileostegia* or as a *Schizophragma*.

PITTOSPORACEAE

Pittosporum oblongilimbum sp. nov.

Frutex vel arbor parva, glabra, ramis teretibus, ramulis ultimis 2 mm. diametro; foliis coriaceis, anguste oblongis, alternis vel subverticillatis, in sicco olivaceis, supra nitidis, 10–18 cm. longis, 2–3 cm. latis, acuminatis, basi acutis, nervis primariis utrinque circiter 12, obscuris, distantibus, inconspicue arcuato-anastomosantibus; petiolo 5–10 mm. longo; cymis terminalibus, fasciculatis, 3–4 cm. longis, paucifloris, laxis, gracilibus, pedicellis 6–10 mm. longis; calycis tubo 1.5–2 mm. longo, lobis 5, oblongis vel oblongo-ovatis, apice obtusis vel subacutis, 2.5–3 mm. longis, glabris; petalis circiter 14 mm. longis, sursum 4 mm. latis, apice rotundatis, deorsum leviter angustatis, basi 2 mm. latis; filamentis 8 mm. longis, antheris oblongis, 3 mm. longis, introrse dehiscentibus, basi obtusis; ovario breviter stipitato, leviter pubescente, 1-loculari, placentis 2, quaque 6-ovulatis; stylis glabris.

INDO-CHINA, Tonkin, Chapa, *A. Petelot 5947*, April, 1936, alt. about 1500 m.

A species well characterized by its rather thick, narrowly oblong or almost strap-shaped, rather abruptly acuminate, obscurely nerved leaves and its slender, lax, few-flowered cymes which are born in terminal fascicles, 2 to 4 at the tip of each branchlet. Judging from the ovary characters the capsules should be 2-valved.

HAMAMELIDACEAE

Altingia chinensis (Champ.) Oliver ex Hance, Jour. Linn. Soc. Bot. **13:** 103. 1873; Lecomte, Bull. Mus. Hist. Nat. Paris **30:** 391. 1924.

INDO-CHINA, Tonkin, Chapa, *Petelot 5944*, April, 1936. Kwangtung, Kwangsi.

The species is closely allied to the Malaysian *A. excelsa* Noronha. It has already been recorded from Chapa by Lecomte as an additional species for the Indo-Chinese flora.

Altingia gracilipes Hemsl. var. **serrulata** Tutcher, Rep. Bot. For. Dep. Hongkong **1914:** 31. 1915; Chun, Sunyatsenia **1:** 173. 1933, 242. 1934.

INDO-CHINA, Annam, near Tourane, *Clemens 3388*. I also refer *Tsiang 6677* from Kweichow here. Hongkong.

In his treatment of the Hamamelidaceae of Indo-China, Guillaumin admits *A. gracilipes* Hemsl. and includes in his description the typical form with entire leaves and forms with toothed leaves.

ROSACEAE

Photinia prunifolia (H. & A.) Lindl. Bot. Reg. **23:** *sub t. 1956*. 1837.

Photinia serrulata Lindl. var. *prunifolia* H. & A. Bot. Beechey Voy. 185. 1833.

INDO-CHINA, Tonkin, Massif du Tam Dao, *Petelot 3866*, December, 1931, in forests, alt. about 1000 m. Southeastern China; new to Indo-China.

Fragaria nilgerrensis Schlecht. ex J. Gay, Ann. Sci. Nat. IV. Bot. **8:** 206. 1857; Hook. f. Fl. Brit. Ind. **2:** 344. 1878.

INDO-CHINA, Tonkin, near Chapa, route to the pass of Lo Qui Ho, *Petelot 4597*, July, 1931, alt. about 1800 m. Khasia and Nilghiri Mountains in India to western and central China; new to Indo-China.

Pygeum lancilimbum sp. nov.

Arbor 8–15 m. alta, ramis teretibus, glabris, ramulis circiter 1 mm. diametro, breviter pubescentibus; foliis lanceolatis, chartaceis ad subcoriaceis, graciliter subcaudato-acuminatis, basi acutis vel subrotundatis, 6–11 cm. longis, 1.5–2.5 cm. latis, supra glabris, olivaceo-brunneis, subtus pallidioribus, junioribus consperse pubescentibus, vetustioribus glabris, glandulis binis, immersis, 2 mm. latis, usque ad 8 mm. supra laminae basim in pagina inferiore locatis; nervis primariis utrinque circiter 5, curvato-adscendentibus, gracilibus, reticulis subobsoletis; petiolo 5–8 mm. longo, primo pubescente, demum glabrescente; spicis axillaribus, solitariis, petiolo vix longioribus, densifloris, ferrugineo-pubescentibus; bracteolis deciduis, trifidis, lobis linearibus, usque ad 4 mm. longis, intermedio quam lateralibus brevioribus; floribus confertis, sessilibus vel brevissime pedicellatis, calycis tubo infundibuliformi, 2 mm. longo, 3 mm. diametro, extus consperse adpresseque ferrugineo-pubescente, intus glabro vel fundo plus minusve barbato, lobis 6 vel 7, oblongo-ovatis, plerumque obtusis, 0.5–1 mm. longis, ferrugineo-ciliatis; petalis 0; staminibus circiter 16, filamentis glabris, usque 4 mm. longis; ovario glabro.

INDO-CHINA, Tonkin, neighborhood of Chapa, Massif du Fan Tre Pan, alt. 1400–1700 m., *Petelot 4499* (type), *4589*, September, 1931, and August, 1930; near Chapa, alt. 1200 m., *Petelot 4588*, July, 1930;

route to Lo Qui Ho, alt. 2000 m., *Petelot 4592*, September, 1931, a tree 8 to 15 m. high.

A species well characterized by its lanceolate, slenderly caudate-acuminate, obscurely reticulate leaves, its dense axillary spikes about equaling the petioles in length. The characteristic trifid bracteoles fall before the flowers open.

Prunus Wallichii Steud. Nomencl. ed. 2, **2**: 404. 1841; Merr. Contr. Arnold Arb. **8**: 72. 1934.

Cerasus acuminatus Wall. List no. 719, 1829, *nomen nudum*, Pl. As. Rar. **2**: 78. *t. 181*. 1831.

Prunus acuminata D. Dietr. Syn. **3**: 42. 1843, non Michx.

INDO-CHINA, Tonkin, Chapa, *Petelot 4587, 5705*, October, 1932, and August, 1935, in forested ravines, alt. 1500 to 1700 m. Himalayan region to Yunnan, Kwangsi and Kweichow, Burma, Siam, and northern Sumatra. New to Indo-China.

LEGUMINOSAE

Caesalpinia stenoptera sp. nov. FIGURE 1.

Frutex scandens, *C. nugae* affinis, differt capsulis valde inaequilateralibus, in latere angustiore rectis vel leviter concavis, distincte alatis; ramis teretibus, glabris; foliis circiter 15 cm. longis, bipinnatis, rhachibus primariis secundariisque remote retrorse aculeatis, aculeis circiter 1 mm. longis; pinnis 2-paribus, 7–10 cm. longis; foliolis plerumque 3-paribus, chartaceis vel subcoriaceis, aequilateralibus, ovatis vel oblongo-ovatis vel late oblongo-lanceolatis, perspicue obtuse acuminatis, basi obtusis vel subrotundatis, utrinque nitidis, 2.5–5 cm. longis, 1.3–2 cm. latis, subreticulatis, nervis primariis utrinque circiter 10; leguminibus suborbicularibus, compressis, 3–3.5 cm. longis, circiter 3 cm. latis, valde inaequilateralibus, in latere latiore suborbicularibus, in latere angustiore subrectis vel convexis et distincte crasse alatis, ala circiter 2 mm. lata, stylis persistentibus circiter 8 mm. longis.

INDO-CHINA, Tonkin, Cao Bang Province, Ban Gioc, *A. Petelot 4757*, June, 1933.

A species in the group with *Caesalpinia nuga* Ait., but with very differently shaped fruits, distinctly winged on the nearly straight or slightly convex narrow side, the wider side suborbicular and not at all winged.

Bauhinia dolichobotrys sp. nov. (§ *Phanera*).

Frutex alte scandens, inflorescentiis exceptis glaber, ramulis ultimis teretibus, glabris, nitidis, laevibus, purpureo-brunneis, 4–5 mm. diametro; foliis oblongo-ellipticis, coriaceis, nitidis, olivaceis, subtus paullo

pallidioribus, 7–12 cm. longis, 3–5 cm. latis, basi rotundatis, 5-nerviis, apice breviter acuminatis, integris, apiculatis, vel leviter retusis, nervis primariis supra basin utrinque circiter 3, gracilibus, haud perspicuis; petiolo glabro 1.5–3.5 cm. longo; cirrhis glabris vel subglabris, circiter 3 cm. longis, gracilibus; inflorescentiis terminalibus, simpliciter race-

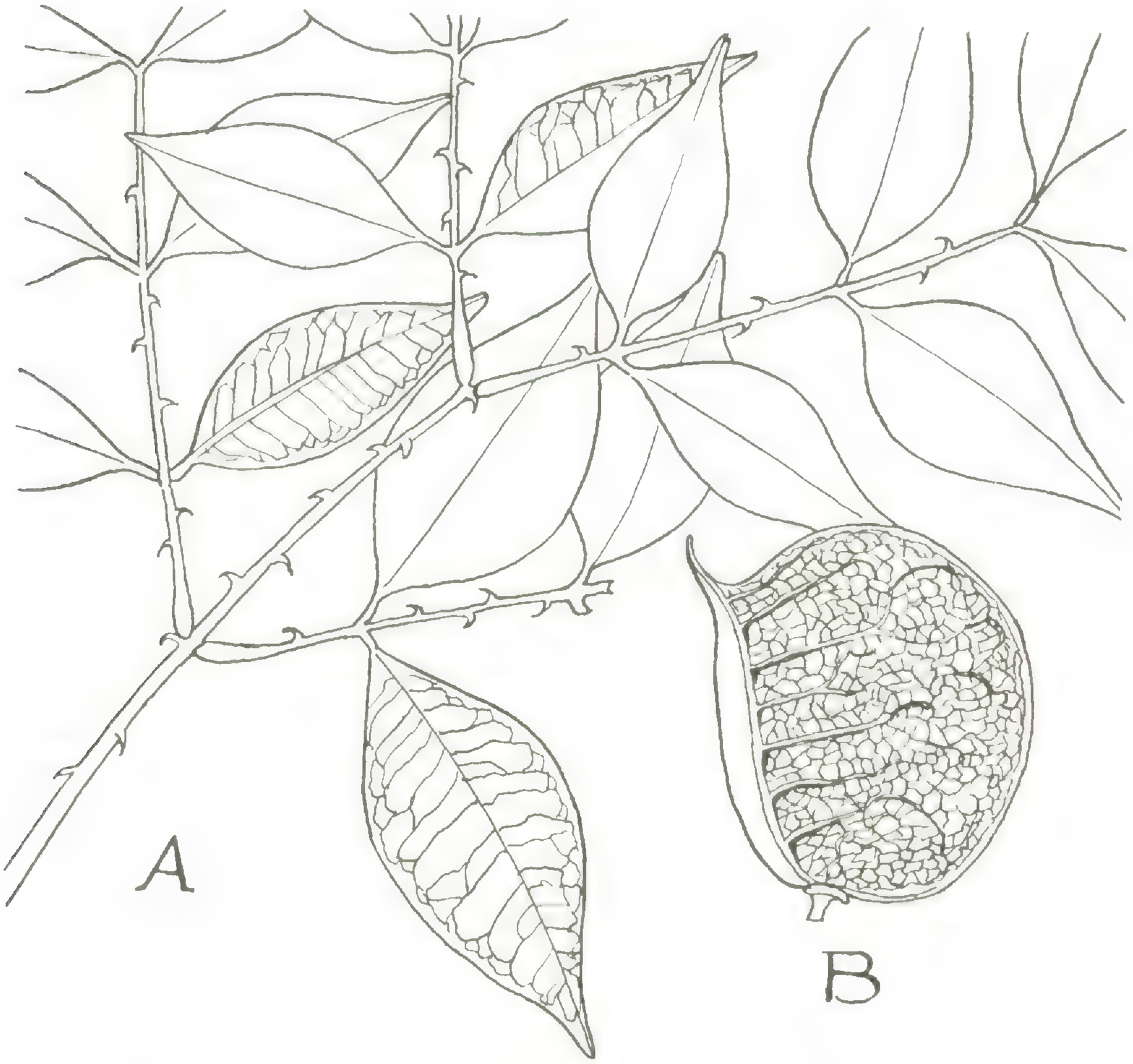


FIGURE 1. CAESALPINIA STENOPTERA Merr. A, leaf; B, fruit.

mosis, multifloris, saltem 35 cm. longis, dense breviterque nitide cupreo-pubescentibus, pedicellis circiter 2 cm. longis, bracteolis acicularibus, curvatis, usque ad 1 cm. longis, alabastris oblongo-ellipsoideis; floribus circiter 4 cm. longis, coccineis, calyce 2 cm. longo, dense breviterque nitide cupreo-pubescente, in parte inferiore circiter 7 mm. longa et 5 mm. diametro cylindraceo, sursum ampliato, et usque ad 1 cm. latis, dentibus 5, vix 3 mm. longis, usque ad 6 mm. latis, plerumque obtusis; petalis omnibus unguiculatis, utrinque plusminusve pubescentibus, 2.5–3 cm. longis, vexillo 1.5 cm. lato, late ovato, basi leviter cordato,

apice obscure apiculato, petalis reliquis angustioribus, rotundatis; staminibus fertilibus 3, filamentis glabris, 3.5 cm. longis, staminoideis 2, glabris, 4–6 mm. longis; ovario pubescente, ovulis circiter 10.

INDO-CHINA, southern Annam, Dalat, *R. W. Squires 818,* April 17, 1931, climbing to a height of 20 m. in forests along river banks, flowers scarlet.

A remarkable species characterized by its oblong-elliptic, entire or very slightly retuse, never cleft or divided leaves, its greatly elongated, terminal, simple, many-flowered simple racemes, and its characteristic flowers. Counting the lower pedicels from which the flowers have fallen and the numerous crowded buds in the upper part of the raceme, each individual raceme may bear in excess of 150 flowers. The racemes elongate gradually as the flowers develop. It is not closely allied to any of the 41 species admitted by Gagnepain as occurring in Indo-China, but in accordance with his arrangements falls in the group of those with three stamens and pubescent ovaries.

RUTACEAE

Boenninghausenia albiflora (Hook.) Rchb. ex Heynhold, Nomencl. Bot. Hort. **1:** 126. 1840; Rehd. Jour. Arnold Arb. **14:** 225. 1933.

Ruta albiflora Hook. Exot. Fl. *t. 79.* 1823–27.

INDO-CHINA, Tonkin, Chapa, alt. 1600 m., *Petelot 4762,* August, 1933. India to Japan, southward to Luzon and Java. The genus is new to Indo-China.

SIMARUBACEAE

Ailanthus sutchuensis Dode, Bull. Soc. Dendr. France **1907:** 192, *fig. a.* Repert. Sp. Nov. **7:** 8. 1909.

Ailanthus altissima (Mill.) Swingle var. *sutchuensis* Rehd. & Wils. (*sutchuenensis*) in Sargent, Pl. Wils. **3:** 449. 1917.

INDO-CHINA, Tonkin, Chapa, *Petelot 5832,* August, 1930, alt. about 1600 m. Yunnan, Szechuan, Hupeh.

Dode's species is a weak one, very closely allied to *Ailanthus altissima* (Mill.) Swingle, a common species in China, usually known as *A. glandulosa* Desf. Rehder & Wilson may be correct in reducing it to varietal status under *A. altissima.* The fruits, however, are distinctly larger than in the latter species.

MELIACEAE

Munronia Petelotii sp. nov. FIGURE 2.

Suffrutex erectus, simplex, circiter 30 cm. altus; caulibus teretibus,

deorsum glabris, pallidis, sursum plusminusve breviter pubescentibus, novellis dense pubescentibus; foliis 1-foliolatis, longe petiolatis, membranaceis, oblongis vel late oblongo-oblanceolatis, 9–11 cm. longis, 2–3 cm. latis, integris, supra glabris, subtus obscure breviter pubescentibus, basi cuneatis vel acutis, apice acutis vel obtusis apiculatisque, nervis

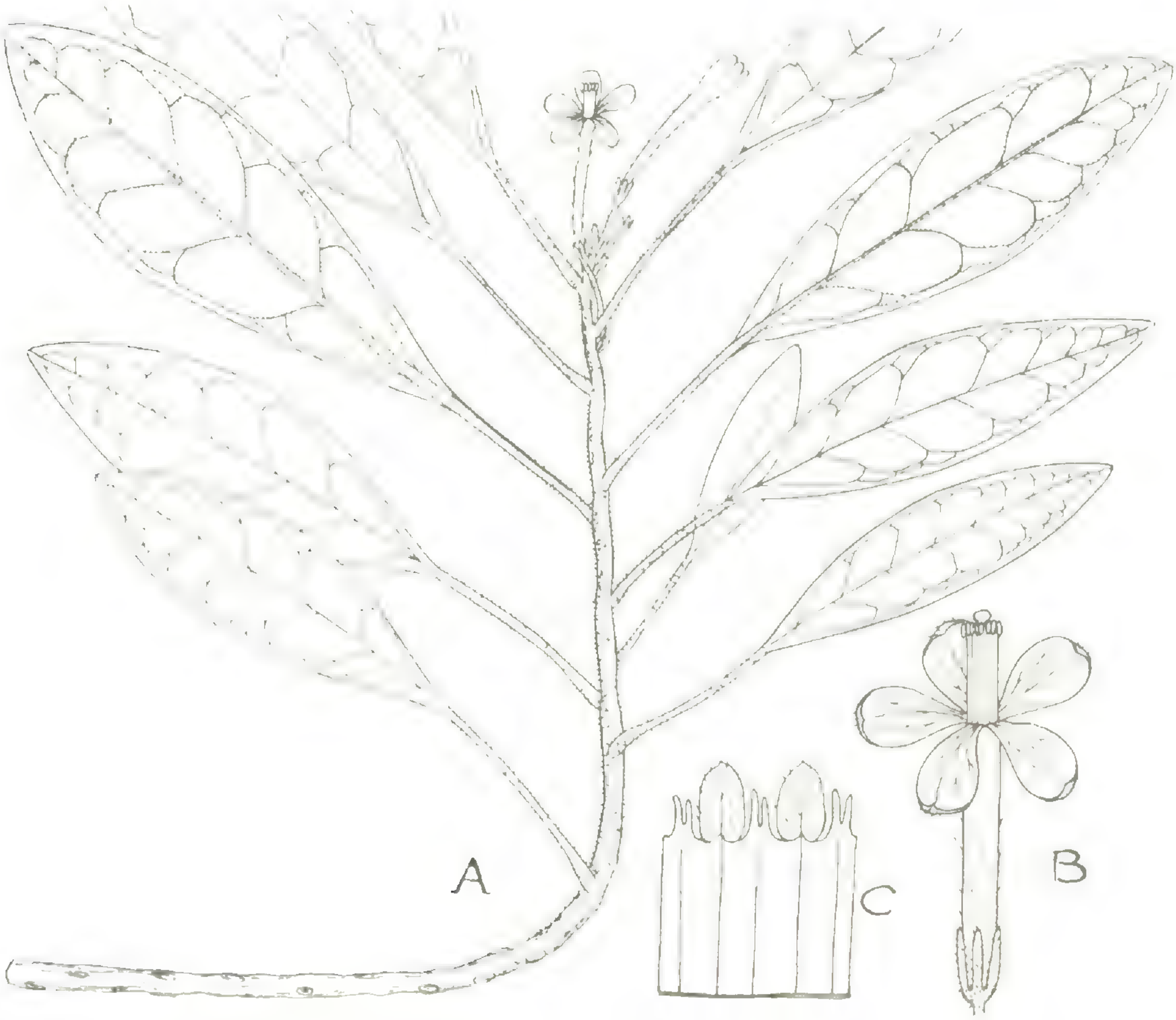


FIGURE 2. MUNRONIA PETELOTII Merr. A, an entire plant; B, a flower, enlarged; C, details of the staminal tube showing two anthers and the cleft lobes.

primariis utrinque 5 vel 6, gracilibus, vix vel obscure arcuato-anastomosantibus; petiolo gracili, leviter pubescente, 2.5–3 cm. longo; floribus paucis, pedicellis circiter 7 mm. longis; sepalis 5, anguste oblongis, obtusis, leviter pubescentibus, 2.5 mm. longis, 0.8 mm. latis; corollae tubo 1.5 cm. longo, extus consperse parcissime pubescente, circiter 1.5 mm. diametro; lobis 5, obovatis, 7–8 mm. longis, 4.5–5 mm. latis, apice rotundatis, leviter cucullatis, tubo stamineo exserto, lobis ad 1 mm. longis, fissis; antheris quam lobis duplo longioribus.

INDO-CHINA, Annam, Quang Binh Province, My Duc, *Petelot s. n.*

July, 1930, a small plant growing in a hole or cavity on the wall of a cave. Herb. N. Y. Botanical Garden.

This is apparently sufficiently characterized by its slenderly petioled, thin, entire, 1-foliolate leaves. The lower part of the stem of the single plant seen appears as if it might have been decumbent.

Munronia heterophylla sp. nov.

Suffrutex erectus, simplex, 15–30 cm. altus, caulibus teretibus, glabris, 2 mm. diametro, sursum breviter pubescentibus; foliis in partibus superioribus plusminusve confertis, pinnatis, 3- vel 5-foliolatis, 5–10 cm. longis, petiolo breviter pubescente, foliolis membranaceis, olivaceis, valde variabilibus, integris vel irregulariter crenato-serratis vel crenatis, obovatis vel lanceolatis, apice rotundatis vel acuminatis, 1.5–5 cm. longis, 0.6–2 cm. latis, utrinque parce consperseque pubescentibus, nervis primariis utrinque 3–7, gracilibus; inflorescentiis axillaribus terminalibusque 1-floris vel depauperato-racemosis, breviter pubescentibus; floribus albidis, 5-meris, sepalis oblongis, obtusis vel acutis, breviter pubescentibus, 2 mm. longis; corollae tubo glabro, circiter 2.3 cm. longo 1 mm. diametro; lobis 5, patulis, glabris, ellipticis, subacutis, 1.3–1.5 cm. longis, 5–7 mm. latis; tubo stamineo 3 cm. longo, perspicue exserto, glabro; antheris 8, vix 1 mm. longis; disco cylindrico, 7 mm. longo; ovario obscure pubescente.

Indo-China, southern Annam, near Dalat, *R. W. Squires 823,* April 12, 1932, in open rocky forests, only a few plants seen.

This is apparently most closely allied to *Munronia sinica* Harms from which it differs notably in its vegetative characters and in its much shorter flowers. It is not closely allied to the two species hitherto recorded from Indo-China, *Munronia pauciflora* Harms and *M. Robinsonii* Pellegr. More often the lower leaves are 3-foliolate and rather prominently toothed, while the upper ones usually have 5 leaflets which are normally entire and often larger than those on the lower leaves; again the terminal leaflet is always larger than the lateral ones.

EUPHORBIACEAE

Acalypha Gagnepainii nom. nov.

Acalypha siamensis Gagnep. Bull. Soc. Bot. France **70:** 874, Feb. 28, 1923, Lecomte Fl. Gén. Indo-Chine **5:** 340. 1925, non Oliv. 1922.

Siam, *Pierre.*

Acalypha siamensis Oliv. in Gage, Rec. Bot. Surv. India **9:** 238. 1922; Ridl. Fl. Malay Penin. **3:** 274. 1924.

Acalypha Evrardii Gagnep. Bull. Soc. Bot. France **70**: 871. 1923, Lecomte Fl. Gén. Indo-Chine **5**: 336. 1925.

INDO-CHINA, Malay Peninsula, Sumatra.

Aporosa yunnanensis (Pax & Hoffm.) Metcalf, Lingnan Sci. Jour. **10**: 486. 1931.

Aporosa Wallichii Hook. f. var. *yunnanensis* Pax & Hoffm. Pflanzenr. **81 (IV. 147. xv)**: 90. 1922.

Aporosa lanceolata sensu Hance, Jour. Bot. **17**: 14. 1879, non Thwaites.

INDO-CHINA, Tonkin, Hoa Binh Province, route from Hanoi to Hoa Binh, *Petelot 5867*, May 23, 1936, a shrub 3 to 4 m. high, in thickets, calcareous formations. Yunnan, Kwangsi, Kwangtung, and Hainan.

This may have been included by Gagnepain, Lecomte Fl. Gén. Indo-Chine **5**: 562. 1927, in his concept of *Aporosa Wallichii* Hook. f., as he credits the latter to Yunnan.

Macaranga Henryi (Pax & Hoffm.) Rehd. Sunyatsenia **3**: 240. 1936.

Mallotus Henryi Pax & Hoffm. Pflanzenr. **63 (IV. 147. vii)**: 177. 1914.

INDO-CHINA, Tonkin, Chapa, *Petelot 1390, 1799*, July, 1924, and 1925, with pistillate and staminate flowers. Kwangsi and Yunnan.

Rehder in transferring this distinct species from *Mallotus* to *Macaranga*, where it manifestly belongs, has given a very complete description based on abundant material. It belongs in the section ECHINOCARPAE.

PENTAPHYLACACEAE

Pentaphylax spicata sp. nov.

Arbor glabra, circiter 20 m. alta, ramis ramulisque teretibus, ramulis ultimis circiter 2 mm. diametro; foliis coriaceis, ellipticis vel oblongo-ellipticis, 6–10 cm. longis, 3–5 cm. latis, perspicue acuminatis, basi acutis, supra olivaceo-viridibus; nervis primariis utrinque circiter 7, gracilibus, adscendentibus, haud perspicuis, obscure anastomosantibus; petiolo 1–1.5 cm. longo; inflorescentiis spicatis, axillaribus, binis, usque ad 6 cm. longis; floribus ignotis; fructibus junioribus ellipsoideis, 5 mm. longis, glabris 5-loculatis, stylis 2 mm. longis, stigmatibus 5, brevissimis; sepalis persistentibus 5, coriaceis, late ovatis, obtusis, 2.5 mm. longis, margine breviter ciliatis; bracteolis binis, ovatis, acutis vel obtusis, 1.5 mm. longis, margine leviter ciliatis.

INDO-CHINA, Tonkin, Chapa, Massif du Fan Tre Pan, *Petelot 4376*, July, 1931, alt. about 1400 m. Massif du Tam Dao, *Petelot 3213, 4560*, April and May, 1931, alt. 1400 m.

A Symplocos-like species, allied to *Pentaphylax euryoides* Gardn. & Champ. of southeastern China, but with strictly spicate, not racemose

infructescences, normally 2 spikes in each axil. The genus is new to Indo-China, the previously known representatives being *P. euryoides* Gardn. & Champ. and *P. racemosa* Merr. which may not be distinct from *P. euryoides*, both from southeastern China, and *P. malayana* Ridl. and *P. arborea* Ridl. of the Malay Peninsula.

AQUIFOLIACEAE

Ilex macrocarpa Oliv. Hook. Ic. **18:** *t. 1787*. 1888.

INDO-CHINA, Tonkin, Chapa, *Petelot 4596*, September, 1931, alt. about 1500 m. Hupeh, Anhwei, Kwangsi, Kwangtung, Kweichow, and Yunnan; new to Indo-China.

CELASTRACEAE

Celastrus gemmata Loesen. Bot. Jahrb. **30:** 468. 1902; Rehd. Jour. Arnold Arb. **14:** 250. 1933.

INDO-CHINA, Tonkin, Chapa, Massif du Song Ta Van, *Petelot 5829, 5946*, August, 1930, and April, 1936, alt. about 1950 m. Shantung to Kwangtung, westward to Kweichow, Szechuan, and Yunnan in China.

Celastrus Hookeri Prain, Jour. As. Soc. Bengal **73**(2): 197. 1904; Rehd. & Wils. in Sargent, Pl. Wils. **2:** 352. 1915.

INDO-CHINA, Tonkin, Chapa, *Petelot 5936*, April, 1936, alt. 1500 m. Fukien, Kwangtung, Kweichow, Kwangsi, Szechuan, and Yunnan in China, and Khasia and Sikkim in India.

Celastrus Loeseneri Rehd. & Wils. in Sargent, Pl. Wils. **2:** 350. 1915.

INDO-CHINA, Tonkin, Chapa, Massif du Song Ta Van, *Petelot 5941*, April, 1936, a large liana, flowers greenish, alt. about 1700 m. Hupeh, Kansu, Shensi, Szechuan, and Yunnan.

Celastrus monosperma Roxb. Hort. Bengal. 18. 1814, *nomen nudum*, Fl. Ind. **2:** 394. 1824; Rehd. & Wils. in Sargent, Pl. Wils. **2:** 357. 1915.

INDO-CHINA, Tonkin, Chapa, *Petelot 5931*, April, 1936, in open forests, alt. 1600 m. Bengal and Assam to Yunnan and Kwangtung.

Evonymus Petelotii sp. nov.

Frutex erectus, glaber, ramis atro-brunneis, teretibus vel obscure sulcato-angulatis, ultimis circiter 2 mm. diametro, internodiis 3.5–7 cm. longis; foliis chartaceis, oblongo-ovatis vel oblongo-ellipticis, utrinque subolivaceo-viridibus concoloribus, nitidis, brevissime petiolatis, 7–12 cm. longis, 4–5 cm. latis, obtusis acutis vel leviter acuminatis, basi late rotundatis vel obtusis, margine crenulato-serrulatis, dentibus parvis,

1–2 mm. remotis, plerumque breviter apiculatis; nervis primariis utrinque 6–7, gracilibus, utrinque paullo elevatis, curvatis, arcuato-anastomosantibus; petiolo circiter 2 mm. longo; cymis axillaribus, solitariis, circiter 6 cm. longis (pedunculo gracili, circiter 3 cm. longo), paucifloris, dichotomis, usque ad 4 cm. latis, ramis primariis ad 1.5 cm. longis; floribus 4-meris, circiter 8 mm. diametro, petalis integris, orbiculari-ellipticis, rotundatis, 2.5–3 mm. longis.

INDO-CHINA, Tonkin, Chapa, *A. Petelot 5942*, April, 1936, a shrub with greenish flowers growing along the borders of torrents, alt. about 1200 m.

A species that in some respects suggests *Euonymus Bockii* Loes. and doubtless as closely allied to that as to any other described species. The leaves are much thinner, while the slenderly peduncled lax cymes are very different, being much longer than in Loesener's species.

Evonymus Balansae Sprague, Kew Bull. **1908:** 180.

Euonymus rhodacanthus Pitard, Lecomte Fl. Gén. Indo-Chine **1**: 870. *f. 108, 8.* 1912 **(syn. nov.)**.

Both species are based on material collected by Balansa at Dong-Dang, Tonkin, cited by Sprague as *Balansa 1451;* Pitard cites merely the collector, not the number. Clearly a single species is represented, Pitard having overlooked Sprague's earlier description.

Evonymus Forbesiana Loesen. Bot. Jahrb. **30:** 457. 1902; Rehd. Jour. Arnold Arb. **14:** 246. 1933.

INDO-CHINA, Tonkin, Bac Giang Province, between Pho Vi and Thanh Moi, *Petelot 5870*, June 5, 1935, a shrub in open forests. Kweichow, Szechuan, and Yunnan.

STAPHYLEACEAE

Turpinia montana (Blume) Kurz, Jour. As. Soc. Bengal **64**(2): 182. 1875; Koord. Atlas Baumart. Java **1:** *t. 92*. 1913; Merr. Contr. Arnold Arb. **8:** 93. 1934, *cum syn.*

Zanthoxylum montanum Blume, Bijdr. 248. 1825.
Maurocenia Zollingeri O. Ktze. Rev. Gen. Pl. 150. 1891.
Turpinia parva Koord. & Val. Meded. Lands Plantent. **61**: 249. 1903 (Bijdr. Boomsoort. Java **9**: 249).
Turpinia gracilis Nakai, Jour. Arnold Arb. **5**: 79. 1924.

INDO-CHINA, Annam, Mount Bana, *Clemens 3894*, May-July, 1903; Tonkin, Hoa Binh Province, Muong Thon, route from Hanoi to Hoa Binh, *Petelot 5259*, May 23, 1936.

I am unable to distinguish *Turpinia gracilis* Nakai, based on *Henry 12039*, from Yunnan, from Blume's species. *Rock 1548* from Siam is

also referable here. *Turpinia glaberrima* Merr. of Kwangtung and Hainan is doubtfully distinct. Burma, Sumatra, Java.

Turpinia cochinchinensis (Lour.) comb. nov.

Triceros cochinchinensis Lour. Fl. Cochinch. 184. 1790, ed. 2, 230. 1793.
Maurocenia cochinchinensis O. Ktze. Rev. Gen. Pl. 150. 1891.
Turpinia nepalensis Wall. List no. 4277, 1830, *nomen nudum;* W. & A. Prodr. 156. 1834; Merr. Contr. Arnold Arb. **8**: 94. 1934, *cum syn.*

INDO-CHINA, Tonkin, Chapa, *Petelot 5216, 5929,* July, 1930, and April, 1935, alt. about 1500 m.; Hanoi to Hoa Binh, *Petelot 5388,* March, 1935; Annam, Mount Bana, *Clemens 3791,* May-July, 1927.

The authors of the "Flore générale de l'Indo-Chine" apparently overlooked this genus (and family), although at least three species of *Turpinia* occur in Indo-China. This form has been confused with *T. pomifera* (Roxb.) DC., a species of British India with much larger fruits, that does not occur in southeastern Asia or in Malaysia. In my extensive paper on Loureiro's species (Trans. Am. Philos. Soc. II **24**(2): 246. 1935) I merely indicated that *Triceros cochinchinensis* Lour. was a *Turpinia.* I am now convinced that *Clemens 3791,* a fruiting specimen from reasonably near the probable type locality (Hue), represents Loureiro's species, for this specimen has fruits with three short horns (remains of the styles) mentioned by Loureiro, and the character whence he derived his generic name. India to southern China, and Malaysia.

Turpinia indochinensis sp. nov.

Arbor glabra, circiter 10 m. alta, ramis ramulisque teretibus, ultimis circiter 3 mm. diametro, internodiis 3–7 cm. longis; foliis simplicibus, ellipticis vel obovato-ellipticis, coriaceis, 8–19 cm. longis, 4–10 cm. latis, in sicco olivaceo-brunneis, acuminatis, basi late acutis, margine subincrassato-serratis, dentibus plusminusve incurvato-apiculatis, nervis primariis utrinque 8–12, manifestis; petiolo 1.5–3 cm. longo; inflorescentiis paniculatis, terminalibus, pedunculatis, multifloris, usque ad 12 cm. longis; floribus numerosis, in ramulis ultimis plus minusve confertis, 5–6 mm. longis, pedicellis circiter 2 mm. longis, bracteolis quam pedicellis paullo brevioribus; sepalis subcoriaceis, ellipticis vel obovato-ellipticis, 3–5 mm. longis; petalis submembranaceis, anguste oblongo-obovatis vel late oblanceolatis, quam sepalis paullo brevioribus; filamentis latis, planis, petalis subaequantibus; ovario glabro, 3-loculari, stylis 3, brevibus.

INDO-CHINA, Tonkin, Massif du Tam Dao, *Petelot 3881,* November, 1930, alt. about 900 m., a tree 10 m. high with white flowers.

The striking character of this species is its simple leaves which in texture and general appearance approximate those of some forms that

are currently referred to *Turpinia pomifera* DC. and *T. nepalensis* Wall., these and their allied species, however, always having pinnate leaves.

ICACINACEAE

Gomphandra obscurinervis sp. nov.

Frutex circiter 3 m. altus, ramulis et petiolis et inflorescentiis adpresse pubescentibus, ceteroquin glabris; ramis teretibus, ramulis ultimis 1 mm. diametro; foliis lanceolatis, coriaceis, in sicco subatris vel brunneis, nitidis, 5–12 cm. longis, .7–2.5 mm. latis, acuminatis, basi acutis, nervis primariis utrinque 5–7, distantibus, curvatis, obscuris, obscure anastomosantibus, interdum obsoletis, reticulis plerumque obsoletis; petiolo 5–10 mm. longo; cymis axillaribus subterminalibusque, pedunculatis, trichotomis, circiter 3 cm. longis, leviter adpresse pubescentibus, pedunculo circiter 1 cm. longo; floribus 4- vel 5-meris, sessilibus, plerumque in triadibus in ramulis ultimis dispositis, calycibus cupulatis, glabris, 1.5 mm. longis latisque, truncatis, dentibus 4 vel 5, minutissimis; corolla 5 mm. longa, lobis plerumque 4, triangulari-ovatis, acutis, apice inflexo-appendiculatis; staminibus 5, filamentis 5–6 mm. longis, sursum intusque barbatis, antheris ellipsoideis, 1 mm. longis; fructibus oblongis, cylindricis, glabris, 2 cm. longis.

INDO-CHINA, Tonkin, Massif du Tam Dao, *A. Petelot 4359* (type), May, 1931, alt. 1100 m.; Chapa, *A. Petelot 4463*, September, 1932, alt. about 1600 m.

A species among the very few known from Indo-China apparently most closely allied to *Gomphandra cambodiana* Pierre. It is well characterized by its narrow, lanceolate, obscurely nerved leaves.

Platea latifolia Blume, Bijdr. 647. 1826; Ridl. Fl. Malay Penin. **1**: 426. 1922.

INDO-CHINA, Tonkin, Chapa, *Petelot 1787*, April, 1925, alt. about 1500 m.; Annam, route to Haut Donai, *Poilane 20987*, Sept. 24, 1932. Java, Malay Peninsula, Hainan; the first representative of the genus to be recorded from Indo-China.

ACERACEAE

Acer decandrum Merr. Lingnan Sci. Jour. **11**: 47. 1932, Merr. & Chun, Sunyatsenia **2**: 269. *t. 56*. 1935.

INDO-CHINA, Tonkin, Tam Dao, *Petelot 5060*, October 15, 1936, a tree 5 m. high, alt. about 900 m. Hainan.

Acer Fabri Hance, Jour. Bot. **22**: 76. 1884; Metcalf, Lingnan Sci. Jour. 11: 204. 1932.

INDO-CHINA, Tonkin, between Chapa and Lo Qui Ho, in deep ravines, alt. about 1600 m., *Petelot 5823*, April, 1936. Kwangtung, Kwangsi, Szechuan, and Hainan, with a variety extending to Hupeh, Kiangsi and Kweichow.

Acer Fenzelianum Hand.-Mazz. Oester. Bot. Zeitschr. **82:** 250. 1933.

The type of this was a specimen collected at Chapa by *Fenzel*. It is represented by *Petelot 5059 bis* from the same locality, August, 1931.

Acer oblongum Wall. var. **concolor** Pax in Hook. Ic. **19:** sub *t. 1897*. 1889, Pflanzenr. **8(IV. 163):** 32. 1902.

INDO-CHINA, Tonkin, Chapa, *Petelot 5366*, Sept., 1930, in forests, alt. about 1500 m. The species from India to central China, the variety in China.

SAPINDACEAE

Allophylus macrodontus sp. nov.

Suffrutex 0.8 m. altus (fide collectoris), caulibus teretibus, perspicue lenticellatis, glabris vel subglabris, circiter 4 mm. diametro, cortice pallide brunneo; foliis longe petiolatis, 3-foliolatis, petiolo 10 cm. longo, consperse adpresse pubescente; foliolis in sicco utrinque viridibus, membranaceis, utrinque glabris vel ad costam breviter adpresse pubescentibus, oblongo-ellipticis, 16–20 cm. longis, 7–9 cm. latis, acuminatis, basi acutis, deorsum integris, in parte superiore grosse et irregulariter subundulato-dentatis, dentibus paucis, 2–3 cm. distantibus, aliquando 1.5 cm. latis, subrotundatis apiculatisque; nervis primariis utrinque circiter 12, gracilibus, perspicuis; petiolulis breviter adpresse pubescentibus; inflorescentiis axillaribus, gracilibus, simplicibus, racemosis, breviter depauperato-pubescentibus, petiolum subaequantibus; floribus pro genere inter minores, circiter 3.5 mm. diametro, breviter (1 mm.) pedicellatis, solitariis, 1–2 mm. remotis, sepalis suborbicularibus, glabris, concavis, 2 mm. longis, petalis sepala aequantibus, deorsum angustatis, sursum barbatis; filamentis glabris; ovario leviter pubescente.

INDO-CHINA, Tonkin, Sontoy Province, route to the Notre Dame rocks, *A. Petelot 5909*, October 8, 1936.

A species characterized not only by its small size for those in the trifoliolate group, the plant being less than one meter high, but also by its long-petioled, 3-foliolate, very coarsely undulate-toothed, uniformly green, membranaceous, glabrous leaflets, and by its solitary, simple, slender, few-flowered, simple racemes that are about as long as the petioles, the flowers not at all crowded, mostly 1 to 2 mm. apart and solitary, very rarely two together. After Radlkofer's arrangement of the species it belongs in the group with *Allophylus serratus* Radlk.,

A. fuscus Radlk., *A. sootepensis* Craib, and *A. viridis* Radlk., distinguished from all by numerous characters, the most evident one being perhaps the coarsely repand-toothed leaves.

Allophylus Petelotii sp. nov.

Frutex scandens, partibus junioribus inflorescentiisque exceptis glaber, ramis teretibus, glabris, subgriseis, ramulis 2 mm. diametro, consperse adpresseque pubescentibus; foliis 1-foliolatis, late oblanceolatis, chartaceis vel submembranaceis, 15–19 cm. longis, 4–6 cm. latis, supra olivaceis, glabris, nitidis, subtus pallidioribus, obscure pubescentibus vel glabrescentibus, deorsum integris, sursum distanter denticulatis, basi acutis, apice acuminatis, nervis primariis utrinque circiter 10, curvatis, anastomosantibus, distinctis; petiolo consperse pubescente, 1 cm. longo; inflorescentiis axillaribus, solitariis, simpliciter racemosis, folia subaequantibus, breviter consperse pubescentibus, pedicellis circiter 1.5 mm. longis, glabris; floribus albidis, 2.5 mm. diametro, sepalis binis exterioribus orbiculari-ovatis, obtusis, leviter pubescentibus, 1 mm. diametro, binis interioribus petaloideis, orbiculari-obovatis, concavis, 2 mm. diametro; petalis 4, membranaceis, leviter pubescentibus, 1.5–1.8 mm. longis, obtusis, squamis crassis, leviter pubescentibus, 1 mm. longis; filamentis glabris, 2 mm. longis, ovario 2-loculari, leviter pubescente.

INDO-CHINA, Tonkin, Massif du Tam Dao, *A. Petelot 4360* (type), May, 1931, "liane à fleurs blanches." Also represented by *Petelot 4814* from Pho Vi, Province of Bac Giang, May, 1933, a shrub 1.5 m. high.

A species unrelated to any of those recorded from Indo-China, characterized by its simple leaves and racemes, the latter about equalling the former in length. It resembles *Allophylus samarensis* Merr. of the Philippines.

Allophylus viridis Radlk. Sitzungsber. Math.-Phys. Kl. Bayer. Akad. Wiss. **38:** 229. 1909, Pflanzenr. **98b (IV-165):** 564. 1932.

INDO-CHINA, Tonkin, Cho Ganh, *Petelot 1237*, September, 1923, on limestone hills. Hainan; the species is new to Indo-China.

BRETSCHNEIDERACEAE

Bretschneidera sinensis Hemsl. Hook. Ic. **28:** *t. 2708.* 1901; Chun, Sunyatsenia **1:** 265. 1934.

INDO-CHINA, Tonkin, Chapa, *Petelot 5830, 5831*, April, 1936, in forests, alt. about 1500 m. Hunan, Kweichow, Kwangtung, and Yunnan. A striking addition to the Indo-Chinese flora, this sole representative of the family previously known only from China.

SABIACEAE

Meliosma Clemensiorum sp. nov. (§*Pinnatae*)

Arbor parva; ramis teretibus, lenticellatis, glabris, pallidis, ramulis ultimis leviter pubescentibus, circiter 4 mm. diametro; foliis pinnatis, circiter 45 cm. longis, petiolis breviter adpresse pubescentibus, foliolis plerumque 11, integris, chartaceis vel subcoriaceis, oblongo-ellipticis vel oblongis, 9–17 cm. longis, 4–7 cm. latis, superioribus majoribus, basi acutis, apice breviter acuminatis, supra olivaceis, glabris vel ad costam breviter pubescentibus, subtus pallidioribus, ad costam nervosque breviter adpresse pubescentibus, nervis primariis utrinque in foliis inferioribus circiter 8, in foliis superioribus circiter 15, subtus manifestis, elevatis, arcuato-anastomosantibus; paniculis saltem 15 cm. longis, pedunculatis, breviter brunneo-pubescentibus, ramis primariis paucis, inferioribus ad 10 cm. longis, floribus sessilibus, in ramulis ultimis spicatim dispositis, haud confertis, spicis 1–2 cm. longis, paucifloris; bracteis bracteolisque ovatis, acutis vel acuminatis, pubescentibus, 0.5 mm. longis; sepalis ovatis, glabris vel subglabris; ovario subgloboso, pubescente, circiter 1 mm. diametro, stylis glabris, ovarium aequantibus.

Indo-China, Annam, Mount Bana, *J. & M. S. Clemens 3775*, May-July, 1927, a small tree in forests, flowers dull yellow.

This is the first pinnate-leaved species of the genus to be recorded from Indo-China. Its alliance seems manifestly to be with *Meliosma Arnottiana* Walp., from which it differs not only in its indumentum but also in its spicately and rather distantly arranged flowers, those of Walpers' species being glomerate on the ultimate branchlets.

Meliosma dolichobotrys sp. nov. (§ *Simplices*).

Arbor parva 6–8 m. alta, ramulis novellis inflorescentiisque exceptis glabra vel subglabra, ramis teretibus, ultimis circiter 3 mm. diametro, lenticellatis, obscure breviter pubescentibus; foliis late oblongo-oblanceolatis vel oblongo-obovatis, chartaceis, integerrimis, apice acutis vel rotundatis, basi acutis, utrinque manifeste et dense sed non profunde subfoveolatis, reticulis ultimis vix 0.3 mm. diametro, supra olivaceis, nitidis, subtus pallidioribus, utrinque ad costam nervosque obscure consperse pubescentibus, ceteroquin glabris, 9–16 cm. longis, 4–8 cm. latis, nervis primariis utrinque 12–18, subtus elevatis, manifestis, sub marginem curvato-anastomosantibus; petiolo 2.5–3.5 cm. longo, consperse adpresseque breviter pubescente; paniculis terminalibus, solitariis, erectis, longe pedunculatis atque exsertis, pedunculo circiter 10 cm. longo, paniculis diffusis, multifloris, circiter 20 cm. longis, ramis primariis paucis, patulis, 12–15 cm. longis, perspicue pubescentibus; floribus

sessilibus, numerosis, parvis, in ramulis ultimis dense spicatim dispositis, vix glomerulos formantibus; bracteis lanceolatis, acuminatis, pubescentibus, bracteolis minoribus; sepalis ovatis, margine ciliatis, ceteroquin glabris; ovario glabro.

INDO-CHINA, Tonkin, Thai Nguyen Province, between Thai Nguyen and Phan Mê, *A. Petelot 4801*, May, 1933, in open forests.

In some respects this species resembles *Meliosma Fordii* Hemsl. but differs remarkably in its long-peduncled, exserted panicles and its rounded, obtuse, or somewhat acute but not acuminate leaves which are minutely and shallowly subfoveolate on both surfaces, the ultimate reticulations being about 0.3 mm. in diameter.

Meliosma sterrophylla sp. nov. (§ *Simplices*).

Arbor 7–8 m. alta, inflorescentiis leviter pubescentibus exceptis glabra, ramis ramulisque teretibus, rigidis, ultimis 3 mm. diametro; foliis simplicibus, integerrimis, rigidis, coriaceis, ellipticis vel obovato-ellipticis, longe petiolatis, 10–15 cm. longis, 4.5–8 cm. latis, breviter obtuse acuminatis, basi acutis vel decurrenti-acuminatis, in sicco supra laevibus, subcastaneis, subtus pallidioribus, brunneis, utrinque glaberrimis; nervis primariis utrinque circiter 12, supra leviter impressis, subtus valde elevatis, perspicuis, arcuato-anastomosantibus, reticulis primariis elevatis, perspicuis, undulato-subparallelis; petiolo 2.5–4 cm. longo, glabro; paniculis terminalibus et in axillis superioribus, circiter 15 cm. longis, rigidis, ramosis, consperse breviter brunneo-pubescentibus, floribus in ramulis ultimis subspicatim dispositis, haud glomeratis, sessilibus, bracteis ovatis, leviter pubescentibus, 1.5 mm. longis; sepalis interioribus ovatis, rotundatis vel obtusis, glabris vel leviter pubescentibus, circiter 1 mm. longis; ovario globoso, glaberrimo, haud 1 mm. longo, stylis aequilongis.

INDO-CHINA, Tonkin, Massif du Fan Tsi Pan, near Chapa, *A. Petelot 4532*, alt. about 1400 m., February, 1932.

Among the simple leaved species *Meliosma sterrophylla* Merr. is distinguished by its rigid glabrous branches and branchlets, its stiff, entire, prominently nerved, long-petioled, glabrous leaves, its stiff panicles which are only slightly pubescent, and its glabrous ovaries, the flowers spicately arranged on the ultimate branchlets, not in glomerules. Its alliance is with *M. Tsangtakii* Merr. of Hainan, but that species has distinctly pubescent leaves.

Meliosma Petelotii sp. nov. (§ *Simplices*).

Species *M. rigidae* S. et Z. affinis, differt areolis ultimis in foliis subtus planis, haud subfoveolatis, foliis glabris vel parcissime pubescentibus.

Arbor 5–6 m. alta, ramis ramulisque teretibus, breviter subcinereo-pubescentibus vel puberulis, ultimis 3–4 mm. diametro; foliis lanceolatis vel oblanceolatis, coriaceis, 15–24 cm. longis, 2.5–7.5 cm. latis, distanter conspicue serratis, dentibus acutis vel acuminatis, 1–2 cm. remotis, margine deorsum integris, apice acuminatis, basi cuneatis, supra costa impressa puberula excepta glabris, olivaceo-brunneis, subtus pallidioribus, glabris vel ad costam nervosque obscure breviter pubescentibus; nervis primariis utrinque 16–22, subtus valde elevatis, perspicuis, sub marginem arcuato-confluentibus, reticulis ultimis manifestis, laxis; petiolo 1.5–2 cm. longo, puberulo; paniculis angustis, solitariis, terminalibus, dense breviter adpresse subferrugineo-pubescentibus, breviter pedunculatis, circiter 15 cm. longis, ramis primariis circiter 3 cm. longis, multifloris, floribus sessilibus, in ramulis ultimis glomeratim confertis; bracteis lanceolatis, acuminatis, 1.5 mm. longis, pubescentibus, bracteolis multo minoribus; sepalis late ovatis, concavis, rotundatis vel obtusis, glabris vel margine minute ciliatis, 1.5 mm. longis; ovario ovoideo, 1 mm. longo, glabro, stylis aequilongis.

INDO-CHINA, Tonkin, near Chapa, *A. Petelot 3556* (type), *5862*, August, 1929, and July, 1935, in open forests, alt. about 1500 m.

Both of these specimens were originally referred to *Meliosma simplicifolia* (Roxb.) Walp., but there were so many manifest differences that a more critical study was made of the available material. The conclusion is that a species very closely allied to the Japanese *Meliosma rigida* Sieb. & Zucc. is represented, there being, however, great differences in the indumentum between this Indo-Chinese form and Japanese material and in the details of the reticulations. In the latter the ultimate reticulations on the lower surfaces of the leaves are more or less foveolate, in the present one the areolae are smooth, not at all impressed.

Meliosma dumicola W. W. Sm. Notes Bot. Gard. Edinb. **13:** 170. 1921.

INDO-CHINA, Tonkin, Chapa, *Petelot 5863*, April, 1936, alt. about 1500 m. Yunnan, Hainan. *Petelot 3944* from the same locality, distributed as *M. simplicifolia* Roxb., apparently represents the same species.

Meliosma Fordii Hemsl. Jour. Linn. Soc. Bot. **23:** 144. 1886.

INDO-CHINA, Tonkin, Chapa, *Petelot 5453*, April, 1935. Kwangsi, Kwangtung, and Hainan; new to the Indo-China flora.

RHAMNACEAE

Rhamnus griseus sp. nov.

Arbor inermis, circiter 10 m. alta; foliis subtus dense minuteque

pallide griseo- ad subcinereo-puberulis, ramis glabris, teretibus, ramulis breviter pubescentibus; foliis alternis, discoloribus, supra olivaceis, glabris, nitidis, subtus pallide cinereis, chartaceis vel subcoriaceis, oblongo-lanceolatis vel oblongis, 6–15 cm. longis, 1.5–5 cm. latis, tenuiter acuteque acuminatis, basi late acutis vel subrotundatis, integerrimis; nervis primariis utrinque 10–12, gracilibus, distinctis, ad marginem curvatis, obscure anastomosantibus; petiolo 1–2 cm. longo, pubescente; infructescentiis axillaribus, fructibus globoso-obovoideis, glabris, 5 mm. longis, fasciculatis, raro solitariis, vel depauperato-umbellatis, pedunculo usque 5–7 mm. longis, calycibus persistentibus puberulis, disciformibus, 2 mm. diametro.

INDO-CHINA, Tonkin, Chapa, *A. Petelot 4371* (type), July, 1931, *4568*, August, 1929, alt. 1500 to 1600 m., fruits red.

A species strongly characterized by its leaves being glabrous olivaceous and shining above, and pale cinereous or pale gray and densely puberulent beneath. The fruits are axillary, or in pairs, or up to 5 in fascicles or in shortly peduncled umbels.

Ventilago leiocarpa Benth. Jour. Linn. Soc. Bot. **5**: 77. 1860.

INDO-CHINA, Tonkin, Thai Nguyen Province, Thai Nguyen to Phan Mê, and Thai Nguyen to Bac Kon, *Petelot 4690, 4807*, April and May, 1933. Formosa, Kwangtung, Kwangsi, and Hainan. The Malay Peninsula form referred here by some authors is *Ventilago malaccensis* Ridl.

VITACEAE

Ampelopsis cantoniensis (H. & A.) K. Koch, var. **grossedentata** Hand.-Maz. Anz. Akad. Wiss. Wien **59**: 104. 1922.

INDO-CHINA, Tonkin, Chapa, *Petelot 5818*, July, 1937, a liana 4 to 5 m. long, alt. 1500 m. Fukien, Kwangtung, Kiangsi, and Kweichow. *Vitis multijugata* Lév. is a synonym.

ELAEOCARPACEAE

Elaeocarpus Griffithii (Wight) A. Gray, Wilkes U. S. Expl. Exped. Bot. **1**: 203. 1854; Kurz Jour. As. Soc. Bengal **39**(2): 68. 1870; Mast. in Hook. f. Fl. Brit. Ind. **1**: 408. 1874; Gagnep. in Lecomte Fl. Gén. Indo-Chine **1**: 570. 1911.

Elaeocarpus argyrodes Hance, Jour. Bot. **15**: 330. 1877 **(syn. nov.)**.

The type of Hance's species was a specimen collected in Cambodia by Pierre, the species not having been accounted for by Gagnepain in his treatment of the Indo-Chinese species; unfortunately Hance cited neither the collector nor the locality in describing his species. The reduction

has been made from Hance's description and an inspection of an excellent photograph of his type kindly supplied by Dr. J. Ramsbottom of the British Museum, Natural History.

Practically all modern authors, including King, Ridley, Gagnepain, and others, credit the binomial *Elaeocarpus Griffithii* to Masters, who independently published it by transfer in Hook. f. Fl. Brit. Ind. **1**: 408. 1874. However, Kurz had made the same transfer four years earlier, Jour. As. Soc. Bengal **39**(2): 68. 1870, and both Kurz and Masters were long antedated by A. Gray. The three botanists independently based the binomial under *Elaeocarpus* on *Monoceras Griffithii* Wight, Ill. **1**: 84. 1838, which is earlier than *Monoceras Griffithii* K. Muell. Annot. Elaeocarp. 12. 1849, the latter being a synonym of *E. paniculatus* Wall. The species occurs in Burma, Siam, Indo-China, the Malay Peninsula, Sumatra, and Borneo.

Elaeocarpus griseo-puberulus sp. nov. (§ *Dicera*).

Arbor circiter 15 m. alta, partibus junioribus et inflorescentiis et foliis subtus perspicue cinereo- vel griseo-puberulis; ramis teretibus, glabris, lenticellatis, circiter 4 mm. diametro, novellis dense puberulis; foliis oblongis, chartaceis vel subcoriaceis, 9–11 cm. longis, 3–4 cm. latis, leviter crenato-serratis dentibus subapiculatis, supra glabris, subolivaceis, subtus pallidioribus, dense adpresse puberulis, apice breviter acuminatis, basi acutis; nervis primariis utrinque 9–12, subtus perspicuis, elevatis, curvato-adscendentibus, obscure arcuato-anastamosantibus, reticulis haud perspicuis; petiolo puberulo, circiter 2 cm. longo; racemis numerosis in axillis defoliatis, puberulis, 6–7 cm. longis; floribus numerosis, 5-meris, pedicellis circiter 4 mm. longis; sepalis anguste oblongis, acutis, puberulis, 4 mm. longis; petalis 6 mm. longis, deorsum angustatis, laciniatis laciniis 8–9 linearibus 2–2.5 mm. longis, extus glabris, intus deorsum obscure pubescentibus, margine leviter ciliatis; staminibus circiter 15, filamentis brevibus, antheris oblongis, scabridulis, loculis subaequalibus, 1.5–1.8 mm. longis, obtusis; ovario ovoideo, dense cinereo-pubescente, stylis circiter 4 mm. longis, deorsum consperse subadpresse pubescentibus, sursum glabris; disco dense pubescente, annulato, circiter 1.5 mm. diametro, obscure crenulato.

INDO-CHINA, Tonkin, Chapa, *A. Petelot 3283*, September, 1928, in forests, alt. about 1500 m.

A species which I have not been able to refer to any described species, characterized by its short, usually dense, appressed, cinereous or subcinereous, puberulent indumentum, characteristic of the tips of the branchlets, inflorescences, petioles, and the lower surfaces of the leaves.

TILIACEAE

Tilia mesembrinos sp. nov.

Arbor, ramis ramulisque teretibus, glaberrimis, ultimis circiter 2 mm. diametro; foliis oblique inaequilateraliterque ovatis, circiter 10 cm. longis et 6 cm. latis, supra subolivaceis, glabris vel in nervis basalibus breviter decidue stellato-pubescentibus, subtus densissime stellato-pubescentibus pilis albidis vel in nervis pallide brunneis, apice acutis, basi latissime inaequilateraliter acutis vel oblique truncatis, haud cordatis, recto- vel curvato-dentatis dentibus 0.5–1 mm. longis 2–5 mm. remotis, subpatulis, versus basim integris; nervis primariis utrinque circiter 7, rectis, adscendentibus, subtus manifestis; petiolo 3–3.5 cm. longo, glabro vel sursum stellato-pubescente; cymis ut videtur 3-floris, sub fructu cum bracteis circiter 14 cm. longis, pedunculis glabris, circiter 3.5 cm. longis, pedicellis breviter stellato-pubescentibus; bracteis sessilibus vel brevissime (1–2 mm.) crasse stipitatis, oblanceolatis, obtusis vel rotundatis, 10–14 cm. longis, sursum circiter 2 cm. latis, deorsum plus minusve angustatis, basi 6–8 mm. latis, obtusis, in sicco pallidis, utrinque breviter stellato-pubescentibus; fructibus ovoideis vel subellipsoideis, circiter 1 cm. longis, breviter apiculatis, subverruculosis et dense breviter pallide pubescentibus.

INDO-CHINA, Tonkin, Massif du Song Ta Van, Chapa, *A. Petelot 5808*, August, 1936.

This is the first representative of the genus to be recorded from Indo-China, the specific name being selected in reference to its rather unusual southern range as compared to most other species of the genus. It is well characterized by its entire leaf-bases being very broadly acute to obliquely truncate, not at all cordate, and by the very dense whitish indumentum covering the entire lower surface. In some respects it suggests *Tilia mofungensis* Chun & Wang of Kwangtung Province, China, but that species has somewhat cordate leaf-bases and a very different indumentum.

STERCULIACEAE

Craigia W. W. Smith & Evans

Craigia yunnanensis W. W. Sm. & W. E. Evans Trans. Proc. Bot. Soc. Edinb. **28:** 69. *t. 1.* 1921.

INDO-CHINA, Tonkin, Chapa, *Petelot 3810*, August, 1930, a tree 15 to 20 m. high, alt. about 1500 m. A monotypic genus previously known only from Yunnan.

Sterculia scandens Hemsl. Kew Bull. **1908:** 179.

INDO-CHINA, Tonkin, near Laokai, *E. H. Wilson 2796* (*Henry 13643*).

This species was not accounted for by Gagnepain in his treatment of the Indo-China species in 1910. The specimen in the herbarium of the New York Botanical Garden bears a Yunnan label, but attached to it is Wilson's original note, reading "2796 climber, fls. salmon-pink, ravine, Namthi route, 1 1-2 miles from Laokai 8/3." On the occasion of Wilson's visit to Henry in Yunnan it is apparent that he presented this material to the latter who gave it a number in his own series. It is suspected that the field note is erroneous in reference to the plant being scandent, for the herbarium material that I have seen shows every indication of its having been an erect plant; and the scandent habit is not that of *Sterculia*. Yet the specimen represents a true *Sterculia*. Hemsley's citation is "Tonking, Laokai, *E. H. Wilson,* 2796; *A. Henry,* 13643, collected by Mr. Wilson."

Dr. A. Petelot informs me that Laokai or Laokay is situated near the Yunnan border, on the railroad line from Hanoi to Yunnanfu, at the confluence of the Red and Namthi Rivers.

Reevesia pubescens Masters in Hook. f. Fl. Brit. Ind. **1**: 364. 1874; Rehder, Jour. Arnold Arb. **15**: 96. 1934, cum syn.

INDO-CHINA, Tonkin, Chapa, *Petelot 6026,* August, 1933, alt. about 1500 m. India to Yunnan, Kweichow and Kwangsi, southward to Java.

ACTINIDIACEAE

Actinidia indochinensis sp. nov.

Frutex scandens, subglaber; ramis glabris, ramulis junioribus subdecidue breviter granulato-puberulis; foliis ovatis vel elliptico-ovatis, utrinque subaequaliter angustatis, apice breviter acute acuminatis, basi acutis, chartaceis vel submembranaceis, 5–7 cm. longis, 2–4 cm. latis, in sicco olivaceo-viridibus, utrinque subconcoloribus, supra glabris, subtus secus costam nervosque obscure granulato-puberulis, margine infra medium integris, sursum distanter apiculato-serrulatis, nervis primariis utrinque 4–6, gracilibus, manifestis; petiolo 1–2.5 cm. longo, primo granuloso-puberulo demum glabro vel subglabro; inflorescentiis breviter granuloso-puberulis, 1–3-floris, petiolum subaequantibus; floribus 5-meris, circiter 2 cm. diametro; sepalis ovatis, obtusis, extus leviter granuloso-puberulis, membranaceis, 4–5 mm. longis; petalis albidis, obovatis, rotundatis, circiter 1 cm. longis et 7 mm. latis; staminibus circiter 30, 1-seriatis, filamentis 3–4 mm. longis, antheris flavidis, oblongo-ovatis, 1.5 mm. longis; ovario subgloboso, dense breviter pubescente, stylis circiter 25, filamenta subaequantibus.

INDO-CHINA, Tonkin, Chapa, *A. Petelot 5938* (type), *5940,* April,

1936, a liana with white flowers in open forests at 1500–1600 m. altitude.

A species clearly in the alliance with *Actinidia callosa* Lindl. and the second representative of the genus to be recorded from Indo-China. Perhaps Dunn would have placed this under his concept of Lindley's species, of which he recognizes six varieties (Jour. Linn. Soc. Bot. **39:** 405–407. 1911), but particularly in the granular indumentum on the younger parts, inflorescences, and along the midrib and nerves on the lower surfaces of its leaves, it does not agree with any of the forms that he very briefly defined.

Saurauia Oldhami Hemsl. Jour. Linn. Soc. Bot. **23:** 79. 1886.

INDO-CHINA, Tonkin, Cho Ganh, *Petelot 820*, January, 1923; Massif du Tam Dao, *Petelot 4448*, December, 1930. Formosa.

I can see no reason for distinguishing this Indo-China form from Hemsley's Formosan species; new to Indo-China.

THEACEAE

Hartia tonkinensis sp. nov. FIGURE 3.

Arbor, partibus junioribus exceptis glabra (floribus ignotis), ramis glabris, ramulis junioribus teretibus, 1 mm. diametro, adpresse pilosis pilis subalbidis nitidis, alabastris densissime nitide pilosis; foliis chartaceis vel subcoriaceis, oblongo-obovatis, 3–6 cm. longis, 2–2.8 cm. latis, brevissime obtuseque acuminatis, basi subacutis, margine cartilagineo integro, supra olivaceis, glabris, subtus paullo pallidioribus, nervis primariis utrinque 10–12, subtus manifestis, arcuato-anastomosantibus, glabris vel ad costam leviter adpresse ciliatis; petiolo 5–8 mm. longo, anguste alato, praesertim supra adpresse ciliato; alabastris dense adpresse albido-pilosis; capsulis ovoideis, glabris, breviter apiculatis, 1 cm. longis, 5-valvis, sepalis persistentibus, subobovatis, rotundatis, adpresse pubescentibus, circiter 4 mm. longis, seminibus compressis, brunneis, suborbiculari-ellipticis, 2.5–4 mm. longis, plerumque anguste alatis.

INDO-CHINA, Tonkin, Massif du Tam Dao, near Chapa, *A. Petelot 3886*, November, 1930.

Characterized by its small glabrous capsules, small entire leaves, and small sepals. The petioles are less conspicuously winged than those of *H. sinensis* Dunn. The genus is new to Indo-China, the species on preliminary identification having been referred to the very closely allied genus *Stewartia*. *Hartia tonkinensis* is apparently most closely allied to *H. micrantha* Chun of Kwangtung Province, China.

In connection with this item the following adjustment is desirable in

connection with another Kwangtung species which has been described under different names in both *Hartia* and *Stewartia*:

Hartia villosa (Merr.) comb. nov.

Stewartia villosa Merr. Lingnan Sci. Jour. **7**: 315. 1931.
Hartia kwangtungensis Chun, Sunyatsenia **2**: 60. 1934, Ic. Pl. Sin. **5**: 10. *t. 210*. 1937 **(syn. nov.)**.

The species described by Chun as *Hartia kwangtungensis* in 1934 is correctly placed if one wishes to retain *Hartia* as distinct from *Stewartia*, the two genera being very closely allied. *Stewartia villosa* described from Kwangtung material by me in 1931 manifestly represents the same species.



FIGURE 3. HARTIA TONKINENSIS Merr. A, a fruiting branch; B, a seed; C, a capsule; D, an inflated or winged petiole.

Adinandra Millettii (Hook. & Arn.) Benth. & Hook. f. ex Hance, Jour. Bot. **16**: 9. 1878.

Adinandra Drakeana Franch. Nouv. Arch. Mus. Paris II. **5**: 208. 1883 (Pl. David **1**: 56).

INDO-CHINA, Tonkin, Chapa, *Petelot 3751, 4308*, July, 1930, 1931,

alt. about 1500 m.; Tam Dao, near Chapa, *Petelot 3976*, May, 1931, alt. about 900 m. Anhwei, Kiangsi, Fukien, Chekiang, and Kwangtung; new to Indo-China.

GUTTIFERAE

Hypericum attenuatum Choisy Prodr. Hyperic. 47. *t.* 6. 1821; DC. Prodr. **1:** 548. 1824.

INDO-CHINA, Tonkin, Chapa, *Petelot 3071*, July, 1927, alt. about 1500 m. Baikal region eastward and southward to Kwangtung.

Cratoxylon parvifolium Merrill sp. nov.

Frutex erectus, glaber, ramis ramulisque teretibus, ramulis ultimis gracilibus, circiter 0.5 mm. diametro; foliis ellipticis vel obovato-ellipticis, chartaceis, 1.5–2.5 cm. longis, 1–1.5 cm. latis, basi late acutis, apice late rotundatis vel obtusis, interdum abrupte brevissime apiculatis, in sicco pallide subolivaceis, subtus pallidioribus et praesertim in partibus superioribus consperse glandulosis; nervis primariis utrinque circiter 5, gracilibus, haud perspicuis, arcuato-anastomosantibus, venulis ultimis inter reticulis liberis; petiolo 3–4 mm. longo; inflorescentiis axillaribus terminalibusque, solitariis, pedunculatis, plerumque bifloris, pedunculo 5–8 mm. longo, pedicellis 3–4 mm. longis; floribus pallide rubris; sepalis ellipticis vel oblongo-ellipticis, rotundatis, 5 mm. longis, 2.5 mm. latis; petalis anguste oblongis, basi angustatis, inappendiculatis, circiter 8 mm. longis et 2.5 mm. latis; phalangibus sub fructu 8 mm. longis, filamentorum parte libera 1.5 mm. longa; capsulis late lanceolatis, 1–1.2 cm. longis, circiter 4 mm. diametro, sursum angustatis, stylis 3, brevibus, persistentibus.

INDO-CHINA, Annam, near Tourane, *J. & M. S. Clemens 3454*, May-July, 1927, a shrub on forested slopes, flowers pale red.

A species belonging in the group with *Cratoxylon ligustrinum* (Spach) Blume (*C. polyanthum* Korth.), distinguished, however, by its very much smaller, differently shaped, usually broadly rounded leaves. The lower surface of the leaves is characteristically supplied with scattered dark colored glands, these being much larger and more numerous in the upper one-third of the leaf. The tips of the ultimate veinlets are free within the rather lax and not very distinct reticulations.

FLACOURTIACEAE

Casearia Petelotii sp. nov.

Arbor parva, 7–8 m. alta, ramis ramulisque dense tomentosis, ultimis 4–5 mm. diametro; foliis coriaceis, oblongis, integris vel minute obscure

denticulatis, 20–25 cm. longis, 6–8 cm. latis, acuminatis, basi leviter cordatis, subinaequilateraliter late rotundatis, in sicco supra atris vel atro-olivaceis, nitidis, glabris vel secus costam nervosque plus minusve pubescentibus, subtus paullo pallidioribus, perspicue breviter pubescentibus, costa crassa, valde elevata, dense pubescente, nervis primariis utrinque circiter 15, subtus perspicuis, elevatis, curvato-adscendentibus, vix vel obscure anastomosantibus; petiolo crasso, dense pubescente, 1 cm. longo; floribus axillaribus, fasciculatis, breviter pedicellatis, confertis, numerosis, pubescentibus, pedicellis ad 3 mm. longis, leviter pubescentibus; floribus circiter 7 mm. diametro, sepalis ellipticis vel elliptico-ovatis, rotundatis, 3 mm. longis, extus leviter pubescentibus; filamentis 2 mm. longis, leviter pubescentibus, antheris ellipticis, 0.8 mm. longis, haud apiculatis; staminodeis oblongis, 1 mm. longis, apice barbatis; ovario consperse ciliato cum stylo 2 mm. longo.

INDO-CHINA, Tonkin, Chapa, *A. Petelot 5930,* April, 1936, in forests, alt. about 1500 m.

The alliance of this species is manifestly with *Casearia villilimba* Merr. and *C. grewiaefolia* Vent. as the latter is interpreted by Gagnepain. It impresses me as being well characterized by its unusually large, coriaceous, many-nerved leaves as well as by its unusually dense indumentum.

BEGONIACEAE

Begonia Handelii Irmscher, Anz. Akad. Wiss. Wien Math.-Nat. Kl. **58:** 24. 1921, Mitt. Inst. Bot. Hamb. **6:** 348. 1927; Hand.-Mazz. Symb. Sin. **7:** 385. 1931.

INDO-CHINA, Tonkin, Phomoi, near Laokay, near the Yunnan border, *Handel-Mazzetti 12.*

We have seen no specimens of this species and do not know whether or not the same form may have been treated by Gagnepain, Lecomte, Fl. Gén. Indo-Chine **2:** 1095–1120. 1921, under some other name. At any rate Irmscher's species was based on Indo-Chinese material. The original description is repeated in the 1927 and 1931 references.

LYTHRACEAE

Lagerstroemia calyculata Kurz in Jour. As. Soc. Bengal **41**(2): 307. 1872; Craib, Fl. Siam. Enum. **1:** 719. 1931.

Lagerstroemia angustifolia Pierre ex Laness. Pl. Util. Colon. Fr. 323. 1886, *nomen;* Gagnep. Not. Syst. **3:** 355. 1918, *descr.,* Lecomte Fl. Gén. Indo-Chine **2:** 965. *f. 103.* 1921.

INDO-CHINA, southern Annam, Dalat, *Squires 820,* April, 1932. After comparing a series of Indo-Chinese specimens, including *Pierre 4993,*

Bejeaud 698, and *Robert 14* with Siamese material, I agree with Craib that Pierre's species is identical with the older *Lagerstroemia calyculata* Kurz. Indo-China, Siam and Burma.

NYSSACEAE

Nyssa sinensis Oliv. Hook. Ic. **20**: *t. 1964*. 1891; Wang. Pflanzenreich **41 (IV-220a)**: 10. 1910.

INDO-CHINA, Tonkin, Chapa, *Petelot 4236*, July, 1931, alt. 1600 m. Kiangsu, Kiangsi, Hupeh, Anhwei, Kwangtung, Kwangsi, Kweichow, Szechuan and Yunnan; new to Indo-China.

MELASTOMATACEAE

Memecylon confertiflorum sp. nov. (§ *Eumemecylon*).

Frutex 3–4.5 m. altus, glaber, ramis ramulisque teretibus, ramulis ultimis circiter 1 mm. diametro; foliis crasse coriaceis, ellipticis vel elliptico-ovatis, 5–9 cm. longis, 3–5 cm. latis, nitidis, apice obtusis, raro leviter retusis, basi acutis vel rotundatis, supra viridibus, subtus brunneo-olivaceis, costa supra impressa, subtus valde perspicua elevata, nervis primariis utrinque circiter 7, gracilibus, haud vel obscurissime anastomosantibus, inconspicuis, saepe obsoletis vel subobsoletis; petiolo 4–8 mm. longo; inflorescentiis axillaribus, multifloris, densis, subglobosis, circiter 1.5 cm. diametro, e cymis vel racemis multis brevibus fasciculatis paucifloris compositis; floribus pedicellatis, 4-meris, lilacinis, calycibus circiter 2 mm. longis, tubo deorsum 1 mm. diametro, sursum ampliato, 2 mm. lato, breviter 4-denticulato; petalis oblongo-lanceolatis, acuminatis, crassis, 3 mm. longis; filamentis 8, 3 mm. longis; bracteolis minutis, basilaribus.

INDO-CHINA, southern Annam, near Dalat, *Squires 787*, May 6, 1932, in forests.

A species characterized by its terete branchlets, very coriaceous obscurely nerved leaves, dense globose axillary inflorescences, these composed of numerous short few-flowered racemes or depauperate cymes, and its thick acuminate petals, which with the filaments are about 3 mm. long. Its alliance is with *Memecylon laevigatum* Blume and *M. Harmandii* Guill.

ARALIACEAE

Dendropanax venosus sp. nov.

Frutex glaber, circiter 2 m. altus, ramulis ultimis 2 mm. diametro; foliis coriaceis, in sicco olivaceis vel olivaceo-brunneis, oblongis vel late oblongo-oblanceolatis, 6–16 cm. longis, 1.5–4 cm. latis, acutis vel

acuminatis, basi acutis, 3-nerviis, margine leviter revoluto, in foliis minoribus integerrimo, in majoribus deorsum integro, sursum distanter acuminato-serrato, dentibus plus minusve incurvatis, circiter 1 mm. longis, inter se 0.5–2 cm. distantibus; nervis primariis, basalibus exceptis, utrinque 7–11, in utraque pagina elevatis, subtus valde perspicuis, arcuato-anastomosantibus, secundariis minus manifestis alternantibus, reticulis primariis sublaxis, leviter elevatis; petiolo 1.5–5 cm. longo; inflorescentiis umbellatis, terminalibus, solitariis, pedunculo crasso, circiter 8 mm. diam.; fructibus paucis (circiter 6–8), ovoideis, circiter 8 mm. longis, 5-locellatis, leviter sulcatis, dentibus persistentibus 5, triangularibus, acutis, 1 mm. longis; stylis 5, subliberis, crassis, patulis vel recurvatis, saltem 1 mm. longis.

INDO-CHINA, Annam, Mount Bana, *J. and M. S. Clemens 4401*, May-July, 1927, fairly frequent near the summit of the mountain.

This differs from the Hainan *Dendropanax oligodontus* Merr. & Chun in its coriaceous, more prominently nerved leaves and particularly in its free or nearly free spreading or recurved styles, the style of *D. oligodontus* being simple and columnar. **Dendropanax Chevalieri** (Viguier) comb. nov. (*Gilibertia Chevalieri* Viguier in Lecomte, Fl. Gén. Indo-Chine **2**: 1181. *f. 141.* 1923), the only other species of the genus hitherto recorded from Indo-China, has the free styles of the present species but its leaves are entire, and apparently with much fewer primary lateral nerves. *Gilibertia* Ruiz & Pavon is invalidated by the earlier *Gilibertia* Gmelin, *Dendropanax* Decne. & Planch. being the next older name. *Textoria* Miquel, based on a Japanese species, is apparently not generically distinct from the American forms.

ERICACEAE

Agapetes cauliflora sp. nov.

Suffrutex ramosus usque ad 30 cm. altus; caulibus deorsum glabris, circiter 4 mm. diametro, sursum plus minusve patule setosis, circiter 2 mm. diametro, ramulis ultimis dense brunneo-setosis, pilis patulis, usque ad 2 mm. longis, plerumque capitato-glandulosis; foliis in ramulis ultimis plus minusve confertis, coriaceis vel subcoriaceis, sessilibus, integris, oblongo-ellipticis, 4–6 cm. longis, 1.5–2.5 cm. latis, acutis vel obscure acuminatis, basi subacutis vel obtusis, nervis lateralibus utrinque 5–7, gracilibus, in utraque pagina leviter elevatis, haud perspicuis, arcuato-anastomosantibus; floribus solitariis vel binis trinisve, in axillis defoliatis longe infra folia, circiter 2.5 cm. longis, pedicellis 5–6 mm. longis, pilis subflaccidis patulis 1–2 mm. longis subcapitato-glandulosis vestitis; calycibus circiter 6 mm. longis, tubo 4 mm. dia-

metro, lobis anguste ovatis, acutis vel acuminatis, 2 mm. longis, patule hirsutis; corolla circiter 2.5 cm. longa, tubo sursum leviter ampliato, extus patule hirsuto, lobis ovatis, obtusis, circiter 3 mm. longis; staminibus 10, filamentis leviter pubescentibus, albidis, 1 cm. longis; antheris 6 mm. longis, basi rotundatis, apice in tubum 3–3.5 mm. longum productum, calcaribus leviter curvatis, circiter 1.5 mm. longis; ovario glabro.

INDO-CHINA, Tonkin, Massif du Song Ta Van, Chapa, *A. Petelot 5947*, August, 1936, on calcareous rocks at the base of a tree, alt. about 1900 m.

Those parts of the stems and branches more or less covered with debris bear rather numerous roots, while attached to the stem is an irregularly ovoid woody growth resembling the underground thickened parts of certain epiphytic or semi-epiphytic Melastomataceae. The branching is largely beneath the covering debris, the tips of the branches protruding and bearing the apical leaves and the lateral flowers. The species seems to be allied to *Agapetes oblonga* Craib of Yunnan, differing in its leaves being crowded at the very tips of the branchlets, in its lateral not axillary flowers, which are hirsute, the spreading hairs on the pedicels, calyx and corolla being more or less capitate-glandular.

Vaccinium chapaense sp. nov.

Frutex erectus, multiramosus, ramis glabris, rigidis, ramulis circiter 1 mm. diametro, glabris vel novellis leviter pubescentibus; foliis numerosis, parvis, coriaceis, rigidis, nitidis, obovatis, 1–1.4 cm. longis, 8–9 mm. latis, obtusis vel rotundatis, basi acutis, deorsum integris, sursum manifeste crenatis, crenulis utrinque plerumque 3, nervis primariis utrinque 3 vel 4, supra leviter impressis, subtus subelevatis, petiolo 1 mm. longo, glabro; infructescentiis terminalibus, subracemoso-spicatis vel fructibus solitariis, rhachibus subangulatis, glabris, ad 8 mm. longis; fructibus immaturis circiter 4 mm. diametro, subsessilibus vel brevissime pedicellatis, circiter 8-locellatis, subgloboso-obovoideis, seminibus paucis, bracteis binis submembranaceis oblanceolatis vel obovatis glabris 5–6 mm. longis ut videtur deciduis suffultis; calycis dentibus 5, parvis, late ovatis, obtusis vel subacutis, subinflexis.

INDO-CHINA, Tonkin, Chapa, Col du Lo Qui Ho, *A. Petelot 3896*, August, 1933, alt. about 2000 m.

A species characterized by its small, obovate, coriaceous, distinctly nerved and somewhat reticulate, rather conspicuously crenate leaves, usually three crenules on each side in the upper one-half, the lower half of the leaves with entire margins. It does not appear to be closely

allied to any of the sixteen species credited to Indo-China by Dop. Its general alliance seems to be with *Vaccinium Nummularia* Hook. f. & Th. of Sikkim and Bhotan. Type, herb. N. Y. Bot. Garden, isotype herb. Arnold Arboretum.

MYRSINACEAE

Embelia Henryi Walker, Jour. Washington Acad. Sci. **27:** 200. *f. 3.* 1937.

INDO-CHINA, Tonkin, Chapa, *Petelot 3827, 3599,* August, 1930, and September, 1929, alt. about 1700 m. Yunnan.

Rapanea yunnanensis Mez, Pflanzenr. **9 (IV. 236):** 358. *f. 60.* 1902.

INDO-CHINA, Tonkin, Chapa, *Petelot 7950,* April, 1936, in open forests at 1500 m. alt. Yunnan.

PRIMULACEAE

Lysimachia Pierrei Petitm. Bull. Acad. Int. Géogr. Bot. **18:** 337. 1908.

The type of this species was indicated by Petitmengin as preserved in the herbarium of the Paris Museum, and it is hence curious that Bonati failed to account for the species in his treatment of the Indo-Chinese species (Lecomte, Fl. Gén. Indo-Chine **3:** 758–764. 1930). It was based on an Indo-Chinese specimen collected by Pierre "Hab. in sabulosis ad Kampot Cambodiae (L. Pierre, 4. 1874)." From Petitmengin's description it should fall very near the form Bonati described as *Lysimachia pedunculariS* Wall.; Petitmengin compares it with *L. ramosa* Wall., *L. floribunda* Z. & M., and *L. callipes* Hemsl.

Lysimachia ramosa Wall. List no. 1490. 1829, *nomen nudum;* Duby in DC. Prodr. **8:** 65. 1844; Pax & Knuth, Pflanzenr. **22 (IV. 237):** 271. *f. 57, A-C.* 1905.

INDO-CHINA, Tonkin, Lo Qui Ho, near Chapa, *Petelot 4763,* August, 1933, alt. about 2000 m. Eastern Himalayan region and the Khasia Mountains, Burma, and Yunnan.

The Philippine form referred here by Pax & Knuth is *Lysimachia fragrans* Hayata; the Javan form placed here probably does not represent Wallich's species.

Lysimachia Petelotii sp. nov. (§ *Alternifoliae*).

Herba glabra, caulibus procumbentibus, ad nodos radicantibus, ramis paucis, 10–25 cm. altis, erectis, sursum folia 3 vel 4 bene alternantes gerentibus; foliis chartaceis, integris, ellipticis vel elliptico-ovatis, 5–13 cm. longis, 3–7 cm. latis, acutis vel brevissime apiculato-

acuminatis, basi acutis, nervis primariis utrinque circiter 6, subtus elevatis, perspicuis, petiolo crasso, 2–3 mm. longo; floribus flavidis, axillaribus, solitariis, pedicellis filiformibus, 4–5 cm. longis; calycibus fere ad basin 5-partitis, sepalis oblongo-ovatis vel ovato-lanceolatis, manifeste acuminatis, 2–4 mm. longis; corolla flavida, campanulato-subrotata, profunde 5-partita, lobis oblongo-ellipticis, usque ad 1.3 cm. longis, acutis vel subobtusis; capsulis ignotis.

INDO-CHINA, Tonkin, Chapa, *A. Petelot 5444,* April, 1935, in open forests on calcareous formations, alt. about 1500 m., type in the Gray Herbarium.

A remarkable species, when dry with a very persistent and pronounced odor of fenugreek (*Trigonella Foenum graecum*) as in *Lysimachia Foenum-graecum* Hance. It is manifestly allied to Hance's species, which extends from Kwangtung and Kwangsi to Szechuan and Yunnan, differing in its remarkable large leaves and its much larger flowers. It is scarcely more closely allied to the Indian *L. evalvis* Wall. than it is to Hance's species.

STYRACACEAE

Huodendron biaristatum (W. W. Sm.) Rehd. Jour. Arnold Arb. **16:** 344. *t. 152.* 1935.

Styrax biaristatus W. W. Sm. Notes Bot. Gard. Edinb. **12:** 233. 1920; C. E. C. Fischer, Kew Bull. **1933:** 365.

INDO-CHINA, Tonkin, vicinity of Chapa, *Petelot 3803,* August, 1930, *4373,* September, 1931. Yunnan, Kweichow, Kwangsi in China, and also occurring in Burma; a variety in Kwangtung Province, China.

This recently described, strongly characterized genus is represented by two known species and one variety, the generic range being Burma, northern Indo-China, Yunnan, southeastern Tibet, Kweichow, Kwangsi, and Kwangtung.

SYMPLOCACEAE

Symplocos Guillauminii nom. nov.

Symplocos triscpala Guillaum. Bull. Soc. Bot. Fr. **79:** 176. 1932, Lecomte, Fl. Gén. Indo-Chine **3:** 1024. 1933, non Merr. 1917.

Indo-China.

OLEACEAE

Jasminum longisepalum Merr. Univ. Calif. Publ. Bot. **10:** 429. 1924.

Jasminum longisetum Gagnep. in Lecomte & Humbert, Fl. Gén. Indo-Chine 3: 1056. 1933 **(syn. nov.).**

Gagnepain overlooked my description of 1924 based on *Petelot 773,*

973, from Cho-Ganh, Indo-China. *Jasminum longisetum* Gagnep. safely represents the same species.

Jasminum pentaneurum Hand.-Mazz. Anz. Akad. Wiss. Wien **59:** 109. 1922; Kobuski, Jour. Arnold Arb. **13:** 167. 1932.

INDO-CHINA, Tonkin, Phu Ho, *Petelot 1514*, October, 1923. Kwangtung, Kwangsi.

This specimen is clearly referable to Handel-Mazzetti's species. It is suspected that this form was included by Gagnepain in his concept of *Jasminum subtriplinerve* Blume (Lecomte, Fl. Gén. Indo-Chine **3:** 1049. 1933).

Jasminum Duclouxii (Lév.) Rehd. Jour. Arnold Arb. **15:** 307. 1934.

Melodinus Duclouxii Lév. Repert. Sp. Nov. **2:** 114. 1906.
Jasminum Schneideri Lév. Monde Pl. II. **18:** 31. 1916.
Jasminum dumicolum W. W. Sm. Notes Bot. Gard. Edinburgh **12:** 207 1920; Kobuski, Jour. Arnold Arb. **13:** 166. 1932.

INDO-CHINA, Tonkin, Chapa, *Petelot 5939*, April, 1936, in open forests, alt. 1500 m. Yunnan. Léveillé erroneously credited *Ducloux 112*, on which his two binomials were based, to Kweichow.

Osmanthus Matsumuranus Hayata, Jour. Coll. Sci. Univ. Tokyo **30**(1): 192. 1911.

INDO-CHINA, Tonkin, Bac Giang Province, between Kep and Pho Vi, *Petelot 5954*, June 5, 1936, in open forests. Kwangsi, Kwangtung, Hainan, and Formosa.

GENTIANACEAE

Crawfurdia speciosa Wall. Tent. Fl. Nepal. 64. *t. 48*. 1826; C. B. Clarke in Hook. f. Fl. Brit. Ind. **4:** 106. 1883.

INDO-CHINA, Tonkin, Massif du Tam Dao, alt. 1000 m., *Petelot 4584*, December, 1930. Central and eastern Himalayan regions; new to Indo-China.

Crawfurdia fasciculata Wall. Tent. Fl. Nepal. 63. *t. 47*. 1826; C. B. Clarke in Hook. f. Fl. Brit. Ind. **4:** 107. 1883.

INDO-CHINA, Tonkin, Chapa, *Petelot 3159*, July, 1927, alt. 1500 m., Khasia Mountains and southeastern China. *Petelot 4585*, from the Massif du Tam Dao, a specimen in fruit, may be referable here.

Canscora Petelotii sp. nov.

Herba parva, annua, erecta, circiter 9 cm. alta, simplex vel parce ramosa, caulibus teretibus, glabris vel parce ciliatis, haud 1 mm. diametro; foliis inferioribus ovatis vel oblongo-ovatis, acutis, usque

ad 1.7 cm. longis et 1.2 cm. latis, parce ciliatis, nervis utrinque circiter 3, petiolo usque ad 2 mm. longo; bracteis bracteolisque foliaceis, perfoliatis, orbicularibus, reticulatis, glabris, 1 ad 1.5 cm. diametro; floribus albidis, solitariis, 1.4 cm. longis, 5-meris, calyce cylindrico, 6 mm. longo, dentibus acutis; corollae tubo calycem aequante, lobis 5, oblongis, obovatis, rotundatis, 7 mm. longis, 4–4.5 mm. latis, tenuiter 8-nerviis; staminibus 5, 3 brevioribus corollae tubum subaequantibus, 2 longioribus distincte (3–4 mm.) exsertis.

INDO-CHINA, Laos, Province of Cammon, Kouan Pha Vang, *A. Petelot 4327*, November, 1930. A rare plant growing on calcareous rocks at an altitude of about 140 m.

This species superficially suggests a dwarfed form of *Canscora perforata* Lam. and *C. Wallichii* C. B. Clarke, of India, differing markedly in its small size, terete, not 4-winged stems, and its 5-merous flowers. It is not closely allied to any of the other 5 species of the genus recorded from Indo-China. Representatives of the genus normally have 4-merous flowers, but this species is anomalous within the genus, as is the totally different *C. pentanthera* C. B. Clarke of the Malay Peninsula, in its 5-merous flowers.

BORAGINACEAE

Trigonotis macrophylla Vaniot var. **verrucosa** Johnston, Jour. Arnold Arb. **18:** 4. 1937.

INDO-CHINA, Tonkin, Chapa, *Petelot 4192*, July, 1930, along roads in forests. This variety also in Kwangsi Province, China, the species and another variety in Kweichow Province, China. The first representative of the genus to be recorded from Indo-China.

VERBENACEAE

Clerodendron Squiresii sp. nov.

Frutex scandens 5–7 m. altus, partibus junioribus inflorescentiisque plusminusve pubescentibus, ramis ramulisque pubescentibus, teretibus, ultimis 2 mm. diametro; foliis ovatis, chartaceis vel subcoriaceis, olivaceis, nitidis, integris, 4–8 cm. longis, 3–4.5 cm. latis, basi late subtruncato-rotundatis vel leviter cordatis, apice acutis vel breviter acuminatis, utrinque ad costam nervosque obscure pubescentibus demum glabrescentibus, nervis primariis utrinque 3 vel 4, subtus manifestis; petiolo 5–10 mm. longo, leviter pubescente; inflorescentiis terminalibus, multifloris, 10–15 cm. longis, 15–20 cm. latis, subcorymbosis vel ramis primariis plus minusve distantibus, patulis, inferioribus oppositis, ad 10 cm. longis, superioribus brevioribus, bracteis bracteolisque linearibus,

pubescentibus, bracteis usque ad 3 mm. longis, bracteolis minoribus; calyce breviter cinereo-pubescente, 3 mm. longo, basi acuto, dentibus parvis, vix 0.5 mm. longis; corollae tubo gracili, circiter 8 mm. longo, albido, glabro, lobis oblongis vel oblongo-obovatis, rotundatis, 2 mm. longis; filamentis longe (ad 13 mm.) exsertis, glabris; fructibus cylindricis, oblongo-ellipsoideis, 5–7 mm. longis, 3 mm. diametro, rotundatis, adpresse hirsutis atque breviter pubescentibus, tarde dehiscentibus, in pyrenas 4 elongatas angustas dissilientibus.

INDO-CHINA, southern Annam, Dalat, *R. W. Squires 858*, March 15, 1932, on sandy river banks, flowers white, fragrant.

In all respects, except in its ultimately dehiscent fruits, this is a typical *Clerodendron*, apparently belonging in the group with *Clerodendron Godefroyi* O. Ktze. The fruiting calyces are very slightly enlarged, about 3 mm. in diameter, and about as long as wide. The fully ripe fruits split longitudinally into two equal parts, which in turn divide into two narrow single-seeded pyrenes, the dehiscence paralleling that of the fully mature fruits of the common *Clerodendron inerme* Gaertn.

Clerodendron Petasites (Lour.) Moore, Jour. Bot. **63:** 285. 1925; Merr. Trans. Am. Philos. Soc. II, **24**(2)**:** 338. 1935.

Volkameria Petasites Lour. Fl. Cochinch. 388. 1790.
Clerodendron subpandurifolium O. Ktze. Rev. Gen. Pl. 506. 1891.
Clerodendron Robinsonii Dop, Not. Syst. **4:** 9. 1920, Lecomte, Fl. Gén. Indo-Chine **4:** 872. *f. 89, 8, f. 90, 1–2.* 1935 **(syn. nov.).**

This fairly well characterized species, known only from Indo-China, was originally described by Loureiro in 1790, Loureiro's type, probably from the vicinity of Hue, being preserved in the herbarium of the British Museum. Moore examined this in 1925 and found it to be identical with *Clerodendron subpandurifolium* O. Ktze. (1891), type from Tourane. Dop overlooked both species in 1935, having redescribed the same form in 1920 as *Clerodendron Robinsonii* Dop, type *Robinson 1290* from Nha Trang. Loureiro's specific name should be retained.

Premna interrupta Wall. List no. 1778. 1929, *nomen nudum;* Schauer In DC. Prodr. **11:** 633. 1847; P'ei, Mem. Sci. Soc. China **1**(3)**:** 88, 1932.

INDO-CHINA, Tonkin, Chapa, alt. 1550 m., *Petelot 4786, 5447,* July, 1933, and April, 1935. India to Tibet and Yunnan.

LABIATAE

Elsholtzia Patrini (Lepech.) Garcke, Fl. Halle **2:** 213. 1856; Britt.

& Brown, Ill. Fl. North. U. S. **3:** 124. *f. 3188*. 1898; Hand.-Mazz. Symb. Sin. **7:** 935. 1936.

Mentha Patrini Lepech. Nova Acta Acad. Petrop. **1**: 336. *t. 8*. 1783.
Elsholtzia cristata Willd. in Roem. & Usteri Mag. Bot. **11**: 5. 1790.

INDO-CHINA, near Hanoi, *Petelot 1370*, April, 1924, planted. Widely distributed in Asia, introduced in Europe and in North America. It is very probable that this is the species considered by Loureiro to represent *Origanum syriacum* Linn.; Fl. Cochinch. 374. 1790.

SOLANACEAE

Solanum pittosporifolium Hemsl. Jour. Linn. Soc. Bot. **26:** 171. 1890.

INDO-CHINA, Tonkin, Chapa, *Petelot 4583*, August, 1930, alt. about 1500 m. Szechuan and probably in other parts of western China.

Lycianthes denticulata (Blume) Bitter var. **leiophylla** Bitter, Abh. Naturwiss. Ver. Bremen **24:** 475. 1920.

INDO-CHINA, Tonkin, Mount Bani, *Petelot 5459*, August, 1931, alt. about 500 m. The variety in Tenasserim, the species in Java and Sumatra.

SCROPHULARIACEAE

Wightia elliptica sp. nov.

Arbor circiter 8 m. alta, ramis ramulisque incrassatis, purpureo-brunneis, lenticellatis, in sicco plus minusve rugosis, ultimis circiter 5 mm. diametro, glabris; foliis crasse coriaceis, ellipticis, 10–20 cm. longis, 6–11 cm. latis, apice obtusis vel breviter obtuseque acuminatis, basi latissime acutis vel rotundatis, supra pallidis vel brunneis, glabris, subtus conspersissime breviter substellato-pubescentibus demum glabrescentibus, in axillis primariis glandulis paucis (circiter 5) ad 20 planis vel impressis plerumque vix 0.5 mm. diametro instructis; nervis primariis utrinque 4–6, supra impressis, subtus paullo elevatis, curvato-adscendentibus, obscure arcuato-anastomosantibus, reticulis distinctis; petiolo glabro vel parcissime pubescente, 1.5–4 cm. longo; thyrsis pedunculatis, ad 15 cm. longis, in ramis aphyllis erectis, ad 70 cm. longis, racemose dispositis; floribus numerosis, plus minusve confertis, circiter 3.5 cm. longis, pallide roseo-purpureis, pedunculo glabrescente, in partibus floriferis dense breviter ferrugineo-puberula, pedicellis usque ad 5 mm. longis; calyce 8–9 mm. longo, 6–7 mm. diametro, extus dense substellato-puberulo, intus glabro, 3-lobato, lobis ovatis, circiter 3 mm. longis, binis acutis, altero rotundato, corollae tubo circiter 1.6 cm. longo, extus dense ferrugineo-puberulo, intus glabro, leviter curvato,

lobis infimis oblong-ovatis, rotundatis, 8 mm. longis, lateralibus circiter 10 mm. longis, supremis bifidis, lobulis imbricatis, ovatis, obtusis, circiter 7 mm. longis; filamentis glabris, antheris oblongo-ellipsoideis, 4 mm. longis; ovario glabro.

INDO-CHINA, Tonkin, Chapa, *A. Petelot 4198,* October, 1931, flowers mauve on leafless erect or ascending branches attaining a length of 70 cm.

When I first studied this species it was referred to **Wightia speciosissima** (D. Don) comb. nov. (*Gmelina speciosissima* D. Don, Prodr. Fl. Nepal. 104. 1825; *Wightia gigantea* Wall. Pl. As. Rar. **1:** 71. *t. 81.* 1830), but because of certain discrepancies observed, I then attempted to place it with one of the few other described species of the genus. It is clearly not the same as the Indian species mentioned above, nor can it be referred to *Wightia Aplinii* Craib of Burma. Its closest ally seems to be *Wightia Lacei* Craib of Burma, from which it differs in its much larger leaves, glabrous petioles, somewhat different flowers, and apparently also in its very numerous axillary glands, varying from 4 or 5 to about 20 in each primary axil on the lower surface of the leaf; this character is not mentioned by Craib for either of the two species he described from Burma. The genus is new to Indo-China.

Artanema longifolium (Linn.) Merr. Philip. Jour. Sci. **19:** 380. 1921.

Columnea longifolia Linn. Mant. **1:** 90. 1767.
Achimenes sesamoides Vahl, Symb. **2:** 71. 1791.
Artanema sesamoides Benth. Scroph. Ind. 39. 1836; Bonati in Leconte, Fl. Gén. Indo-Chine **4:** 384. 1927.

INDO-CHINA, southern Annam, Dalat, *Squires 926,* March 17, 1932, on sandy river banks. India to Indo-China, Malaysia, and Luzon. Other synonyms are *Sesamum javanicum* Burm. f. (1768), and *Artanema longiflorum* Wettst. (1891).

Paulownia Fargesii Franchet, Bull. Mus. Hist. Nat. Paris **2:** 280. 1896; Rehd. in Sargent, Pl. Wils. **1:** 575. 1913.

INDO-CHINA, Tonkin, Chapa, *Petelot 5861,* April, 1936, alt. about 1600 m., in open forests. Szechuan, Yunnan.

RUBIACEAE

Ixora hainanensis Merr. Lingnan Sci. Jour. **6:** 287. 331. 1930.

INDO-CHINA, southern Annam, near Dalat, *Squires 910,* June 10, 1932. A shrub with white flowers in open rocky forests. Kwangtung Province, China, and Hainan.

In *Ixora Henryi* Lév. Repert. Sp. Nov. **13:** 178. 1914, type *Cavalerie*

3496, Kweichow Province, China, the leaves are slenderly and sharply acuminate and the calyx-lobes are much shorter than the calyx tubes. I have not seen the Indo-Chinese material referred by Pitard to *Ixora Henryi* Lév., but the specimen above cited, which may or may not represent *Ixora Henryi* as interpreted by Pitard in Lecomte, Fl. Gén. Indo-China **3:** 324. 1924, I believe to be safely conspecific with *Ixora hainanensis* Merr.; *I. Henryi* Lév., as originally described from Kweichow material, is distinctly different from *Ixora hainanensis* Merr.

Ixora Pierrei nom. nov.

Ixora gracilipes Pierre ex Pitard in Lecomte, Fl. Gen. Indo-Chine **3:** 314. 1924, non Merr. 1915.

A new name is needed for this Indo-China species the actual type being *Pierre 3185*.

Mussaenda Squiresii sp. nov.

Frutex 1–2 m. altus, ramis teretibus, elongatis, glabris, ramulis consperse hirsutis, ultimis circiter 2 mm. diametro; foliis chartaceis, oblongis vel oblongo-ovatis, 7–10 cm. longis, 2.5–3.5 cm. latis, supra olivaceis, subtus viridibus, graciliter acute acuminatis, basi acutis, utrinque consperse hirsutis, nervis primariis utrinque 7–9, gracilibus, manifestis; petiolo 5–7 mm. longo, ciliato-hirsuto; stipulis lanceolatis, acuminatis, ciliato-hirsutis, circiter 8 mm. longis; cymis terminalibus 6–8 cm. latis, multifloris, foliosis, ciliato-hirsutis, plerumque e basi 3-ramosis, ramis vel pedunculis 2–4 cm. longis; floribus aurantiacis, in ramulis ultimis plusminusve confertis; floribus circiter 2.5 cm. longis, calycis tubo ciliato-hirsuto, 2 mm. longo, lobis normalibus lanceolatis, acuminatis, ciliato-hirsutis, quam tubo duplo longioribus, lobo petaloideo lamina ovato- vel oblongo-lanceolata, 7–8 cm. longa et 1.5–3 cm. lata, in stipitem 2–3 cm. longum attenuata; corollae tubo gracili, consperse ciliato-hirsuto, 2 cm. longo, sursum leviter ampliato, 1–1.5 cm. diametro, lobis 5, oblongo-ovatis, acuminatis, 5 mm. longis, bracteolis linearibus, 5–8 mm. longis.

INDO-CHINA, southern Annam, near Dalat, *R. W. Squires 827*, April 21, 1932, a shrub, in rocky open field, flowers bright orange.

A species apparently allied to *Mussaenda saigonensis* Pierre among those where the calyx-lobes are much longer than the calyx-tubes, but with very different petaloid sepals.

Nertera sinensis Hemsl. Jour. Linn. Soc. Bot. **23:** 391. *t. 10*. 1888.

INDO-CHINA, Tonkin, Chapa, *Petelot 3127*, July, 1927, alt. about 1500 m. Szechuan to Kweichow and Kwangtung. The genus is new to Indo-China.

Hymenopogon parasiticus Wall. in Roxb. Fl. Ind. **2:** 157. 1824; Pitard in Lecomte, Fl. Gén. Indo-Chine **3:** 57. *f. 4, 18–21, 6, 2–3.* 1922.

INDO-CHINA, Tonkin, near Chapa, *Petelot 3138, 3254,* September, 1927, and July, 1928, alt. 1500 to 1600 m. India to Yunnan and Siam.

This was admitted by Pitard on the Siamese record; he had no material from French Indo-China.

Prismatomeris Labordei (Lév.) Merr. ex Rehder, Jour. Arnold Arb. **18:** 249. 1937.

Canthium Labordei Lév. Repert. Sp. Nov. **13:** 178. 1914.
Lasianthus Labordei Rehd. Jour. Arnold Arb. **13:** 340. 1932, **16:** 323. 1935.
Prismatomeris linearis Hutch. in Sargent, Pl. Wils. **3:** 414. 1916. **(syn. nov.).**

INDO-CHINA, Tonkin, Chapa, route from Lo Qui Ho to Ta Phinh, and Massif du Fan Tri Pan, *Petelot 3595, 4646,* September, 1929, and February, 1932. Kweichow, Kwangsi, Yunnan.

The flowers seem to be slightly larger than in the Chinese form, but none of the latter material that I have seen has fully mature ones. Clearly *Prismatomeris linearis* Hutch., type *Henry 9040,* cannot be distinguished from Léveillé's species.

CUCURBITACEAE

Gynostemma laxum (Wall.) Cogn. in DC. Monog. Phan. **3:** 914. 1881.

Zanonia laxa Wall. List no. 3727. 1830, *nomen nudum,* Pl. As. Rar. 2: 29. 1831.
Gynostemma crenulatum Ridl. Jour. Fed. Malay States Mus. **10:** 93. 1920.

INDO-CHINA, Tonkin, Mount Bani, *Petelot 5682,* May, 1935, alt. about 500 m. India to Burma, Siam, Sumatra, Java, Borneo, and Mindanao.

King (Jour. As. Soc. Bengal **67**(2): 41. 1898; Mater. Fl. Malay. Penin. **3:** 385) accepted Clarke's idea that a single species was represented by the 3-foliolate (*G. laxum* Cogn.) and the 5-foliolate (*G. pedatum* Bl. = *G. pentaphyllum* (Thunb.) Mak.) forms. Craib, however (Fl. Siam. Enum. **1:** 766. 1931), considers that Cogniaux was apparently justified in treating the plant with uniformly 3-foliolate leaves as specifically distinct from the 5-foliolate form. In any case the 3-foliolate form has apparently not previously been recorded from Indo-China. Craib placed *G. crenulatum* Ridl. as a synonym of *G. laxum* Cogn.

Gynostemma siamicum Craib, Kew Bull. 362. 1918, Fl. Siam. Enum. **1**: 767, 1931.

INDO-CHINA, Tonkin, Hoa Binh Province, near Muong Thon, route from Hanoi to Hoa Binh, *Petelot 5385*, February, 1931, in open forests. Siam.

This agrees well with Craib's description and differs from *G. laxum* Cogn. in exactly the characters that he emphasizes.

Gymnopetalum quinquelobatum sp. nov.

Herba scandens, ramis glabris vel parcissime pubescentibus, laevibus, 1–1.5 mm. diametro, sulcatis; foliis ambitu ovatis, profunde anguste 5-lobatis, ad 10 cm. longis et 8 cm. latis, utrinque papillatis, scabris, basi profunde cordatis, lobis basalibus ad 3 cm. longis, deflexis, lateralibus patulis, usque ad 4 cm. longis, terminalibus rectis, usque ad 7 cm. longis, omnibus circiter 1 cm. latis, distanter sinuato-denticulatis, plerumque breviter apiculatis vel basilaribus plus minusve obovatis et paullo latioribus; petiolo circiter 1 cm. longo, pubescente; floribus ♀ axillaribus, solitariis, pedunculo 1–2.5 cm. longo, calycis tubo plus minusve pubescente, lobis lanceolatis, acuminatis, 8–9 mm. longis, 2 mm. latis, corolla 2 cm. longa, lobis ovatis, acutis; inflorescentiis ♂ axillaribus, solitariis, longe pedunculatis, ad 12 cm. longis, pedunculo 6–8 cm. longo, subglabro, partibus floriferis bracteisque pubescentibus, bracteis in sicco brunneis, elliptico-ovatis, 2–2.5 cm. longis, inferioribus 2- vel 3-lobatis, superioribus plerumque irregulariter grosse dentatis; fructibus 5–6 cm. longis, 1.5 cm. diametro, perspicue longitudinaliter 10-carinatis, longe acuminatis, leviter pubescentibus.

INDO-CHINA, southern Annam, near Dalat, *R. W. Squires 943*, March 18, 1932, on sandy river banks, flowers white.

A species allied to *Gymnopetalum cochinchinense* (Lour.) Kurz, differentiated, however, by its deeply and narrowly 5-lobed leaves.

COMPOSITAE

Blumeopsis falcata (D. Don) comb. nov.

Erigeron falcatum D. Don, Prodr. Fl. Nepal. 172. 1825.
Conyza fasciculata Wall. List no. 3017. 1831, *nomen nudum*.
Laggera flava Benth. in C. B. Clarke, Comp. Ind. 90. 1876.
Blumeopsis flava Gagnep. Bull. Mus. Hist. Nat. Paris **26**: 76. 1920; Lecomte, Fl. Gén. Indo-Chine **3**: 567. *f. 61, 1–6*. 1924.

INDO-CHINA, Laos, Province of Tranninh, plaine des Jarres, *Petelot 4612*. India to Yunnan (*Henry 11595A*), Burma, Siam, Indo-China, and Hainan. The species has also been recorded from Penang, but this was probably due to an erroneously labelled specimen.

ARNOLD ARBORETUM,
HARVARD UNIVERSITY.

NEW SPECIES, VARIETIES AND COMBINATIONS FROM THE HERBARIUM AND THE COLLECTIONS OF THE ARNOLD ARBORETUM[1]

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With plates 217 and 218

Ostrya multinervis, sp. nov. PLATE 217[2]

Arbor 16 m. alta, ramulis maturis purpureo-brunneis lenticellatis sparse adpresse pilosis; gemmae oblongo-ovoideae, 5–6 mm. longae, perulis striatis glabris. Folia oblongo-lanceolata, 8–12 cm. longa et 3–4.5 cm. lata, caudato-acuminata, basi rotundata vel late cuneata, argute et inaequaliter subsimpliciter serratis dentibus aristatis, supra pilis longis adpressis conspersa et in costa pubescentia, subtus in costa et venis sparse pilosa, ceterum fere glabra, venis lateralibus 18–20 inter se 3–4 mm. distantibus et trabeculis satis conspicuis conjunctis; petioli 5–7 mm. longi; sparse adpresse pilosi. Amenta mascula immatura, bracteis abrupte cuspidatis striatis ciliatis. Inflorescentia fructifera 4.5–6 cm. longa, densa, pedunculo sparse adpresse piloso 1.5–2 cm. longo; bracteae utriculosae ellipticae, circiter 1.5 cm. longae, acutae, mucronatae, basi late cuneata setulosae, nervosae, sparsissime adpresse pilosae; nuculae anguste ovoideae, compressae, 6–7 mm. longae et 3–3.5 mm. latae, levissime striatae, apice ciliatae, pallide brunneae.

CHINA. H u n a n : Ma-ling-tung, Sinning Hsien, in mixed forest on slope, alt. 650 m., *C. S. Fan & Y. Y. Li, no. 605,* Oct. 13, 1935 (type).

This species differs from the other Asiatic species of the genus in the more numerous and closer veins of the generally narrow and caudate-acuminate leaves. In the shape of its fruiting bracts and inflorescence it resembles *O. japonica* Sarg. but differs besides in the more numerous veins, in the nearly simple and closer serration of the nearly glabrous leaves and the stouter and shorter peduncle. Besides in the leaves it differs from *O. Liana* Hu in the larger and closely imbricate fruiting bracts and from *O. Rehderiana* Chun in the broad-cuneate, not stipitate, base of the fruiting bracts and the shorter and broader nutlet.

[1]Continued from vol. **14**: 350.

[2]Plate 217. *Ostrya multinervis* Rehd. Holotype; × 2/5. Bracts and nutlets; ×2.

Betula mandshurica (Regel) Nakai in Bot. Mag. Tokyo, **29**: 42 (1915); Fl. Sylv. Kor. **2**: 27, t. 14 (1915).

Betula alba L. subsp. *mandshurica* Regel in Bull. Soc. Nat. Moscou, **38**[2]: 399, t. 7, fig. 15 (1865); in DeCandolle, Prodr. **16**[2]: 165 (1868).

Betula latifolia sensu Komarov in Act. Hort. Petrop. **22**: 38 (Fl. Mansh. II) (1903), pro parte, non Tausch.

Betula japonica Sieb. var. *a. mandshurica* (Regel) H. Winkler in Engler, Pflanzenr. IV. **61** (Heft 19): 78 (1904). — Nakai in Jour. Coll. Sci. Tokyo, **31**: 202 (Fl. Kor. II) (1911).

As *Betula japonica* Sieb. ex Winkl. is invalidated by *B. japonica* Thunb.[1] which is a synonym of *Alnus japonica* (Thunb.) Sieb. & Zucc., and *Betula latifolia* of Komarov is a misapplication of the name *B. latifolia* Tausch, which is a synonym of *B. papyrifera* Marsh., the next oldest binomial available is *B. mandshurica* (Reg.) Nakai, thus *B. mandshurica* becomes the type of the species concept called generally *B. japonica* Sieb. and *B. japonica* becomes a variety. From var. *japonica* typical *B. mandshurica* differs chiefly in the glabrous or less pubescent leaves only slightly or scarcely bearded in the axils of the veins beneath and broad cuneate to truncate at base.

Betula mandshurica var. **japonica** (Miq.), comb. nov.

Betula japonica Siebold in Verh. Bat. Genootsch. **12**: 25 (Syn. Pl. Oec. Jap.) (1830), nom. nud. — Siebold & Zuccarini in Abh. Akad. Münch. **4**[3]: 229 (Fl. Jap. Fam. Nat. **1**: 105) (1846), nom. nud. — Winkler in Engler, Pflanzenr. IV. **61** (Heft 19): 78 (1904), quoad var. *β*. — Nakai in Bot. Mag. Tokyo, **29**: 42 (1915). — Schneider in Sargent, Pl. Wilson. **2**: 485 (1916). — Rehder, Man. Cult. Trees Shrubs, 140 (1927). — Non *B. japonica* Thunb.

Betula alba var. *japonica* Miquel in Ann. Mus. Bot. Lugd.-Bat. **2**: 136 (Prol. Fl. Jap. 68) (1865).

Betula alba subsp. *B. latifolia a. Tauschi* Regel in Bull. Soc. Bot. Nat. Moscou, **38**[2]: 399, t. 7, fig. 11–14 (1865); in DeCandolle, Prodr. **16**[2]: 165 (1868); non *B. latifolia* Tausch.

Betula alba var. *Tauschii* (Reg.) Shirai in Bot. Mag. Tokyo, **8**: 319 (1894).

Betula pendula var. *japonica* Rehder in Bailey, Cycl. Am. Hort. **1**: 159 (1900). — Schneider, Ill. Handb. Laubholzk. **1**: 112, fig. 62q[1–3] (1904).

Betula pendula var. *Tauschii* Winkler in Engler, Pflanzenr. IV. **61** (Heft 19): 78 (1904). — Nakai in Jour. Coll. Sci. Tokyo, **31**: 202 (Fl. Kor. II) (1911).

Betula japonica var. *ε pluricostata* Winkler in Engler, Pflanzenr. IV. **61** (Heft 19): 79 (1904).

Betula alba L. var. *vulgaris* sensu Shirasawa, Icon. Ess. For. Jap. **2**: t. 11 (1908), non Spach.

[1] *Betula japonica* Thunberg in Nov. Act. Soc. Sci. Upsal. **6**: 45, t. 4 (1799).

Betula verrucosa var. *japonica* Henry in Elwes & Henry, Trees Gt. Brit. Irel. **4**: 967 (1909).

Betula pendula var. *Tauschii* Rehder in Bailey, Stand. Cycl. Hort. **1**: 498 (1914).

For additional synonyms see Schneider in Sargent, Pl. Wilson. **2**: 485–486.

Winkler (l. c.), Schneider (l. c.) and other authors include under the name *B. japonica* all the varieties enumerated here under *B. mandshurica*. Nakai (in Bot. Mag. Tokyo, **29**: 42) keeps *B. mandshurica* and *B. japonica* as distinct species and refers var. *kamschatica* as a synonym to *B. japonica*. Both varieties, var. *japonica* and var. *kamtschatica* are common in Japan.

From the type the var. *japonica* differs in the more or less pubescent leaves distinctly bearded in the axils beneath and usually truncate to subcordate at the base.

Betula mandshurica var. **kamtschatica** (Regel), comb. nov.

Betula alba subsp. 4. *B. latifolia* Tausch, β. *kamtschatica* Regel in Bull. Soc. Nat. Moscou, **38**²: 400, t. 7, fig. 16–20 (1865); in DeCandolle, Prodr. **16**²: 165 (1868) "subsp. IV, *latifolia*."

Betula pendula var. *japonica* f. *typica* Schneider in Ill. Handb. Laubholzk. **1**: 113, fig. 628² (1904).

Betula alba subsp. 1. *B. verrucosa* var. *resinifera* Regel in Bull. Soc. Nat. Moscou, **38**²: 398 (1865); in DeCandolle, Prodr. **16**²: 164 (1868) "subsp. I, *verrucosa* δ. *resinifera*," pro parte.

Betula japonica var. *resinifera* (Regel) Winkler in Engler, Pflanzenr. IV. **61** (Heft 19): 79 (1904).

Betula japonica var. γ. *camtschatica* (Regel) Winkler in Engler, Pflanzenr. IV. **61** (Heft 19): 79 (1904). — Schneider in Sargent, Pl. Wilson. **2**: 486 (1916) *"kamtschatica."*

Betula alba var. *vulgaris* sensu Shirasawa, Icon. Ess. For. Jap. **2**: t. 11, fig. 19–37 (1908), non Spach (1841).

Betula japonica var. *sachalinensis* Koidzumi in Bot. Mag. Tokyo, **27**: 563 (1913). — Matsumura, Ic. Pl. Koisikav. **2**: 39, t. 104 (1914).

This variety is very closely related to var. *japonica* and differs chiefly in the usually thinner leaves truncate or broad-cuneate at the base, more sharply doubly serrate and often slightly lobulate, glabrous or sometimes slightly pilose and with small axillary tufts of hairs beneath.

Betula mandshurica var. **szechuanica** (Schneid.), comb. nov.

Betula alba var. *vulgaris* Franchet in Jour. de Bot. **16**: 406 (1899). — Burkill in Jour. Linn. Soc. **26**: 497 (Ind. Fl. Sin. **2**) (1899). — Non Spach.

Betula japonica var. *mandshurica* sensu Schneider in Sargent, Pl. Wilson. **2**: 461 (1916), non *B. alba* subsp. *mandshurica* Regel.

Betula japonica var. *szechuanica* Schneider in Sargent, Pl. Wilson. **3**: 454 (1917). — Rehder in Jour. Arnold Arb. **9**: 24 (1928).

This variety differs in its rhombic-ovate or triangular-ovate larger leaves, truncate or broad-cuneate at base, unequally dentate-serrate, densely glandular-punctate beneath and glabrous, dark dull green above. It occurs in western China and forms a tree with wide-spreading branches.

Betula mandshurica var. **Rockii** (Rehd.), comb. nov.

Betula japonica var. *Rockii* Rehder in Jour. Arnold Arb. **9**: 25 (1928).

This form is known only from the Kokonor region and thus marks the northwestern limit of the range of the species. It is close to var. *szechuanica* but differs chiefly in its much smaller, cuneate, doubly serrate or even lobulate leaves and the suberect or ascending lateral lobes of the fruiting bract. In shape the leaves resemble those of *B. pendula* Roth, but the fruiting bracts are quite different.

Sorbaria tomentosa (Lindl.), comb. nov.

Spiraea Lindleyana Wallich, Num. List, no. 703 (1828), nom. nud. — Royle, Ill. Him. Bot. 203 (1839), nom. nud. — Lindley in Bot. Reg. **31**: t. 33 (1845).

Schizonotus tomentosus Lindley in Bot. Reg. **26**: Misc., p. 71 (1840).

Spiraea sorbifolia L. δ. *Lindleyana* (Wall.) K. Koch, Hort. Dendr. 108 (1853).

Spiraea sorbifolia sensu Hooker f., Fl. Brit. India, **2**: 324 (1878), non Linnaeus.

Sorbaria Lindleyana (Lindl.) Maximowicz in Act. Hort. Petrop. **6**: 224 (1879). — Dippel, Handb. Laubholzk. **3**: 503 (1893). — Schneider, Ill. Handb. Laubholzk. **1**: 490, fig. 297, i–k, 299a (1905). — Rehder, Man. Cult. Trees Shrubs, 349 (1927).

Basilima Lindleyana (Wall.) Kuntze, Rev. Gen. **1**: 215 (1891). — Koehne, Deutsch. Dendr. 223 (1893).

Schizonotus Lindleyanus Nash in Jour. New York Bot. Gard. **19**: 141 (1918).

Though Lindley in 1840 (l. c.) cites as a synonym *Spiraea Lindleyana* Wall., a nomen nudum, his remarks show clearly that he was referring to the briefly characterized Himalayan representative of *Spiraea sorbifolia*. At the same time he gave a brief description of the distinguishing characters of the genus *Schizonotus* published as a nomen nudum in 1828 (in Wallich, Num. List, no. 703).

Aronia prunifolia (Marsh.), comb. nov.

Mespilus prunifolia Marshall, Arbust. Am. 90 (1785).

Pyrus floribunda Lindley in Bot. Reg. **12**: t. 1006 (1826).

Aronia (*Pyrus*) *floribunda* (Lindl.) Spach, Hist. Veg. **2**: 89 (1834). — Rehder in Jour. Arnold Arb. **2**: 44 (1920).

Sorbus floribunda Heynhold, Nomencl. Bot. 773 (1840).

Aronia atropurpurea Britton, Man. 517 (1901); in Addisonia, **3:** 1, t. 81 (1918).
Pyrus arbutifolia var. *atropurpurea* (Britt.) Robinson in Rhodora, **10:** 33 (1908).
Adenorachis atropurpurea (Robins.) Nieuwland in Am. Midl. Nat. **4:** 94 (1915).
Pyrus atropurpurea (Britt.) Bailey in Rhodora, **18:** 154 (1916).
Pyrus melanocarpa var. *atropurpurea* (Britt.) Farwell in Rep. Mich. Acad. Sci. **19:** 258 (1917).
For further synonymy see Rehder (l. c.) under *Aronia floribunda*.

Mespilus prunifolia Marsh. has apparently been confused by most authors with *M. prunifolia* Lam. (Encycl. Méth. **4:** 443. 1798) which is a species of *Crataegus,* and therefore its real identity has not been recognized, but Marshall's description leaves no doubt that he intended to describe the shrub now usually called *Aronia atropurpurea* or *A. floribunda.* In his Arbustrum Americanum, p. 90–91, he describes three species of unarmed *Mespilus;* the first, *M. nivea,* is a synonym of *Amelanchier canadensis* (L.) Med.; the second is the species under discussion; the third, *M. canadensis,* is identical with *Aronia arbutifolia* (L.) Elliott. Owing to a garbled translation of the original text in the French translation (Cat. Alphab. Arb. Arbriss. 140. 1788) Nieuwland (in Am. Midl. Naturalist, **12:** 122. 1930) identified it with *Pyrus melanocarpa* (Michx.) Willd. and made the combination *Pyrus canadensis* (Marsh.) Nieuwl., because *Mespilus canadensis* has priority over *P. melanocarpa* (Michx.) Willd. (1809), but *Pyrus canadensis* (Marsh.) Nieuwl. is referable, as to the name-bringing synonym, to *A. arbutifolia,* and only as to Nieuwland's description based on a misidentification, to *A. melanocarpa.* The original description reads in part: "much resembling the last described [*M. prunifolia*], except in having fruit of a red colour when ripe. There is also a variety of this of smaller growth which produces fruit of a beautiful red colour." In the French translation the corresponding sentences read: "qui resemble beaucoup au précédent. Ses feuilles sont rouges on en trouve une varieté qui est encore plus petite." There is no mention of the color of the fruit in this translation, which misled Nieuwland to assume that the color is black, though the English name of the species is given as "Dwarf red fruited Medlar" and the description says that it much resembles the preceding [*M. prunifolia*] which is described as having the leaves "cotonneuses" beneath.

Evonymus Fortunei (Turcz.) Handel-Mazzetti, Symb. Sin. **7:** 660 (1933), syn. *E. kiautschovia* et var. et specim. cit. exclud.

PLATE 218[1]

[1] *Evonymus Fortunei* (Turcz.) Hand.-Mazz. Isotype of *Elaeodendron Fortunei* Turcz. in Herb. Kew; × 2/5.

Elaeodendron Fortunei Turczaninow in Bull. Soc. Nat. Moscou, **36**[1]: 603 (1863). — Walpers Ann. **7**: 582 (1868). — Maximowicz in Bull. Acad. Sci. St. Pétersb. **27**: 460 (in Mel. Biol. **11**: 205) (1882). — Hemsley in Jour. Linn. Soc. Bot. **23**: 124 (1886).

Evonymus japonica Thunb. var. *acuta* Rehder in Sargent, Pl. Wilson. **1**: 485 (1913).

Evonymus radicans Sieb. var. *acuta* Rehder in Mitt. Deutsch. Dendr. Ges. **22**: 257 (1913); Man. Cult. Trees Shrubs, 552 (1927).

Elaeodendron Fortunei had been already identified with *Evonymus radicans* var. *acuta* by Dr. E. D. Merrill in connection with his study of *Microtropis*. A note by Dunn under *Microtropis reticulata* in Jour. Bot. **47**: 376 (1909) referring to *Elaeodendron Fortunei* as possibly belonging to *Microtropis* induced him to examine an isotype of Turczaninow's species in the Kew herbarium (Fortune, 946, China, 1845) which he found to be identical with *Evonymus radicans* var. *acuta*. Handel-Mazzetti in 1933 (l. c.) had transferred *Elaeodendron Fortunei* to *Evonymus*, but had identified it with *E. kiautschovica* Loes. and had made *E. patens* Rehd. a variety of *E. Fortunei* (Turcz.). From *E. kiautschovica*, however, it is easily distinguished by its compact inflorescence, the secondary axes of the cyme not exceeding 6 mm., and by the elliptic or oblong-elliptic acute leaves of firmer texture, while *E. kiautschovica* has a loose inflorescence with the secondary axes up to 16 mm. long, obovate or obovate-oblong leaves, abruptly acuminulate or sometimes obtuse or rounded at apex, gradually narrowed into the petiole and at least in the var. *patens* (Rehd.) Loes. of thinner texture and only half-evergreen.[1] The isotype of *Elaeodendron Fortunei* from Kew before me agrees exactly with the flowering isotypes of *E. japonica* var. *acuta* (Wilson, nos. 562 and Veitch Expedition no. 1227) except that the leaves in Fortune's specimen are generally somewhat narrower. Fortune's specimen was probably collected either in Kiangsu or Chekiang where he spent the spring of 1845; from both these provinces and also from Anhwei we have in this herbarium many specimens of *E. radicans* var. *acuta*. Turczaninow gives northern China as the habitat of *Elaeodendron Fortunei*, but Fortune's label reads simply "China" and what Fortune calls the north of China is the region around Ningpo and Shanghai.[2]

Typical *Eonymus Fortunei* is widely distributed throughout eastern,

[1]Through the kindness of Dr. L. Diels, Director of the Botanical Museum at Berlin-Dahlem, I received recently a photograph of the type of *Evonymus kiautschovica* Loes. which shows that there is apparently no difference between the type and var. *patens* (*E. patens* Rehd.).

[2]See p. 346 of his "Three years wanderings in the northern provinces of China. London, 1847."

central and western China; in this herbarium it is represented from the provinces of Shantung (cultivated), Kiangsu, Chekiang, Anhwei, Kwangsi, Yunnan, Hupeh, Honan, Shensi and Shansi. In Japan and Korea the species is represented by the following varieties including some garden forms; there is also the following slight form of the type known only in cultivation.

Evonymus Fortunei f. **colorata** (Rehd.), comb. nov.

Evonymus radicans var. *acuta* f. *colorata* Rehder in Jour. Arnold Arb. 7: 30 (1926).

Evonymus radicans var. *colorata* (Rehd.) Rehder in Man. Cult. Trees Shrubs, 552 (1927).

This form was raised from seed collected in Shensi by F. N. Meyer and differs only in the leaves assuming in autumn a purple color retained during the winter, a very dark deep purple on the upper and a brighter and lighter purple on the lower surface.

Evonymus Fortunei var. **alticola** (Hand.-Mazz.), comb. nov.

Evonymus radicans (Miq.) Sieb. var. *alticola* Handel-Mazzetti, Symb. Sin. 7: 660 (1933).

This variety occurs in Yunnan and differs from the type chiefly in its most elliptic-obovate to oblong-obovate leaves, abruptly acuminulate, minutely serrulate to entire or nearly entire, often glaucous above the second year, and in its very dense small cymes 7–10 mm. across. Besides the specimens listed Simeon Ten's specimen from Tchao-tong (Arn. Arb. distr. 491) belongs here.

Evonymus Fortunei var. **radicans** (Miq.), comb. nov.

Evonymus gracilis Siebold, Cat. Rais. Pl. Jap. Chine, 33 (1863)[1] nom. nud. — K. Koch, Dendr. **1**: 632 (1869), nom. nud.

Evonymus radicans Sieb. ex Siebold, l. c. (1863) pro synon. praeced. — Miquel in Ann. Mus. Bot. Lugd.-Bat. **2**: 86 (Prol. Fl. Jap. 18) (1865), pro synon. *E. japonici* var. *radicantis*.

Evonymus japonicus var. *β. radicans* Miquel in Ann. Mus. Bot. Lugd.-Bat. **2**: 86 (Prol. Fl. Jap. 18) (1865). — Maximowicz in Mél. Biol. **11**: 178 (1881); in Bull. Acad. Sci. St. Pétersb. **27**: 441 (1882). — Dippel, Handb. Laubholzk. **2**: 495 (1892). — Nakai in Jour. Coll. Sci. Tokyo, **26**, **1**: 123 (Fl. Kor. I) (1908). — Matsumura, Ind. Pl. Jap. **2**: 321 (1912). — Makino & Tanaka, Man. Fl. Nippon, 328 (1927).

Evonymus radicans Sieb. ex Miquel in Ann. Mus. Bot. Lugd.-Bat. **3**: 202 (Prol. Fl. Jap. 366) (1867). — Franchet & Savatier, Enum. Pl. Jap. **1**: 79 (1875). — Anon. in Bull. Féd. Soc. Hort. Belg. **1883–85**: 269

[1]I am indebted to Dr. H. J. Lam, Director of the Rijksherbarium at Leiden, for a copy of Siebold's Catalogue of 1863 and for the information that in none of the catalogues in the library of that institution issued between 1844 and 1871 are descriptions of new species given.

(1887). — Rehder in Bailey, Cycl. Am. Hort. **2**: 559 (1900); in Sargent, Trees Shrubs, **1**: 129 (1903); Man. Cult. Trees Shrubs, 552 (1927). — Schneider, Ill. Handb. Laubholzk. **2**: 173, fig. 112p–q, 114e (1907). — Bean, Trees Shrubs Brit. Isl. **1**: 542 (1914).

Evonymus japonicus μ. *radicans viridis* Regel, Ind. Sem. Hort. Bot. Petrop. **1866**: 103 (1867).

Evonymus repens Carrière in Rev. Hort. **1885**: 296, fig. 51.

Evonymus japonica β. *gracilis* Koehne, Deutsch. Dendr. 363 (1893), not Regel.

Evonymus radicans var. *viridis* Rgl. ex Schneider, Ill. Handb. Laubholzk. **2**: 173 (1907).

This variety occurs in central Japan and in southern Korea. It differs from the Chinese type chiefly in the usually smaller and less pointed leaves, more distinctly and sharply serrate, in their thicker texture and obsolete lateral veins. It is much cultivated in Japan and has produced a number of forms in Japanese and European gardens.

Evonymus Fortunei var. **radicans** f. **reticulata** (Reg.), comb. nov.

Evonymus japonicus λ *reticulatus* Regel, Ind. Sem. Hort. Bot. Petrop. **1866**: 102 (1867).

Evonymus gracilis h. Sieb. ex Regel, l. c. (1867), pro syn. praeced.

Evonymus radicans var. *reticulatus* Rgl. ex Rehder in Bailey, Cycl. Am. Hort. **2**: 559 (1900); in Bailey, Stand. Cycl. Hort. **3**: 1188 (1914).

Evonymus radicans var. *viridis* Rgl. f. *reticulata* Schneider, Ill. Handb. Laubholzk. **2**: 173 (1907).

Evonymus radicans var. *picta* Jacob Makoy ex Rehder, Man. Cult. Trees Shrubs, 552 (1927).

This form differs from typical var. *radicans* in the leaves being variegated with white along the veins.

Evonymus Fortunei var. **radicans** f. **gracilis** (Reg.), comb. nov.

Evonymus japonicus δ *gracilis* Regel, Ind. Hort. Bot. Petrop. **1866**: 103 (1867).

Evonymus gracilis argenteo-variegatus h. Sieb. ex Regel, l. c. (1867), pro syn. preced. — Spaeth, Spaeth-Buch, 171 (1920) as *argentei-variegata.*

Evonymus gracilis roseo-variegatus h. Sieb. ex Regel, l. c. (1867), pro syn. preced.

Evonymus radicans variegata Carrière in Rev. Hort. **1876**: 354, fig. 75–77.

Evonymus radicans var. *viridis* Rgl. f. *gracilis* Schneider, Ill. Handb. Laubholzk. **2**: 173 (1907).

Evonymus radicans var. *argenteo-marginatus* Rehder in Bailey, Cycl. Am. Hort. **2**: 559 (1900); Man. Cult. Trees Shrubs, 552 (1927).

To this form may be referred the following variegated forms:

Leaves dark green variegated with golden-yellow:

Evonymus radicans pictus J. Makoy et Cie. in Belg. Hort. **15**: 146 (1865).

Leaves variegated with pink on the margin:

Evonymus japonicus ι. *radicans* Regel, Ind. Sem. Hort. Bot. Petrop, **1866**: 103 (1867), not *E. japonicus* var. *radicans* Miq.

Evonymus radicans roseo-marginatus h. Jacob Makoy et Cie. ex Regel, l. c. (1867), pro syn. preced. — Rehder in Bailey, Cycl. Am. Hort. **2**: 559 (1900), pro var.; Man. Cult. Trees Shrubs, 552 (1927), pro var.

Evonymus radicans var. *viridis* Rgl. f. *roseo-marginata* Schneider, Ill. Handb. Laubholzk. **2**: 173 (1907).

Leaves variegated with white, yellow and bright green:

Evonymus japonicus κ. *tricolor* Regel, Ind. Sem. Hort. Bot. Petrop. **1866**: 103 (1867).

Evonymus tricolor Jacob Makoy et Cie. ex Regel, l. c. (1867), pro synon. preced.[1]

Evonymus radicans pictus h. Lambertianus ex Regel, l. c. (1867), pro synon. preced.

All these variegated forms are rather inconstant and variable and do not seem to be at present in cultivation as distinct forms under their various names.

Evonymus Fortunei var. **radicans** f. **minima** (Simon Louis), comb. nov.

Evonymus radicans minimus Simon-Louis, Cat. **1912–13**: 43 (1912), vel prius.

Evonymus radicans var. *minima* Simon-Louis ex Rehder in Bailey Stand. Cycl. Hort. **2**: 1188 (1914).

Evonymus radicans var. *kewensis* Hort. ex Bean, Trees Shrubs Hardy Brit. Isles, **1**: 542 (1914).

This form is known only as a sterile plant of creeping habit and differs in its very small leaves 0.6–1.5 cm. long. It is probably the same form mentioned as *E. radicans fol. minimis* in Vilmorin & Bois, Frutic. Vilmor. 34 (1904), nom. nud. The form cultivated as var. *kewensis* has generally smaller leaves than the plant grown as f. *minima;* it was introduced, according to Bean, by Professor C. S. Sargent from Japan and sent to Kew in 1893.

Evonymus Fortunei var. **radicans** f. **Carrierei** (Vauvel), comb. nov.

Evonymus Carrierei Vauvel in Vulgaris. Hort. 1881, no. 6. — Carrière in Rev. Hort. **1881**: 373, fig. 92; **1885**: 295, fig. 50.

Evonymus japonicus var. *gracilis* Dippel, Handb. Laubholzk. **2**: 495 (1892), pro parte.

Evonymus japonicus Carrierei Mottet, Dict. Prat. Hort. Jard. **2**: 351 (1894).

[1]In a list of new varieties offered by Jacob Makoy et Cie., no *E. tricolor* is listed, but a *E. japonicus tricolor* (in Belg. Hort. **15**: 145) which probably does not belong to *E. radicans* since *E. japonicus* is being kept distinct from *E. radicans*.

Evonymus radicans var. *Carrierei* Nicholson in Hand-list Trees Shrubs Kew, **1**: 67 (1894). — Mouillefert, Traité Arb. Arbriss. 752 (1895). — Schneider, Ill. Handb. Laubholzk. **2**: 173 (1907). — Rehder in Bailey, Stand. Cycl. Hort. **2**: 1188 (1914); Man. Cult. Trees Shrubs, 552 (1927).

This form differs in its shrubby, not climbing habit forming a low spreading shrub and in its elliptic to elliptic-oblong leaves, lustrous dark green above and up to 5 cm. long. It flowers and fruits profusely and sometimes develops branches with leaves broadly margined with white. The form known as "Silver Queen" belongs probably here.

Evonymus Fortunei var. **vegeta** (Rehd.), comb. nov.

Evonymus radicans var. *vegetus* Rehder in Sargent, Trees & Shrubs, **1**: 129, t. 65 (1903); Man. Cult. Trees Shrubs, 552 (1927). — Schneider, Ill. Handb. Laubholzk. **2**: 173 (1907). — Wilson in Hortic. Boston, n. ser. **4**: 530, fig. (1926).

This variety occurs spontaneously in Hokkaido and Hondo (Mt. Kirishima, Kyushu, *Z. Tashiro,* July 21, 1917). It differs in its more coriaceous, orbicular-oval to broad-elliptic, coarsely crenate leaves 2.5–5 cm. long and 2–3.5 cm. broad, also in the larger inflorescence with the secondary axes sometimes 1–1.5 cm. long. It may remain a low-spreading shrub flowering and fruiting profusely, but climbs with rootlets, if it finds suitable support.

Acer Mono Maximowicz in Bull. Phys. Math. Acad. Sci. St. Pétersb. **15**: 126 (Mél. Biol. **2**: 416) (1857).

Acer pictum Thunberg, Fl. Jap. 162 (1784), sensu lato. — Siebold & Zuccarini in Abh. Akad. Wiss. Muench. **4**^{2}: 156 (Fl. Jap. Fam. Nat. **1**: 48) (1844). — Non Thunberg 1783.

Acer laetum var. *parviflorum* Regel in Bull. Acad. Sci. St. Pétersb. **15**: 219 (Mél. Biol. **2**: 486) (1857).

Acer pictum γ. Maximowicz in Bull. Acad. Sci. St. Pétersb. **26**: 443 (Mél. Biol. **10**: 600) (1880).

Acer pictum var. *Mono* Pax in Bot. Jahrb. **7**: 236 (1886).

Acer pictum var. *a. typicum* Schwerin subvar. *2. mono* (Maxim.) Pax in Engler, Pflanzenr. (Heft 8) IV. **163**: 47 (1902).

Acer Hayatae var. *glabra* Léveillé & Vaniot in Bull. Soc. Bot. France, **53**: 590 (1906), syn. ex Rehder in Jour. Arnold Arb. **15**: 5 (1934).

Acer pictum var. *parviflorum* (Reg.) Schneider, Ill. Handb. Laubholzk. **2**: 225 (1907).

As Nakai has shown (in Bot. Mag. Tokyo, **45**: 124–126. 1931), the name *Acer pictum* under which this species has been generally known is invalidated by *A. pictum* Thunberg of 1783 (in Nov. Act. Soc. Sci. Upsal. **4**: 40) which is not an *Acer*, but belongs to the Araliaceae and is *Kalopanax pictus* (Thunb.) Nakai, Fl. Sylv. Kor. **16**: 34 (1927) to

which *Kalopanax ricinifolius* (Sieb. & Zucc.) Miq. and *K. septemlobus* (Thunb.) Koidz. are referable as synonyms.

Acer Mono is a very variable species; it varies considerably in the size, shape and lobing of the leaves and in the direction of the samaras which may be nearly horizontal to upright and connivent. As in other species of the genus, the extremes of these characters are connected by numerous intergrading forms, and the varieties and even species based on these characters are best considered as representing only forms, particularly as they do not show any clear geographical segregation.

From a taxonomic point of view it seems fortunate that the name *Acer pictum* generally applied to this species has become untenable on account of an earlier synonym, since it was based on a sterile branch with variegated leaves of a cultivated plant of which neither flowers nor fruits have ever been described. This facts makes it possible to adopt for the species the name *Acer Mono* which represents the most common and widely distributed form, while the form having a fruit with upright wings which has been considered by most authors the type of *A. pictum* is comparatively rare and occurs only in Japan.

Several new varieties have recently been described under *A. Mono* by Nakai, by Hara and by Hondo and several names transferred by the last-named author from *A. pictum* to *A. Mono,* but no transfer seems to have been made as yet of the three following forms or varieties.

Acer Mono f. **connivens** (Nichols.), comb. nov.

Acer pictum Siebold & Zuccarini in Abh. Akad. Wiss. Muench. **4**[2]: 156 (Fl. Jap. Fam. Nat. **1**: 48) (1844), p. p. — Miquel in Ann. Mus. Bot. Lugd.-Bat. **2**: 87 (Prol. Fl. Jap. 19) (1865) p. p. — K. Koch, Dendr. **1**: 531 (1869), p. p. — Shirasawa, Ic. Ess. For. Jap. **1**: t. 65, fig. 1–12 (1900). — Schneider, Ill. Handb. Laubholzk. **2**: 225, fig. 150 e, 151 d-f (1907). — Rehder, Man. Cult. Trees Shrubs, 562 (1927). — Non *A. pictum* Thunb. (1783).

Acer pictum var. *connivens* Nicholson in Gard. Chron. II. **16**: 375 (1881).

Acer pictum var. *eupictum* Pax in Bot. Jahrb. **7**: 236 (1886).

Acer pictum was originally based on a sterile branch and Siebold & Zuccarini seem to have been the first authors to describe the fruit and they based their description on the form with upright wings which subsequently was adopted by most later authors as the type of *A. pictum*.

Acer Mono f. **marmoratum** (Nichols.), comb. nov.

Acer pictum Thunberg, Fl. Jap. 162 (1784); Diss. de Acere (Rep. J. L. Aschan) 7. 1793 (Repr. in Diss. Acad. **2**: 341. 1800 and in Misc. Papers Thunb. 293. 1935); Icon. Pl. Jap. **5**: t. 3 (1805). — Willdenow, Sp. Pl. **4**: 983 (1806). — Trattinick, Archiv. Gewächsk. **1**: 3 t. 15

(1811). — Sprengel, Syst. **2**: 224 (1825). — G. Don, Gen. Syst. **1**: 65 (1832). — Loudon, Arb. Frut. Brit. **1**: 432 (1838). — Non Thunb. (1783).

Acer pictum var. *marmoratum* Nicholson in Gard. Chron. II. **16**: 375 (1881). — Bean, Trees Shrubs Brit. Isl. **1**: 154 (1914). — Rehder, Man. Cult. Trees Shrubs, 562 (1927).

This form represents the type of *Acer pictum* Thunberg of 1784; all descriptions up to 1838 are based on the descriptions and illustration published by Thunberg. Siebold & Zuccarini in 1844 seem to have been the first to have published descriptions based on spontaneous material with flowers and fruits.

Acer Mono var. **tricuspis** (Rehd.), comb. nov.

Acer tenellum Pax in Hooker Icon. Pl. **19**: t. 1897 (1889); in Engler Pflanzenr. (Heft 8) IV. **163**: 53, fig. 9 (1902). — **Synon. nov.**

Acer Bodinieri Léveillé in Repert. Spec. Nov. **10**: 433 (1912); Fl. Kouy-Tchéou, 382 (1915).

Acer pictum var. *parviflorum* Schneid. f. *tricuspis* Rehder in Mitt. Deutsch. Dendr. Ges. **22**: 258 (1913); in Jour. Arnold Arb. **15**: 5 (1934); Man. Cult. Trees Shrubs, 562 (1927).

This variety differs from the type chiefly in the smaller 3-lobed leaves and the ciliate sepals, the smallest leaves being sometimes quite entire and ovate in outline. Ciliate sepals are also found in typical *A. Mono*, e. g. Wilson 1915 and 1919 from Hupeh, but in the Japanese specimen they seem to be always quite glabrous.

Acer Mono var. *tricuspis* seems to be restricted to Central China.

Acer velutinum Boissier, Diagn. Pl. Or. Nov. **6**: 28 (1845) "Pl. Kotsch. Pers. Feb. 1845."

Acer insigne Boissier & Buhse in Nouv. Mém. Soc. Nat. Moscou, **12**: 46 (Aufzähl. Transkauk. Pers. Pfl.) (1860), quoad var. *α*.

Acer insigne var. *α. velutina* Boissier & Buhse, l. c. (1860).

Acer insigne var. *β. velutinum* Boissier, Fl. Or. **1**: 948 (1867). — Pax in Bot. Jahrb. **7**: 194 (1886); **16**: 395 (1893); in Engler, Pflanzenr. IV. **163** (Heft 8): 15 (1902). — Wesmael in Bull. Soc. Bot. Belg. **29**: 36 (1890). — Masters in Gard. Chron. III. **10**: 189, fig. 24 (1891). — Schwerin in Gartenfl. **42**: 268 (Var. Acer, 29) (1893). — Koehne, Deutsch. Dendr. 377 (1893). — Dippel, Handb. Laubholzk. **2**: 430, fig. 202 (1893). — Rehder in Bailey, Cycl. Am. Hort. **1**: 15 (1900); in Bailey, Stand. Cycl. Hort. **1**: 201 (1914); Man. Cult. Trees Shrubs, 567 (1927). — Schneider, Ill. Handb. Laubholzk. **2**: 203 (1907). — Henry in Elwes & Henry, Trees Gt. Brit. Irel. **3**: 667 (1907). — Bean, Trees Shrubs Brit. Isles, **1**: 144 (1914).

Acer insigne var. *typica* f. *velutina* Bornmüller in Bull. Herb. Boissier, II. **5**: 643 (1905).

Boissier in 1860 referred *A. velutinum* as the typical variety to the

new species *A. insigne*, but in 1867 he reversed this status and made the glabrous form the type of *A. insigne* and var. *velutinum* a variety, a disposition followed by later authors. I agree with Bornmüller (l. c.) that these two varieties should be considered only forms being closely connected by intermediates which he found more common than the extremes.

Acer velutinum f. **longilobum** (Bornm.), comb. nov.

Acer insigne var. *longiloba* Bornmüller in Bull. Herb. Boissier, II. **5**: 643 (1905).

This is a rather striking form agreeing with the type in the pubescent under side of the leaves, but differing in three-lobed leaves with upright elongated narrow lobes, the middle lobe being about twice as long as broad and twice as long as the undivided portion of the leaf. This form is represented in this herbarium by an isotype of the only collection known. It seems to be an extreme form of the type.

Acer velutinum f. **glabrescens** (Boiss. & Buhse), comb. nov.

Acer insigne Boiss. & Buhse var. *β. glabrescens* Boissier & Buhse in Nouv. Mém. Soc. Nat. Moscou, **12**: 46 (Aufzähl. Transkauk. Pers. Pflanz.) (1860). — Pax in Bot. Jahrb. **7**: 194 (1886). — Wesmael in Bull. Soc. Bot. Belg. **29**: 36 (1890). — Rehder in Bailey, Cycl. Am. Hort. **1**: 15 (1900); in Bailey, Stand. Cycl. Hort. **1**: 201 (1914); Man. Cult. Trees Shrubs, 567 (1927). — Schneider, Ill. Handb. Laubholzk. **2**: 203, fig. 126f, 132 a–d (1907).

Acer insigne Boissier & Buhse l. c. (1860), quoad var. *glabrescens*. — Boissier, Fl. Or. **1**: 947 (1867). — Regel in Gartenfl. **30**: 120, fig. (1881). — Dippel, Handb. Laubholzk. **2**: 430, fig. *202* (1893). — Koehne, Deutsch. Dendr. 377 (1893), excl. syn. *A. Van Volxemi*. — Henry in Elwes & Henry, Trees Gt. Brit. Irel. **3**: 667 (1907), quoad var. *glabrescens*.

Acer insigne var. *Van Volxemi* sensu Pax in Bot. Jahrb. **16**: 395 (1893); in Engler, Pflanzenr. IV. **163** (Heft 8): 15 (1902). — Rehder in Bailey, Cycl. Am. Hort. **1**: 15 (1900). — Quoad syn. var. *glabrescens*, non *A. Van Volxemi* Mast.

Acer insigne var. *Van Volxemi* (Mast.) Pax *2. glabrescens* Pax ex Schwerin in Gartenfl. **42**: 267 (Var. Acer, 29) (1893).

Acer insigne (?) *β. obtusiloba* Freyn & Sintenis in Bull. Herb. Boiss. II. **2**: 843 (1902). — Bornmüller in Bull. Herb. Boiss. **5**: 643 (1905).

As stated in my remarks under the type, I do not consider the glabrous and pubescent forms as entitled to varietal rank, since both forms are found in the same locality and intermediate forms are frequent between the type and the typical f. *glabrescens* which has the under side perfectly glabrous. *Acer insigne* var. *obtusiloba* Freyn & Sint. of which I have seen Bornmüller's no. 6532 referred by him to that variety, seems hardly

distinct from f. *glabrescens;* the lobes are rather shorter and more obtuse, but the leaves are otherwise indistinguishable from those of f. *glabrescens.*

Acer velutinum f. **Wolfii** (Schwerin), comb. nov.

Acer insigne Wolfii Schwerin in Mitt. Deutsch. Dendr. Ges. **14**: 210 (1905). — Schneider, Ill. Handb. Laubholzk. **2**: 203 (1907) "f. *Wolfi*." — Rehder in Bailey, Stand. Cycl. Hort. **1**: 201 (1914); Man. Cult. Trees Shrubs, 567 (1927), pro var.

This form differs from the preceding in the purplish red under side of the leaves, very much like *A. Pseudoplatanus* var. *purpureum* Loud.

Acer velutinum var. **Van Volxemii** (Mast.), comb. nov.

Acer Van Volxemii Masters in Gard. Chron. II. **7**: 72, fig. 10 (1877). — Nicholson in Gard. Chron. II. **15**: 10 (1881). — Dippel, Handb. Laubholzk. **2**: 432, fig. 203 (1893).

Acer Pseudo-Platanus subsp. *Van Volxemi* (Mast.) Wesmael in Bull. Soc. Bot. Belg. **29**: 35 (1890).

Acer Volxemi Masters in Gard. Chron. III. **10**: 9, fig. 1, 2 (1891). — Henry in Elwes & Henry, Trees Gt. Brit. Irel. **3**: 660 (1908).

Acer insigne var. 1. *Van Volxemi* (Mast.) Pax in Bot. Jahrb. **16**: 395 (1893); in Engler, Pflanzenr. IV. **163** (Heft 8): 15 (1902); excl. syn. var. *glabrescens.* — Rehder, Man. Cult. Trees Shrubs, 567 (1927).

Acer Kakheti Hort. Belg. ex Pax, l. c. (1893), pro synon. precedentis.

Acer insigne var. *Van Volxemi* (Mast.) Pax l. *perckense* Schwerin in Gartenfl. **42**: 268 (Var. Acer, 29) (1893).

By several authors this maple has been united or confused with var. *glabrescens,* but Henry maintains that it is quite distinct, and he considers it a distinct species or possibly a hybrid between *A. insigne* and *A. Trautvetteri* Medw., but neither in the leaves nor in the inflorescence can I see any influence of the latter species. He states that it has extremely large leaves with white pubescence along the midrib beneath and twigs pubescent at the nodes and on the upper edge of the leaf-scars, and that the inflorescence has long bracts and bractlets like *A. Trautvetteri* Medw. I find, however, that the pubescence at the internodes is present also in the other varieties and the pubescence along the midrib of the leaves is found on plants intermediate between the type and the f. *glabrescens.* I have seen no flowering specimens of var. *Van Volxemi,* but judging from the illustration by Masters (l. c.) the inflorescence is quite different; it has the appearance of a dense semiglobose corymb instead of a pyramidal panicle, the bracts and bractlets are longer and more conspicuous, while in the other forms of *A. velutinum* they are minute and caducous, and the wings of the fruit spread nearly horizontally. The tree seems never to have been collected again in a wild

state and the original specimen upon which Masters based his description has apparently been lost.

Acer brevilobum Hesse, nom. nov.

Acer brevilobum Hesse, Haupt-Preisverz. 1903–4, p. 80 (1903), nom. nud. — Kache in Mitt. Deutsch. Dendr. Ges. **28**: 226 (1919), pro synon.

Acer parviflorum Franchet & Savatier, Enum. Fl. Jap. **2**: 321, 323 (1879). — Maximowicz in Bull. Acad. Sci. St. Pétersb. **26**: 439 (Mél. Biol. **10**: 595) (1880). — Pax in Bot. Jahrb. **7**: 247 (1886); in Engler, Pflanzenr. IV, **163** (Heft 8): 69 (1902). —Schneider, Ill. Handb. Laubholzk. **2**: 236, 1029, fig. 164 d (1907). — Shirasawa, Ic. Ess. For. Jap. **2**: t. 42 (1908). — Koidzumi in Jour. Coll. Sci. Tokyo, **32**, **1**: 11, t. 1 (1911). — Silva-Tarouca, Uns. Freil.-Laubgeh. 131, fig. 113 (1913). — Kache in Mitt. Deutsch. Dendr. Ges. **28**: 226 (1919). — Rehder, Man. Cult. Trees Shrubs, 569 (1927). — Non Ehrhardt (1789).

Acer pennsylvanicum subsp. 4. *parviflorum* Wesmael in Bull. Soc. Bot. Belg. **29**: 62 (1890).

Acer crassipes Pax in Engler, Pflanzenr. IV. **163** (Heft 8): 69 (1902). — Hesse in Mitt. Deutsch. Dendr. Ges. **21**: 358, fig. (1912). — Non Heer (1859).

Acer pictum var. *parviflorum* Schneider in Silva-Tarouca & Schneider, Uns. Freil.-Laubgeh. ed. 2, p. 85, fig. 73 (1922), quoad syn. *A. crassipes* et fig.

Acer parviflorum Franch. & Sav., the name up to the present time universally accepted for this species, is invalidated by the older homonym *A. parviflorum* Ehrh. which is a synonym of *A. spicatum*. *Acer crassipes* was based by Pax on material from the same plant as was *A. brevilobum*. This plant was growing in the nursery of A. H. Hesse in Weener, Germany, where I collected specimens in 1901 under the designation "A. spec. Japan" and in 1910 received flowering material named *A. crassipes* from Mr. Hesse. Mr. Hesse sent material to Schwerin and to Pax for identification; the former named it *A. brevilobum*, the name under which Hesse offered it in his catalogue in 1903 without author's citation, but Schwerin never published it, apparently because he identified it soon after with *A. parviflorum*. By Pax it was described in 1902 as a new species, *A. crassipes*, a name invalidated by the older homonym *A. crassipes* Heer (1859); it was first cited as a synonym of *A. parviflorum* in 1913 by Count Silva Tarouca (l. c.). Kache in 1919 cited both names, *A. crassipes* Pax and *A. brevilobum* Schwerin, as synonyms of *A. parviflorum*.

Acer palmatum Thunb. var. **palmatum** (Thunb.), comb. nov.

Acer palmatum Thunberg in Nov. Act. Soc. Sci. Upsal. **4**: 40 (1783); Fl. Jap. 162 (1784).

Acer septemlobum Siebold & Comp. in Jaarb. Nederl. Maatsch. Tuinb. 1844, p. 23, t. 2, fig. c., nom. seminud.[1]

Acer Meïkets Siebold & Comp. (l. c.) t. 2, fig. d., nom. seminud.

Acer polymorphum Sieb. & Zucc. γ. *palmatum* K. Koch, Hort. Dendr. 80 (1853).

Acer palmatum var. *quinquelobum* K. Koch in Ann. Mus. Bot. Lugd.-Bat. **1**: 251 (1864). — Miquel in Arch. Néerland. **2**: 469 (1867).

Acer palmatum var. α. *Thunbergii* Pax in Bot. Jahrb. 7: 202 (1886), pro parte. — Rehder, Man. Cult. Trees Shrubs, 570 (1927).

Acer palmatum var. *Thunbergii* Pax subvar. *eupalmatum* 1. *normale* Schwerin in Gartenfl. **42**: 652, fig. (1893). — Pax in Engler, Pflanzenr. IV. **163** (Heft 8): 26 (1902). — Schneider, Ill. Handb. Laubholzk. **2**: 207, fig. 135a (1907).

Acer palmatum var. *septemloba* Miquel in Ann. Mus. Bot. Lugd.-Bat. **2**: 88 (Prol. Fl. Jap. 20) (1865), based on *A. Meïkets* in Jaarb. Nederl. Maatsch. Tuinb. tab. 2, fig. d.

Acer palmatum f. *genuina* Miquel in Siebold & Zuccarini, Fl. Jap. **2**: 84 (1870), quoad nomen, excl. syn. descr. et planta depicta.

Acer palmatum "*palmatum* proper" Nicholson in Gard. Chron. n. ser. **16**: 137 (1881).

Acer palmatum subsp. *genuinum* (S. & Z.) Koidzumi in Jour. Coll. Sci. Tokyo, **32, 1**: 44, t. 26, fig. 1–6 (1911).

The oldest varietal epithet for typical *Acer palmatum* is apparently Koch's *A. polymorphum* γ. *palmatum* of 1853. The varietal epithet *Thunbergii* proposed by Pax in 1886, and used by many later authors is antedated not only by that of 1853, but also by *A. palmatum* β *quinquelobum* K. Koch of 1864.

Acer palmatum Thunb. var. **heptalobum,** nom. nov.

Acer polymorphum δ. *septemlobum* sensu K. Koch, Hort. Dendr. 80 (1853) non *A. septemlobum* Thunb. — Anon. in Bull. Féd. Hort. Soc. Belg. 1883–85, p. 358 (1887).

Acer septemlobum sensu K. Koch, Hort. Dendr. 80 (1853), non Thunberg; pro synon. praecedentis.

Acer palmatum forma *genuina* Miquel in Siebold & Zuccarini, Fl. Jap. **2**: 84, t. 145 (1870), pro parte, quoad plantam depictam et syn. *A. septemlobum* sensu Miquel, non Thunberg.

Acer palmatum var. *Thunbergii* subvar. *septemlobum* 17. *euseptemlobum* Schwerin in Gartenfl. **42**: 678, fig. (1893). — Pax in Engler Pflanzenr. IV. **163** (Heft 8): 26 (1902), sphalmate "*subseptemlobum*". — Schneider, Ill. Handb. Laubholzk. **2**: 207, fig. 135b (1907).

Acer palmatum var. *septemlobum* Nicholson in Gard. Chron. n. ser. **16**: 137 (1881). — Rehder in Bailey, Cycl. Am. Hort. **1**: 14 (1900); Man. Cult. Trees Shrubs, 570 (1927).

Acer palmatum b. *A. septemlobum* K. Koch, Dendr. **1**: 525 (1869).

Acer palmatum subsp. *septemlobum* Koidzumi in Jour. Coll. Sci. Tokyo, **32, 1**: 46, t. 26, fig. 7, 8, t. 27 (1911).

[1]This and the following represent forms belonging to typical *A. palmatum* as the lobulate and coarsely and unequally serrate lobes show.



OSTRYA MULTINERVIS Rehder

FULL-TONE — MERIDEN



EVONYMUS FORTUNEI (Turcz.) Hand.-Mazz.

The name *Acer septemlobum* Thunb. has been applied to a variety of *A. palmatum* by all authors after 1853, until Koidzumi, after examination of Thunberg's type recognized it as being identical with *Kalopanax ricinifolius* Miq. and in 1925 he published the combination *Kalopanax septemlobus*. In 1927 the writer made the combination *Acanthopanax septemlobus* attributing it erroneously to Koidzumi. He could affirm the correctness of Koidzumi's identification when examining in 1928 Thunberg's herbarium in Uppsala. All references to *Acer septemlobum* Thunb.[1] up to Steudel in 1841 are based solely on Thunberg's description and therefore apply to *Kalopanax*. Siebold, in 1844, seems to have been the first one to use the name for a definite species of *Acer*, but for a form which according to his figure belongs to typical *A. palmatum* and not to the form to which later authors applied the name and which agrees fairly well with Thunberg's description, while Siebold's figure does not agree at all with Thunberg's description of the lobes as "aequaliter argute serratis."

Since the specific epithet of Thunberg's *Acer septemlobum* belongs to *Kalopanax* and since no other epithet under *Acer palmatum* seems to be available, I propose the new name *heptalobum* for the variety of *Acer palmatum* generally designated as *septemlobum* and based erroneously on *A. septemlobum* Thunb.

Acer oblongum Wall. var. **biauritum** W. W. Smith in Notes Bot. Gard. Edinb. **8:** 329 (1915). — Metcalf in Lingnan Sci. Jour. **11:** 195 (1932). — Rehder in Jour. Arnold Arb. **15:** 6 (1934).

Acer Paxii Franchet in Bull. Soc. Bot. France, **33:** 464 (1887); Pl. Delavay. 144, t. 31 (1889). — Pax in Engler, Pflanzenr. IV. **164** (Heft 8): 10, fig. 3 (1902). — Rehder in Sargent, Trees & Shrubs, **1:** 178 (1905). — Schneider, Ill. Handb. Laubholzk. **2:** 198, fig. 126d, 127 e–i (1907). — **Synon. nov.**

I am unable to find any character to separate *Acer Paxii* from *A. oblongum* var. *biauritum*, and I agree with W. W. Smith that this maple represents only a variety of *A. oblongum* with prevailingly 3-lobed leaves. The reason why the identity of *A. Paxii* with *A. oblongum* was not recognized, is probably the fact that Pax and all later authors placed *A. Paxii* in the Sect. SPICATA, while *A. oblongum* was referred to Sect. INTEGRIFOLIA. Also *A. Buergerianum* should be transferred from the Sect. SPICATA to the Sect. INTEGRIFOLIA.

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[1] *Acer septemlobum* Thunberg, Fl. Jap. 162 (1784); Diss. de Acere (resp. J. L. Aschan) 1793; in his Diss. Acad. **2:** 345 (1800). — Willdenow, Spec. Pl. **4:** 983 (1805). — Persoon, Syn. Pl. **1:** 417 (1805). — DeCandolle, Prodr. **1:** 595 (1824). — Sprengel, Syst. Veg. **2:** 225 (1825). — Spach, Hist. Nat. Veg. **3:** 99 (1834). — Steudel, Nomencl. ed. **2, 1:** 12 (1841).

NOTES ON SOME ASTRAGALUS SPECIES OF ECUADOR AND PERU

IVAN M. JOHNSTON

THE SPECIES here discussed are plants of Ecuador and west-central and northern Peru. They represent the few South American species of the genus which have not been discussed in my forthcoming revision of the *Astragalus* species of Bolivia, Chile and Argentina. Though these few northern species are well marked, to have included them in my larger paper would have disproportionately complicated the keys to the very abundant and generally less well marked more southern species. Practical considerations have, therefore, demanded a separate treatment of the present outlying northern species of South America. Since the Galapagos Islands are territory belonging to Ecuador I have given notes on the identity and probably true home of the two species of *Astragalus* based upon specimens falsely said to have come from those islands.

The abbreviations of herbaria used in this paper are as follows: BD = Berlin-Dahlem; BM = British Museum; Boiss. = Boissier Herbarium, Geneva; FM = Field Museum, Chicago; G = Gray Herbarium, Harvard Univ.; K = Kew; Stock. = Stockholm; US = United States National Herbarium.

Astragalus Sprucei, sp. nov.

Prostrata gracilis, e radice gracili perenni oriens; caulibus gracilibus 1–1.5 mm. crassis 1–5 dm. longis sparse longiramosis plus minusve minute pallide strigosis; foliis numerosis; rhachi 4–7 mm. longa sparse strigosa internodiis caulis 1–3 cm. longis evidenter longiore; foliolis 9–13-jugis oblongis vel oblongo-obovatis vel late cuneatis basim versus attenuatis glabris vel subtus in costa sparse strigosis apice latis conspicue emarginatis; stipulis dorsaliter connatis 5–7 mm. longis pallide chartaceis laxe ocreatis apice 1–1.5 mm. profunde bidentatis; floribus 3–6 parvis; racemis quam folia ½ vel ⅓ brevioribus; pedunculis axillaribus 5–20 mm. longis gracilibus maturitate decurvatis; bracteis ovatis chartaceis acutis 1–2 mm. longis; pedicellis ca. 1 mm. longis; calycibus 2.5–3.5 mm. longis extus sparse strigosis, tubo cupulato 1.5–2 mm. longo et crasso, lobis lanceolatis 1–2 mm. longis; vexillo ca. 5 mm. longo caeruleo medio albo-picto, lamina suborbiculata ca. 5 mm. diametro; alis caeruleis angustis ca. 4 mm. longis; carina alba obtusa ca. 3 mm. longa; ovario striguloso; leguminibus prismaticis ascendentibus sparse strigosis

straminaceis 8–12 mm. longis 4–6 mm. crassis 2–4 mm. altis uniloculari-bus, plus minusve dorsiventraliter compressis cum partibus inferioribus leguminis subplanis vel plus minusve lateraliter compressis cum partibus inferioribus leguminis late introflexis; seminibus 6–8 brunneis ca. 1.8 mm. longis compressis oblique ovatis.

ECUADOR. TUNGURAHUA: Tilulún, near Ambato, Feb. 1919, *Pachano 117* (US). CHIMBORAZO: Riobamba in sandy places, fl. violaceous, Nov. 1858, *Spruce 5771* (TYPE, Gray Herb.; K, BD, Stock.); in gravel along the Rio Chambo, Dec. 1858, *Spruce 5811* (K, BD, Stock.); repent in sandy fields, Riobamba, Dec. 1922, *Mille A17* (BD); sandy hills, Riobamba, May 1921, *Rimbach 148* (BD); dry interandine highland, small half-shrub in sandy soil, Riobamba, 2800 m., *Rimbach 202* (US); without locality, *Pearce* (BM) and *Jameson* (US).

Related to the habitually very dissimilar *A. micranthellus* Wedd. and *A. arequipensis* Vogel, perennials of the Bolivian plateau, and to *A. triflorus* (DC.) Gray, an annual of the coastal hills of Peru and northern Chile. All these related species have small racemose flowers borne on abbreviated peduncles much shorter than the leaves, as well as usually flat, non-complicate, leaflets and ascending legumes. The pods of *A. Sprucei* have no false septum or, at most, only an extremely narrow very weakly developed and inconspicuous one. Though the walls of the pod are tough they are not very thick. The total width of the fruit is usually ½ to ⅓ their total length and is evidently greater than its dorsi-ventral measurements (i. e. height). The pod may be angled along its entire upper edge or only along its distal half, the half of the pod next the pedicel being frequently somewhat flattened dorsally and the superior suture somewhat inflexed. The fruit is essentially triquetrous and broadly prismatic. The very broad lower face of the fruit may remain flat but it usually becomes broadly inflexed for its total length thus causing the pod to appear folded.

Astragalus Weberbaueri Ulbrich, Bot. Jahrb. **37:** 419 (1906).

Infrequent in the mountains of northern Peru and central Ecuador.

PERU. CAJAMARCA: below San Pablo, 2200–2400 m., shrubby, ca. 5 dm. tall, *Weberbauer 3869* (TYPE, Berlin); Montana de Nancho, Nov. 23, 1874, *Raimondi 8294* (BD). PIURA: above Palambla, cordilleras west of Huancabamba, 2700–3200 m., spreading shrub, April 1912, *Weberbauer 6035* (BD) and *6050* (G, US, FM, BD). ECUADOR. PICHINCHA: Quito, *Jameson* (K). CAÑAR: below paramo, near Cañar, Sept. 16, 1918, *Rose & Rose 22776* (US) Paramo de Chaning, andes east of Azogues, 3000–3400 m., *Lehmann 5357* (K).

This species has elongate sparsely branched erect stems which become somewhat shrubby below. Its habit, subglabrous yellowish olive-green leaves, large corollas and brownish calyces give the plant a very distinctive aspect. The ovary is strigose. The sparsely strigose mature fruit is 10–14 mm. long, more or less reflexed and triquetrous and prismatic. The three subequal faces of the legume are 4–5 mm. broad. The lower face may be flattened or more or less inflexed. Viewed from the side the upper edge may be nearly straight or broadly convex in outline. The lower edge is usually more strongly convex in outline and more abruptly contracted into the slender (1.5–3 mm. long) persistent stylar beak. The base of the fruit is rounded in lateral outline. Inside the pod there is a weakly developed false septum 0.5–1 mm. high.

The gross habit of *A. Weberbaueri* is somewhat suggestive of a coarse form of *A. Garbancillo*. Our plant, however, may be quickly distinguished from that variable and widely ranging species by its larger, glabrescent deflexed legumes with rudimentary rather than well developed false septum, and its glabrescent olivaceous herbage, and besides it has a detached distinctly more northern geographical range.

Astragalus geminiflorus Humb. & Bonpl. Plant. Aequat. **1:** 128, tab. 37 (1808); Weddel, Chlor. Andina **2:** 258 (1861).

Endemic to the volcanic peaks of Ecuador at altitude between 4000 and 5000 meters.

ECUADOR. PICHINCHA: east side of Cayambe, upper paramo, 4300 m., March 1871, *Stübel 113* (BD); Rucu-Pichincha, 1923, *Anthony & Tate 170* (S); Pichincha, en una hondonada del "Padre Encantado," 4400 m., 1928, *Firmin 586* (US); Mt. Pichincha, 4100–4500 m., *Hitchcock 21067* (G, US); north side of Pichincha, 1870, *Stübel 39* (BD); Pichincha, 1855, *Couthouy* (G); summit of Pichincha, March 18, 1849, *Jameson* (Paris); sides of crater and volcanic summit, Pichincha, *Jameson 68* and *28* (K); west side of Antisana, ca. 4500 m., March 1880, *Whymper* (BM); Antisana, 4500 m., 1923, *Anthony & Tate 289* (US); Antisana, *Humboldt & Bonpland* (Paris, TYPE; BD); Corazon, paramo, 4200 m., *Stübel 22A* (BD); summit of Rumiñahui, 4750 m., 1920, *Holmgren 954* (Stock.). LEON: Vallevicioso, base of Cotopaxi, Oct. 1856, *Remy* (Paris); Cerro de Cotopaxi, *Jameson* (US); Iliniza, Atatinqui, in paramo, Jan. 1874, *Stübel 299* (BD). CHIMBOROZO: Chimborozo, 4200 m., June 1860, *Spruce* (K); Chimborozo loose blowing sand, 4950 m., Dec. 25, 1826, *Jameson* (K); Chimborozo near Totorillas, loose drifting volcanic sand near snow-line, 4600 m., July 7, 1876, *Andre 3949* (K); dunes at base of Chimborozo, Nov., 1856, *Remy* (Paris);

Arenal de Chimborozo, 4200–4500 m., *Lehmann 418* (K, BM, US); Chimborozo near snow-line, *Hartweg 957* (K, BM, BD, Boiss., Paris), northwest side of Chimborozo, 4700 m., 1903, *Mayer 79* (BD).

A very well marked species with its abundant coarse stems trailing in volcanic sand. The leaves are silvery and have very numerous small crowded leaflets. The flowers are usually solitary in the leaf-axils. The ascending fruit is silky strigose, like the herbage, and is usually found persistent on the buried stems of past years. Its lower suture is strongly inflexed. Inside the fruit there is an evident false septum which becomes at least 1 mm. high and is usually hairy. The species is a relative of *A. Garbancillo* and *A. Pickeringii*, of central Peru.

Astragalus Cracca De Candolle, Astrag. 101, tab. 9 (1802) and Prodr. **2:** 284 (1825).

Astragalus ocrosianus Ulbrich, Bot. Jahrb. **37**: 419 (1906).

Semi-desert western slopes of the Peruvian Cordilleras east and northeast of Lima.

PERU. ANCASH: Ocros, ca. 3300 m., 1903, *Weberbauer 2666* (FM; Berlin, TYPE of *A. ocrosianus*). LIMA: Purrochuca, *Mathews 550* (BM); Huamantanga, *Mathews 550* (K); prov. Canta, *Mathews* (K); Cerro de Surco, *Ramondi 11908* (BD); near Canta, open grassy hillside, ca. 3100 m., 1925, *Pennell 14607* (G, US, FM); Canta, open rocky slope, ca. 2800 m., 1925, *Pennell 14345* (G, FM); Matucana, loose soil on steep hillside, ca. 2400 m., 1922, *Macbride & Featherstone 293* (FM).

A species known only from west-central Peru. The laxly branched stems are spreading or decumbent from a slender perennial root. The ovary is glabrous. The reflexed glabrous pods are 10–17 mm. long. At first they are more or less three-faced with the flattened (slightly the broadest) lower face 4–5 mm. broad, but finally at maturity they become laterally compressed with the lower face strongly and deeply inflexed. There is an incomplete papery false septum becoming 1 mm. high.

The species is most closely related to *A. Weberbaueri* of northern Peru and Ecuador, from which it differs in its glabrous ovary and fruit, much smaller flowers, much shorter more slender spreading stems, and distinctly brighter green herbage. The herbage of *A. Cracca* is sparsely pale-strigose, the new growths may be somewhat cinereous but the older parts tend to be glabrescent and green. It is never olivaceous as in *A. Weberbaueri.* The structure, size and shape of the pods in these two species are similar. The gross habit of *A. Cracca* is very similar to that of *A. Richii,* but our plant has a very much more scanty indument, and hence is more or less glabrescent, rather than cinereous as in the rather

copiously strigose *A. Richii*. The pods of *A. Cracca* are, furthermore, distinctly deflexed and glabrous. Those of *A. Richii* are strigose, somewhat inflated and ascending or only erratically and laxly reflexed.

When *A. Cracca* was first published by de Candolle it was given as from Peru without any indication as to who collected the type or as to the locality where it was found. Later in the Prodromus he again attributed the species to Peru but added the note, "v. s. olim in herb. Desf.," which suggests that the type may be in the Webb Herbarium at Florence. At Paris there are some collections labelled as collected in Chile by Dombey. These are very similar to the plant illustrated and described by de Candolle and I believe them to be isotypes of the species. I suspect that the type of *A. Cracca* was collected by Dombey, probably near Canta, Peru. The species is most certainly not Chilean.

Astragalus Richii Gray, Bot. U. S. Explor. Exped. **1**: 414 (1854).

Astragalus macrorrhynchus Ulbrich, Bot. Jahrb. **37**: 420 (1906).

Western slopes of the Andes in central and southern Peru.

PERU. LIMA: along the ascent to Obrajillo, May 1839, *Wilkes Exped.* (US, TYPE of *A. Richii;* G); Matucana, 1922, *Macbride & Featherstone 214* and *351* (FM); between Matucana and Tambo, 1901, *Weberbauer 112* (BD, TYPE of *A. macrorrhynchus*). AREQUIPA: southern slopes of Chachani, 3355 m., 1920, *Hinkley 20* (G); near Arequipa, 2700 m., 1925, *Hopp 25* (BD); Arequipa 1892, *Douglas* (G); Arequipa, 2800–2900 m., 1925, *Pennell 13241* (G, US, FM, BD). TACNA: near Lake Huananhuata, Candareve, March 1925, *Weberbauer 7365* (G, US, FM, BM, BD).

A species much resembling *A. Cracca,* but ranging to the south of that species and differing from it in the less triquetrous and more inflated strigose pods. The flowers after anthesis and the maturing fruit of *A. Richii* seem to have spreading or loosely recurved pedicels. They are not so distinctly reflexed as in *A. Cracca, A. Weberbaueri* or *A. Sprucei.* The pods of *A. Richii* have no false septum.

Astragalus alienus Gray, Bot. U. S. Explor. Exped. **1**: 418 (1854).

Astragalus imputatus Macbride, Candollea **5**: 370 (1934).

Western slopes of the Andes east and northeast of Lima, Peru.

PERU. LIMA: Above Baños, "midrib of leaves persistent, and becoming spinescent; on the sloping summit of the ridge that forms the northern border of the Chancay Valley, rare," May 1839. [*Pickering*] *Wilkes Exped.* (US, TYPE of *A. alienus;* G); Rio Blanco, open hillside, shrub with subprostrate branches, ca. 3250 m., April 1929, *Killip & Smith*

21739 (FM, TYPE of *A. imputatus;* NY, US); Altos de San Mateo, May 1876, *Raimondi 12128* (BD).

This remarkable plant is known only from the three collections cited. The leaflets are very small and deciduous from the stiffish slender leaf-rachis which persists as a weak elongate spine. These slender spines are morphologically equivalent to those found in a large group of species of the Old World. This homology and the resulting great similarity in gross aspect between this Peruvian plant and those of the Old World has suggested that possibly some direct relationship may exist between these widely separated plants. The similarities, however, may be dismissed as merely parallel evolution. Our plant is evidently related to *A. Garbancillo,* a species in which the leaf-rhachises frequenty persist after the leaflets have fallen. A study of any large series of Peruvian *A. Garbancillo* will reveal many evidences of this habit, which is merely intensified in *A. alienus.* Our plant is not directly related to the spinescent species of Asia!

Macbride distinguished *A. imputatus* from *A. alienus* by attributing to the former subacute green rather than retuse canescent leaflets, larger flowers (17 mm. rather than 12 mm.) and a more shallowly lobed calyx. However, the younger leaves of *A. imputatus* are as canescent as those in *A. alienus.* The leaflets of *A. alienus* are actually acutish rather than retuse. The differences in flower-size and calyx-proportions are of minor importance if we may judge of their variability in *A. Garbancillo.* Finally the two plants come from a small natural area from which we can hardly expect two species so evidently related as *A. alienus* and *A. imputatus.*

Astragalus Pickeringii Gray, Bot. U. S. Explor. Exped. **1**: 415 (1854).

Astragalus Pickeringii var. *serpens* Ball, Jour. Linn. Soc. London, **22**: 36 (1885).

Astragalus Garbancillo var. *varus* Macbride, Field Mus. Publ. Bot. **8**: 99 (1930).

High altitudes of central Peru.

PERU. LIMA: Rio Blanco, 4500 m., 1922, *Macbride & Featherstone 776* (FM); Casapalca, ca. 4200 m., April 22, 1882, *Ball* (K, TYPE of var. *serpens;* G); between Casa Cancha and Culmai, *Wilkes Exped.* (US, TYPE of *A. Pickeringii;* G); Ticlio, on hillside, 1929, *Ledig 32* (US). JUNIN: Cerro de Pasco, *Mathews 592* (BM); Cerro de Pasco, 4200 m., *Macbride 3068* (FM); Shelby, 4050 m., June 1922, *Macbride & Featherstone 1090* (FM); high plains near Junin, 3900 m., *Mackenzie* (US, FM; between Tarma and Jauja, 4500 m., 1929, *Killip & Smith 23570* (US); near Oroya, *Kalenborn 133* (G, US). ANCASH: Pomo-

pampa, 4200 m., *Macbride & Featherstone 2499* (FM, TYPE of var. *varus*). HUANUCO: Chavanillo, caespitose on upland grassland, ca. 2400 m., Aug. 1922, *Macbride & Featherstone 2308* (FM); Chasqui near Mito, grassy subalpine slopes, April 1923, *Macbride 3295* (FM).

Assembled here is a group of plants which is evidently related to *A. Garbancillo* and probably derived from it. The characters of these plants, their reduced dense habit of growth, short internodes, small leaves, few-flowered short-pedunculate inflorescences, are all modifications to be expected in plants growing in alpine conditions at high altitudes. Curiously, however, although *A. Garbancillo* is one of the most widely ranging of South American *Astragalus*, growing from Tucuman and Mendoza in Argentina north to central Peru and so adjacent to many areas of puna and high mountain slopes, it has produced a marked, depauperate, high-altitude form only in *A. Pickeringii* and that only in central Peru at the northern limit of its geographical range. Our plant is probably only an ecotype, but because of its extreme departure from its probable parent-form and its relatively restricted range, I believe it will be convenient to treat it as a species. I have not seen a complete series of intergrades, connecting *A. Pickeringii* and *A. Garbancillo*, but such collections as *Macbride & Featherstone 945* from Oroyo (which must be referred to *A. Garbancillo*) and *Killip & Smith 23370* from between Tarma and Jauja (which is evidently robust *A. Pickeringii*) do indicate that the two species do approach one another and that a complete series of intergrades probably do exist in nature.

In *A. Pickeringii* the leafy stems (annual growths) may reach 8 cm. in length and have internodes as much as 1 cm. long. On the other hand they may be very much shortened or even suppressed with the plant more or less cespitose and the leaves even tufted on the crowns of the coarse branched subterranean caudex. The 1–6 (usually 2–4) flowers are congested on peduncles 0.5–6 (usually less than 2) cm. long which are conspicuously overtopped by the leaves. The corolla and fruit are those of *A. Garbancillo*. The leaves, stems, and stipules usually have a dense pale silky indument. The peduncles are frequently spreading or decurved.

The collections from the department of Huanuco have been determined by the collector as *A. geminiflorus*, but that is certainly incorrect. Though at first I considered them to represent an undescribed species further study and comparison with *A. Pickeringii* has convinced me that they are merely the ultimate habital reduction in that species. Tendencies towards their extreme cespitose habit may be observed in collections I have cited from Lima and Junin.

Astragalus romasanus Ulbrich, Bot. Jahrb. **37:** 421 (1906).

PERU. ANCASH: Pampa Romas, between Samanco and Caraz, spreading half-shrub, 3400–3500 m., May 30, 1903, *Weberbauer 3209* (BD, TYPE).

The status of *A. romasanus* is uncertain. Further collection from Ancash are needed before we can determine its relations to *A. Pickeringii* and *A. Garbancillo*. It differs from the latter in having short slender leafy stems 1–5 cm. long, and, perhaps, slightly smaller flowers and more elongate pods. Its abbreviated stems suggest *A. Pickeringii,* but its caudex is diffuse, its stems much more slender, its peduncles more slender and elongate, its flowers loosely racemose, and its much smaller leaves and leaflets glabrous above.

Astragalus Brackenridgei Gray, Bot. U. S. Explor. Exped. **1:** 416 (1854).

Astragalus salubris Macbride, Field Mus. Pub. Bot. **11:** 25 (1931).

Known only from high altitudes in the Andes of central Peru.

PERU. JUNIN: Shelby, 4000 m., June 8, 1922, *Macbride & Featherstone 1089* (FM); Morococha, 4500 m., 1922, *Macbride & Featherstone 889* (FM); Cord. de Morococha, *Martinet 1531* (Paris); Hacienda Atocsaico near Junin, 1923, *Hitchcock 22189* (US); Cerro de Pasco, 1927, *Sawada P86* (FM, TYPE of *A. salubris*); Tuapata, 3750 m., 1916, *Watkins* (US). LIMA: puna above Baños, *Wilkes Exped.* (US, TYPE of *A. Brackenridgei*).

This species is clearly related to *A. arequipensis* Vogel, which ranges at high altitudes from southern Peru south into northern Argentina, and perhaps is no more than a geographic variant of that species. It differs from its southern relative only in its smaller proportionately broader oblong (rather than lunate) fruit and in its generally smaller narrower leaflets. These differences are not always decisive.

Astragalus Edmonstonei (Hook.) Robinson, Proc. Amer. Acad. **38:** 148 (1902).

Phaca Edmonstonei Hooker, Trans. Linn. Soc. London, **20:** 227 (1847).

This species is based upon material collected by Thomas Edmonstone which is labelled as from the Galapagos Islands. The type collection, however, is without any doubt that well known coastal plant of central Chile which has been described as *Phaca flava* H. & A. and *Phaca chrysantha* Moris. Since neither of these two earlier specific names may be applied to the Chilean species of *Astragalus,* because of earlier homonyms, the name *A. Edmonstonei* becomes the valid name of the species.

Edmonstone, who was botanist on the exploring ship, *Herald*, was killed while in Ecuador. There is other evidence that parts of his collection became confused after his death. There can be little doubt that he collected his material of the *Astragalus* near Valparaiso where he is known to have botanized in Nov. 1846. The species is not a plant of the Galapagos Islands.

Astragalus brevidentatus Wright, Kew Bull. **1906:** 200.

This species, said to be from the Galapagos Islands, is based upon a flowering specimen received by Hooker from Decaisne. This specimen, apparently a duplicate of the collection by Du Petit Thouars mentioned by Hooker when he described *Phaca Edmonstonei*, though attributed to the Galapagos Islands, was probably collected at Monterey, California. The specimen seems to be characteristic *A. Menziesii* Gray of the Californian coast. It is not a South American species and was not collected on the Galapagos Islands.

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A MISINTERPRETED FORMOSAN SPECIES, EUPHORBIA CALONESIACA, SPEC. NOV.

Leon Croizat

Hayata is the first botanist, it would seem, who has introduced *Euphorbia orientalis* L. into the flora of Formosa (Jour. Coll. Sci. Tokyo, **20**[3]: 70. 1904). His indication has been accepted by Matsumura (Ind. Pl. Jap. **2:** 304. 1912), Sasaki (List Pl. Form. 261. 1928), Masamune (Short Fl. Form. 119. 1936), and, as far as I know, by all Japanese authors.

That *E. orientalis* is not, and cannot be endemic to Formosa is clear. The Linnaean specific name, and the locality "in oriente" (Sp. Pl. **1:** 460. 1753) refer to the Near, not to the Far East. The plant has the status of a near-relict in Armenia and in northern Persia (Boissier, Fl. Or. **4:** 1100. 1879). Its characters are intermediate between those of the species represented by *E. bupleuroides* Desf., of northern Africa, and by *E. Bivonae* (Biv.) Steud., of the central Mediterranean region. Only two species that might be brought within this affinity, namely *E. prolifera* Ham. and *E. himalayensis* Klotzsch, *nec al.*, are found in Yunnan as elements of the Himalayan flora. Neither one is reported beyond the eastern boundary of that Chinese province.

Boissier saw the type (in DC. Prodr. **15**[2]: 121. 1862, and l. c.) which, *fide* Jackson (Ind. Linn. Herb. 74. 1912), was in the Linnaean herbarium on or before 1753, and found that it agreed with the synonyms and the diagnosis of the publication. Other European botanists before and after Boissier, however, held it to be doubtful whether the Linnaean binomial applied to *E. ceratocarpa* Ten., which is endemic to southern Italy. Gussone who is usually well informed errs this time in stating that no specimen of *E. orientalis* is extant in the Linnaean herbarium (Fl. Sicul. Synop. **1:** 543. 1842). Bertoloni confuses *E. orientalis* with *E. ceratocarpa* (Fl. Ital. **5:** 75. 1842), as does Tornabene (Fl. Aetn. **3:** 365. 1891). Parlatore, however, is of a different opinion (Fl. Ital. **4:** 458. 1867), not unlike Fiori (Nuov. Fl. Anal. Ital. **2:** 172. 1926). The confusion seems to have arisen because Sibthorp and Smith identified as *E. orientalis* (Prodr. Fl. Graec. **1:** 330. 1806) a specimen presumably collected in the vicinity of Constantinople. Gussone recognized (l. c.) *E. ceratocarpa* in this specimen from the Sibthorp Herbarium. I

am inclined to believe, until the contrary is proved true, that the Sibthorpian specimen represents the species known to Stoianoff and Stefanoff (Fl. Bulg. **2:** 722. 1925) as *E. soongarica,* a species being very similar to *E. ceratocarpa.*

The specimen of Szovits cited by Boissier (in DC. Prodr. **15**[2]**:** 122. 1862) "prope Nakitschewan" is in the Gray Herbarium, where also is preserved a photograph of the Linnaean type of *E. orientalis.* The specimen of Linnaeus is excellent, and consists of two stems in anthesis. Although the caulinar leaves of these exsiccata suggest the broad lanceolate form of these of *E. ceratocarpa,* rather than the narrow-lanceolate shape of those of the specimen of Szovits, the identification is essentially established by the four peculiar obcuneate mucronate involucels surrounding the cyathia. The polynomial of Van Royen cited by Linnaeus (l. c.) describes these involucels very well.

Knowing that the Formosan plant was not *E. orientalis* I tried in vain for a long time to secure a specimen of the species so named by Hayata. Unexpectedly an unidentified specimen of Faurie (Formosa No. 220, Takao, 1914[1]) in the Gray Herbarium proved to agree perfectly with the description that Hayata (l. c.) gives of his *E. orientalis.* The locality of Faurie, Takao, I judge to be probably a mere orthographic variant of Taichu, of Hayata. The specimen, moreover, seems to fit the illustration of Boissier (Ic. Euph. pl. 72. 1866) which presumably is the document upon which Hayata established the determination. It is unfortunate, in a way, that the none too good illustration of *E. orientalis,* of the Icones, follows that of *E. Jolkinii,* which indeed is a Japanese endemic.

Euphorbia orientalis of Hayata, of course, is not the Linnaean plant. It is a segregate of the complex of species in the vicinity of *E. Jolkinii* Boiss. and *E. pekinensis* Rupr. in Maxim., and although near to the form of the latter which Hara understands as *vulgaris* (Jour. Jap. Bot. **11:** 387. fig. 14a. 1935, sub *Galarrhoeo*) it has in my opinion an independent status. I propose it as **Euphorbia calonesiaca,** nom. nov. (*E. orientalis* Hayata, non L.: Hayata l. c., et auct. jap. supra citat.).

The specific epithet is derived from "Ilha Formosa" of the Portuguese discoverers.

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[1]The plant in question never was described by Léveillé.

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ON THE INDO-CHINESE SPECIES OF SYZYGIUM GAERTNER

E. D. MERRILL and L. M. PERRY

THE OCCASION for this enumeration of certain Indo-Chinese species of *Syzygium* is, in part, to characterize a few new species which have appeared in collections received for identification, and in part to readjust the nomenclature of certain other Indo-Chinese species actually represented in the herbarium material available to us for study. This is in conformity with our recently accepted generic concept of *Syzygium* as the proper name under which to place most of the Old World species of *Eugenia*. Comments on a few individual species are added.

We are specially indebted both to Dr. A. Pételot, whose collections form the major part of our additional citations, and to Dr. F. Gagnepain who, at the beginning of our study of the Chinese species of *Eugenia*, graciously supplied us with fragments from types or authentic specimens of his new species from Indo-China.

Syzygium Gaertner has had a varied career. Established, with only four species, primarily on the structure of the fruit supplemented by a very brief floral description, this group has had a checkered career. It has been ranked by various authors as a genus, as a subgenus, and as a section, and shifted from one status to another for no particular or evident reason or reasons. This is in part due, we believe, to the difficulties investigators have experienced in assigning proper generic limits and partly owing to the fact that emphasis in the delineation of the genus was shifted by later authors from fruiting to floral characters. Since flowering specimens were overwhelmingly predominant in collections, perhaps this was inevitable. Our concept of the genus, like that of Alston in Trimen, Handb. Fl. Ceyl. 6(Suppl.): 112. 1931, includes not only *Syzygium* proper but also *Jambosa* de Candolle (although excluding *Acmena* de Candolle[1] as we interpret it). Throughout our study of

[1] **Merrill, E. D.** and **L. M. Perry.** A synopsis of Acmena DC., a valid genus of the Myrtaceae. Jour. Arnold Arb. **19**: 1-20. 1938.

the numerous Chinese and the much more numerous Bornean species of *Eugenia* in its broader significance, we have been unable to find any single character or any combination of characters by which these two "genera" may be maintained as independent units. In adopting *Syzygium* Gaertner as name for the genus represented by the majority of the species of Old World *Eugenia* Linn. *sensu latiore*, we again direct attention to the detailed structure of the fruits, temporarily neglected in taxonomic studies of this group, but eminently worthy of consideration in the differentiation of genera.

Most of the species with fruits (usually immature) in our Old World collections show the seed-coat adhering more or less loosely to the pericarp and the two distinct cotyledons attached chiefly near the middle of the opposing faces concealing the hypocotyl within. This is the distinguishing character of *Syzygium*, not the calyptrate character of the corolla so unduly emphasized. The inflorescence is most often paniculate-cymose.

In contrast to the above we find that in most of the New World species of *Eugenia* (of which we have examined the fruits) the pericarp is easily crushed (thinner than in most of the fruits examined from Old World species), the seed (not the naked embryo) is free, the testa is smooth and usually shining, and the embryo, characterized by de Candolle as pseudo-monocotyledonous, appears undivided. The inflorescence is generally in clusters of pedicelled flowers (one flower on a pedicel), the calyx limb is not so prolonged as in *Syzygium* and the stamens are much less incurved in the bud. The species belong to *Eugenia* proper.

Gagnepain's treatment of "Eugenia L. (*Jambosa* et *Syzygium* incl.)" in Lecomte, Fl. Gén. Indo-Chine **2**: 796–844. 1920, 1921, is the latest study of the complex in this region. Since, as a whole, this renders the species fairly accessible, although we are not entirely in agreement with the major divisions of his key, our enumeration follows the general plan of his conspectus. The new species are inserted adjacent to those with which they appear to be approximately coincident as regards the ultimate divisions of the key. Wherever possible we have added new records of collections. The other species of which we have some representation are indicated merely as being found in Indo-China.

The following species included in Gagnepain's work are not represented in our herbarium by Indo-Chinese specimens: *Eugenia chlorantha* Duthie, *E. bracteolata* Wight, *E. albiflora* Duthie, *E. tephrodes* Hance, *E. leptantha* Wight, *E. formosa* var. *ternifolia* (Roxb.) Duthie, *E. malayana* Gagnep. (but cf. discussion under *S. crassiflorum* Merr. & Perry), *E. malaccensis* Linn., *E. Wightiana* Wight (we have been unable

to distinguish some of Gagnepain's citations from some Indian specimens determined as *E. claviflora* Roxb.), and *E. siamensis* Craib. *E. nigrans* Gagnep. and *E. operculata* Roxb. both belong to the genus *Cleistocalyx*.[1] *E. bracteata* Roxb. is a true *Eugenia*. *E. circumscissa* Gagnep. is best left as is until more adequate material is available to determine its status, as it may well prove to be worthy of generic rank.

1. **Syzygium abortivum** (Gagnep.) comb. nov.

Eugenia abortiva Gagnep. Not. Syst. 3: 316. 1917, et in Lecomte, Fl. Gén. Indo-Chine **2**: 802, *f. 86*. 1920; Craib, Fl. Siam. Enum. **1**: 631. 1931.

INDO-CHINA, Annam, Hue and vicinity, *Squires 106*, Jan.-May, 1927. Burma, Laos, Annam.

With some hesitation we have associated the above collection with this species. It differs in having leaves up to 7.5 cm. long and scarcely more than 1 cm. broad. The primary veins are somewhat closer than in the fragment kindly supplied by Dr. F. Gagnepain but they compare favorably with those of some leaves of *Rock 2002*, Ken Tung Territory, Burma, which seems unquestionably to be referable to this species. Further, the inflorescence is not always strictly terminal, a character noted by both Gagnepain and Craib.

2. **Syzygium zeylanicum** (Linn.) DC. Prodr. **3**: 260. 1828; Wight, Ic. **1**: *t. 73*. 1838.

Myrtus zeylanica Linn. Sp. Pl. 472. 1753.

Eugenia spicata Lam. Encycl. **3**: 201. 1789; Koord. & Val. Meded. Lands Plant. **40**: 122. 1900 (Bijdr. Boomsoort. Java **6**: 122).

Eugenia zeylanica Wight, Ill. **2**: 15. 1841; Duthie in Hooker f. Fl. Brit. Ind. **2**: 485. 1878; King, Jour. As. Soc. Bengal **70**(2): 108. 1901 (Mater. Fl. Malay. Penin. **3**: 538); Gagnep. in Lecomte, Fl. Gén. Indo-Chine **2**: 804. 1920; Ridl. Fl. Malay Penin. **1**: 738. 1922; Craib, Fl. Siam. Enum. **1**: 666. 1931.

INDO-CHINA. Ranging from China and India southward into Malaysia.

3. **Syzygium oblatum** (Roxb.) Wall. List, no. 3569. 1831, *nomen nudum;* Cowan & Cowan, Trees North. Bengal 68. 1929.

Eugenia oblata Roxb. Hort. Beng. 37. 1814, *nomen nudum;* Fl. Ind. ed. 2, **2**: 493. 1832; Kurz, For. Fl. Brit. Burma **1**: 488. 1877; Duthie in Hooker f. Fl. Brit. Ind. **2**: 492. 1878; King, Jour. As. Soc. Bengal **70**(2): 114. 1901 (Mater. Fl. Malay. Penin. **3**: 544); Ridley, Fl. Malay Penin. **1**: 749. 1922, pro parte; Craib, Fl. Siam. Enum. **1**: 652. 1931.

[1] **Merrill, E. D.** and **L. M. Perry.** Reinstatement and revision of Cleistocalyx Blume (including Acicalyptus A. Gray), a valid genus of the Myrtaceae. Jour. Arnold Arb. **18**: 322-343, *t. 215*. 1937.

INDO-CHINA, Annam, Mount Bana, *Clemens 3293*, May-July, 1927. Burma, Siam, the Malay Peninsula, and Borneo.

4. **Syzygium baviense** (Gagnep.) comb. nov.

Eugenia baviensis Gagnep. Not. Syst. **3**: 317. 1917, et in Lecomte, Fl. Gén. Indo-Chine **2**: 806, *f. 86*. 1920.

INDO-CHINA, Tonkin, Chapa, *Pételot 6152*, July, 1931, forest back of the hotel, at about 1500 m. alt. Known only from Tonkin.

5. **Syzygium odoratum** (Lour.) DC. Prodr. **3**: 260. 1828; Hook. & Arn. Bot. Beechey's Voy. 187. 1833; Benth. Fl. Hongk. 119. 1861.

Opa odorata Lour. Fl. Cochinch. 309. 1790; Moore, Jour. Bot. **63**: 283. 1925, non *Eugenia odorata* Berg.

Eugenia Millettiana Hemsl. Jour. Linn. Soc. Bot. **23**: 297. 1887; Merr. Trans. Amer. Phil. Soc. **24**(2): 285. 1935; Lingnan Sci. Jour. **14**: 41. 1935.

Eugenia Deckeri Gagnep. Not. Syst. **3**: 323. 1918, et in Lecomte, Fl. Gén. Indo-Chine **2**: 807. 1920.

INDO-CHINA, Annam, Tourane and vicinity, *Clemens 3778, 4215, 4366, 4489;* probably from the vicinity of Hue, *Loureiro*, photograph of the type of *Opa odorata* Lour., the original in the herbarium of the British Museum. Kwangtung and Hainan.

A complete discussion of this species under the name *Eugenia Millettiana* Hemsl. may be found in Merr. Trans. Amer. Phil. Soc. l. c. Much confusion in this particular concept arose owing to the fact that Hemsley cited collections of two wholly different species under *Eugenia Millettiana*, and both have been accepted as typifying his species. When no original description is given, the species must be interpreted from the name-bringing synonym, i. e. *Opa odorata* Lour. This specific name was invalid in *Eugenia* but is tenable in *Syzygium*. Dr. F. Gagnepain very kindly sent us a fragment of *E. Deckeri* which proved to be, as we had anticipated, true *S. odoratum* (Lour.) DC. It should be noted that the specimen on which the description of *Eugenia Deckeri* Gagnep. was based was not from Tonkin, Indo-China, but rather from the small French colony of Kwangchow on the Luichow Peninsula, Kwangtung Province, China.

6. **Syzygium mekongense** (Gagnep.) comb. nov.

Eugenia mekongensis Gagnep. Not. Syst. **3**: 328. 1918, et in Lecomte, Fl. Gén. Indo-Chine **2**: 807. 1920; Craib, Fl. Siam. Enum. **1**: 652. 1931.

INDO-CHINA.

7. **Syzygium Bonii** (Gagnep.) comb. nov.

Eugenia Bonii Gagnep. Not. Syst. **3**: 318. 1917, et in Lecomte, Fl. Gén. Indo-Chine **2**: 808, *f. 87*. 1920.

INDO-CHINA.

8. **Syzygium Petelotii** sp. nov.

Rami nigro-cinerei; ramulis leviter compressis brunnescentibus, minute pustulatis; foliis 4–7 cm. longis, 2–4 cm. latis, ellipticis vel leviter obovatis, basi cuneatis, apice obtuse ac breviter acuminatis, acumine circiter 0.5 mm. longo, subcoriaceis, crebre ac minute punctatis, costa supra canaliculata subtus prominula, venis primariis circiter 3 mm. remotis supra ± obscuris, subtus manifestis sed non prominulis, vena intramarginali leviter manifesta circiter 1 mm. a margine disposita, venulis ± obscuris; petiolo 4–6 mm. longo; inflorescentiis terminalibus, compactis, ± 1.5 cm. altis latisque, ramis brevibus, plerumque 3-floris; alabastris obovoideis, ± 5 mm. longis, apice circiter 4 mm. diametro; calyce undulato, lobis vix 0.7 mm. longis, petalis calyptratim deciduis, antheris 0.5 mm. longis, ellipticis, minute glanduloso-mucronatis; fructibus ignotis.

INDO-CHINA, Tonkin, Province of Phu Tho, Phu Ho, *Pételot 1043* (**type**, Herb. Arn. Arb.), June, 1923.

This species suggests an alliance with *Syzygium Bonii* (Gagnep.) in the compact inflorescence and the practically truncate calyces (after anthesis) but the leaves of *S. Bonii* are lanceolate and lack the copious minute glands so characteristic of the lower surface of those of *S. Petelotii*.

9. **Syzygium sterrophyllum** sp. nov.

Eugenia fluviatilis sensu Gagnep. in Lecomte, Fl. Gén. Indo-Chine **2**: 810. 1920, non Hemsl.

Arbuscula 1–3 m. alta; ramulis tetragonis, junioribus subalatis, brunneis, glabris; foliis coriaceis, lineari-lanceolatis, utrinque obtuse acuminatis subaequaliter angustatis, 4.5–9 cm. longis, 1–1.8 cm. latis, siccis olivaceis, supra sparse et minute punctatis, subtus crebre glanduloso-punctatis, venis primariis numerosis, perspicuis, ascendentibus, circiter 2 mm. remotis, vena submarginali a margine 0.5–1 mm. distante; petiolo 3–6 mm. longo; paniculis multifloris, axillaribus terminalibusque, circiter 2.5 cm. longis, ramulis 2–5 mm. longis; floribus sessilibus vel subsessilibus, alabastris obovoideis, 5 mm. longis, 3 mm. latis; calyce turbinato, truncato vel undulato; petalis calyptratim vel singulatim deciduis; staminibus numerosis, antheris ellipticis, 0.6 mm. longis; stylo ± 5 mm. longo; fructibus immaturis elongato-urceolatis, 7 mm. longis, 5 mm. diametro.

CHINA, Kwangtung, Shi-wan-da-shan, *Tso 23377* (**type**, Herb. Arn. Arb.), July, 1933, shrub in shaded ravine. Kwangsi, Seh-feng, Dar Shan, S. Nanning, *Ching 7857, 7890, 8089, 8230*, October, 1928. INDO-CHINA, Tonkin, *Balansa 1159;* Long-tcheou, *Simond s. n.*

All the Chinese specimens were collected at 350–600 m. altitude. The leaves are described as dark and shining green above, light green below; little, if any, of the lustre remains in the dried collections and all are brownish in tone.

This species most closely approaches *Eugenia fluviatilis* Hemsl. in habit; but, the branchlets are tetragonous and the leaves more acuminate at the apex. They are also obscurely punctate above although copiously glandular beneath; furthermore, the flowers are a little broader and sessile or subsessile. In contrast, the branchlets of *E. fluviatilis* are only compressed or at most slightly sulcate, the leaves are rounded at the apex, copiously punctate above and obscurely, if at all, glandular-punctate beneath, and the flowers are pedicellate. This species also recalls *E. Winitii* Craib, but the leaves are smaller and the inflorescences are much shorter.

Eugenia fluviatilis Hemsl. was based on a collection from Hainan. As far as we know (and we have examined as many available collections as possible), the species is confined to the island.

10. **Syzygium buxifolium** Hook. & Arn. Bot. Beechey's Voy. 187. 1833; Walpers Rep. **2:** 180. 1843; Benth. Jour. Bot. Kew Gard. Misc. **4:** 118. 1852, Fl. Hongk. 118. 1861.

Eugenia microphylla Abel, Narr. Jour. China 181, 364. 1818; Forbes, Jour. Bot. **22:** 124. 1884; Rehder & Wilson in Sargent, Pl. Wils. **2:** 420. 1915, Jour. Arnold Arb. **8:** 179. 1927; Merr. Jour. Arnold Arb. **18:** 71. 1937; non *Syzygium microphyllum* Gamble, 1919.

Syllysium buxifolium Meyen & Schauer, Nov. Act. Acad. Leop.-Carol. Nat. Cur. **19:** Suppl. **1:** 334. 1843.

Eugenia sinensis Hemsl. Jour. Linn. Soc. Bot. **23:** 298. 1887.

Syzygium microphyllum sensu Masamune, Mem. Fac. Sci. Agr. Taihoku Univ. **11:** 323. 1934, non Gamble.

INDO-CHINA, Tonkin, Chapa, Massif du Fan Tsi Pan, *Pételot 4678*, July, 1931, about 1500 m. alt. Chekiang, Anhwei, Fukien, Kiangsi, Kweichow, Kwangtung, Riu Kiu Islands and Formosa.

Pételot 4678, a collection in the early fruiting stage, appears to be a form of this most variable and puzzling species. The leaves are more elongate than in the typical but are fairly comparable to those of a specimen from Kiangsi. A full account of *Syzygium buxifolium* is to be found in our forthcoming study of the Chinese species of this genus. *Syzygium microphyllum* Gamble was based on *Eugenia microphylla* Bedd., not on *E. microphylla* Abel.

11. **Syzygium szemaoense** sp. nov.

Arbuscula 2–3 m. alta; ramulis tetragonis, subalatis, post alarum delapsum cylindricis; foliis 4–10 cm. longis, 1.7–4 cm. latis, late vel anguste ellipticis, basi cuneatis, apice obtuse acuminatis, subcoriaceis, consperse punctatis, siccis brunneis, venis primariis subtus gracilibus, 3–4 mm. remotis, manifeste in venam intramarginalem a margine 1 mm. distantem confluentibus, minute glanduloso-punctatis; petiolo 3–5 mm. longo; paniculis axillaribus terminalibusque, vix 1.5 cm. longis, ramulis brachiatis; floribus immaturis, sessilibus vel brevipedicellatis, alabastris anguste obovoideis, 3.5 mm. longis, vix 2 mm. diametro; fructibus ellipsoideis vel pyriformibus, 10–15 mm. longis, 7–10 mm. diametro, atris, polyembryonatis.

China, Yunnan, Szemao, *Henry 12138* (**type,** Herb. New York Bot. Gard.; isotype, Herb. Arn. Arb.), *12895;* Lung-ling Hsien, *Tsai 56689.* Indo-China, Tonkin, Chapa, Massif du Fan Tsi Pan, *Pételot 6153,* about 1400 m. alt.

This species may be allied to *S. campylocarpum* (Gagnep.) Merr. & Perry. In that species, however, the leaves are much thinner and obscurely pellucid-punctate; the fruits are inequilateral and slightly curved. In our species the leaves are thicker and the fruit is regular and equilateral. Two collections closely allied, but perhaps not conspecific with the above, are: Hainan, Po-ting, *How 72922, 73422.*

12. **Syzygium cambodianum** (Gagnep.) comb. nov.

Eugenia cambodiana Gagnep. Not. Syst. **3**: 319. 1917, et in Lecomte, Fl. Gén. Indo-Chine **2**: 810. 1920.

Indo-China.

13. **Syzygium tonkinense** (Gagnep.) comb. nov.

Eugenia tonkinensis Gagnep. Not. Syst. **3**: 334. 1918, et in Lecomte, Fl. Gén. Indo-Chine **2**: 811. 1920.

Indo-China.

14. **Syzygium corticosum** (Lour.) comb. nov.

Eugenia corticosa Lour. Fl. Cochinch. 308. 1790, ed. Willd. 376. 1793; Moore, Jour. Bot. **63**: 283. 1925; Merr. Trans. Am. Philos. Soc. **24**(*2*): 284. 1935.

Myrtus corticosa Spreng. Syst. **2**: 488. 1825.

Indo-China, Annam, Mount Bana, *J. & M. S. Clemens 3532,* May-July, 1927; probably from near Hue, *Loureiro,* photograph of the type of *Eugenia corticosa* Lour., the original in Herb. Brit. Museum.

Merrill has examined the original and found it to be very closely

matched by *Clemens 3532*. This species, if traced through Gagnepain's key, falls in the vicinity of *E. tonkinensis*. A comparison of the two shows that the former differs slightly from the latter in both foliar and floral characters. The dried leaves of *Clemens 3532* are of a pale olive-green color (not brown nor reddish), the upper surfaces are minutely and inconspicuously puncticulate and the lower ones are sprinkled with minute dark glands. Gagnepain does not mention this character in his description of *E. tonkinensis* and we do not find glands on the one authentic leaf at our disposal. The flower-buds of *Clemens 3532* are about 2.5 mm. long and 1.5 mm. in diameter at the apex; those of *E. tonkinensis* are about 4 mm. long and 2.5 mm. in diameter at the apex, with, we suspect from the remnants, much longer stamens than in the former.

15. **Syzygium cinereum** Wall. List, no. 3576. 1831, *nomen nudum*.

Eugenia cinerea Kurz, Prel. Rep. Pegu App. **A**: LXIV, App. **B**: 50. 1875, Jour. As. Soc. Bengal **46**(2): 66. 1877, For. Fl. Brit. Burma **1**: 483. 1877; Ridley, Fl. Malay Penin. **1**: 744. 1922; Craib, Fl. Siam. Enum. **1**: 634. 1931.

Eugenia brachiata sensu Duthie in Hooker f. Fl. Brit. Ind. **2**: 496. 1878, pro parte; Gagnep. in Lecomte, Fl. Gén. Indo-Chine **2**: 811. 1920, non Roxb.

Eugenia pseudosubtilis King var. *platyphylla* King, Jour. As. Soc. Bengal **70**(2): 124. 1901 (Mater. Fl. Malay. Penin. **3**: 554).

INDO-CHINA, Tonkin, Province of Thai Nguyen, between Thai Nguyen and Phan Mê, *Pételot 5272, 6146*, May, 1933 and April, 1935; Province of Vinh Yen, *Pételot 6154*. Burma and the Malay Peninsula.

Nomenclaturally perhaps the identity of this species is open to some question. Tentatively we are accepting *Syzygium cinereum* Wall. as a valid name owing to the fact that Kurz first published his species as "*Eugenia cinerea* Wall. Cat. 3576" in the Pegu Report, Appendix A, and also in the Journal of the Asiatic Society of Bengal thus typifying the species and at the same time associating Wallich's name with a valid description. However, we must also call attention to Craib's comment, Fl. Siam. Enum. **1**: 634, in which he chooses the Burmese plant as the type (Wallich's specimen was collected in Penang). King seems to have overlooked Kurz's name, or else, like Craib, he had seen no specimens from Burma to match the plant from the Malay Peninsula. We cannot determine from Ridley's key, Fl. Malay Penin. **1**: 722, just what he regards as differences between *E. cinerea* Kurz and *E. pseudosubtilis* King. We have only one immature collection from the Malay Peninsula determined as *E. pseudosubtilis* King by Dr. M. R. Henderson. It closely resembles our Indo-Chinese material. *Eugenia brachiata* Roxb. is a native of Amboina and has lateral inflorescences.

16. **Syzygium irregulare** (Craib) comb. nov.

Eugenia irregularis Craib, Kew Bull. **1930**: 167. 1930, Fl. Siam. Enum. **1**: 646. 1931.

INDO-CHINA, Tonkin, near Chapa, Massif du Fan Tse Pan, *Pételot 4677*, July, 1931, at about 1400 m. alt., *6151*, September, 1930, at about 1700 m. alt. Siam.

Without authentic (or even any so-named) material for comparison, these collections so closely match Craib's description that we hesitate to place them elsewhere. They do differ in having slightly angled branchlets and in the dried state are of a brownish rather than a greenish color. The petals tend to separate but by Gagnepain's key the species seems to be close to "12. E. brachyata" *i.e. E. brachiata* Roxb., so we are placing it in this position.

17. **Syzygium eburneum** (Gagnep.) comb. nov.

Eugenia eburnea Gagnep. Not. Syst. **3**: 324. 1918, et in Lecomte, Fl. Gén. Indo-Chine **2**: 812, *f. 88*. 1920.

INDO-CHINA.

18. **Syzygium cochinchinense** (Gagnep.) comb. nov.

Eugenia cochinchinensis Gagnep. Not. Syst. **3**: 322. 1918, et in Lecomte, Fl. Gén. Indo-Chine, **2**: 814. 1920; Craib, Fl. Siam. Enum. **1**: 636. 1931.

INDO-CHINA.

19. **Syzygium Thorelii** (Gagnep.) comb. nov.

Eugenia Thorelii Gagnep. Not. Syst. **3**: 333. 1918, et in Lecomte, Fl. Gén. Indo-Chine **2**: 816. 1920.

INDO-CHINA.

20. **Syzygium attopeuense** (Gagnep.) comb. nov.

Eugenia attopeuensis Gagnep. Not. Syst. **3**: 316. 1917, et in Lecomte, Fl. Gén. Indo-Chine **2**: 816. 1920.

INDO-CHINA.

21. **Syzygium Bullockii** (Hance) comb. nov.

Eugenia Bullockii Hance, Jour. Bot. **16**: 227. 1878; Forbes & Hemsl. Jour. Linn. Soc. Bot. **23**: 296. 1887; Merr. Philip. Jour. Sci. **15**: 249. 1919; Gagnep. in Lecomte, Fl. Gén. Indo-Chine **2**: 817. 1920; Merr. Lingnan Sci. Jour. **5**: 136. 1927, Trans. Amer. Phil. Soc. **24**(2): 284. 1935.

Myrtus androsaemoides sensu Lour. Fl. Cochinch. 312. 1790, non Linn.

INDO-CHINA, Annam, Province of Quang Binh, Duc Thi village, *Pételot 6149*, July, 1930; Dam Thuy village, *Pételot 6150*, June, 1930; Tourane and vicinity, *J. & M. S. Clemens 3716*, May-July, 1927; Hue

and vicinity, *F. A. McClure s. n.*, September 29, 1921. Kwangtung, Hainan, Tonkin and Laos.

22. **Syzygium Cumini** (L.) Skeels, U. S. Dept. Agr. Bur. Pl. Ind. Bull. **248:** 25. 1912; Alston, Handb. Fl. Ceyl. **6**(Suppl.)**:** 116. 1931.

Myrtus Cumini Linn. Sp. Pl. 471. 1753.
Eugenia Jambolana Lam. Encycl. **3:** 198. 1789; Gagnep. in Lecomte, Fl. Gén. Indo-Chine **2:** 818. 1920.
Jambolifera pedunculata sensu Lour. Fl. Cochinch. 230. 1790, non Linn.
Syzygium Jambolanum DC. Prodr. **3:** 259. 1828; Wight & Arn. Prodr. **1:** 329. 1834.
Eugenia Cumini Druce, Rept. Bot. Exch. Club Brit. Isles **3:** 418. 1914; Merr. Lingnan Sci. Jour. **5:** 136. 1927; Craib, Fl. Siam. Enum. **1:** 637. 1931, Merr. Trans. Amer. Phil. Soc. **24**(*2*)**:** 284. 1935 (Comment. Fl. Cochinch.).
Eugenia Tsoi Merr. & Chun, Sunyat. **2:** 291. 1935.

INDO-CHINA, Tonkin, route from Vinh Yen to Tam Dao, *Pételot 4679*, April, 1931, at about 200 m. alt.; Province of Vinh Yen, route from Vinh Yen to Pont des Linh, *Pételot 6148*, April, 1933; Annam, Mount Bana, *J. & M. S. Clemens 4040*, May-July, 1927; Dalat and vicinity, *Squires 925*, March-April, 1932.

Widely distributed in the Indo-Malaysian region, extending from India and China southward.

23. **Syzygium balsameum** Wall. List, no. 3592. 1831, *nomen nudum*; Wight, Ill. **2:** 16. 1841, in syn.; Cowan & Cowan, Trees North. Bengal 68. 1929.

Eugenia balsamea Wight, Ill. **2:** 16. 1841; Kurz, For. Fl. Brit. Burma **1:** 485. 1877; Gagnep. in Lecomte, Fl. Gén. Indo-Chine **2:** 819. 1920; Craib, Fl. Siam. Enum. **1:** 633. 1921.

INDO-CHINA, Tonkin, Province of Tuyen-Quang, no collector given, no. *7*, January, 1931. India to Burma, Indo-China and the southwestern part of China.

24. **Syzygium polyanthum** (Wight) Walp. Rep. **2:** 180. 1843, non Miq. (1855).

Eugenia polyantha Wight, Ill. **2:** 17. 1841; Duthie in Hooker f. Fl. Brit. Ind. **2:** 496. 1878; King, Jour. As. Soc. Bengal **70**(*2*)**:** 103. 1901 (Mater. Fl. Malay. Penin. **3:** 533); Craib, Fl. Siam. Enum. **1:** 656. 1931.
Eugenia resinosa Gagnep. Not. Syst. **3:** 331. 1918, et in Lecomte, Fl. Gén. Indo-Chine **2:** 820. 1920; Craib, Fl. Siam. Enum. **1:** 656. 1931, in syn.
Eugenia balsamea sensu Ridley, Fl. Malay Penin. **1:** 754. 1922, non Wight (fide Craib).

INDO-CHINA, Tonkin, Province of Ninh Binh, vicinity of Cho Ganh,

Pételot 981, July, 1923; Cho Ganh, *Pételot 1481,* October, 1923; near Hanoi, *Pételot 4305,* February, 1932.

A wide-spread species found in Indo-China, Burma, Siam, the Malay Peninsula, Sumatra, Borneo and Java.

25. **Syzygium fruticosum** DC. Prodr. **3**: 260. 1828, Mém. Myrt. *t. 19.* 1842.

Eugenia fruticosa Roxb. Fl. Ind. ed. 2, **2**: 487. 1832; Wight, Ic. **2**: *t. 624.* 1843; Kurz, For. Fl. Brit. Burma **1**: 485. 1877; Duthie in Hooker f. Fl. Brit. Ind. **2**: 499. 1879; Gagnep. in Lecomte, Fl. Gén. Indo-Chine **2**: 843. 1921; Craib, Fl. Siam. Enum. **1**: 642. 1931.

Indo-China, Laos, Mong Hsing, *Ward 8913,* May, 1929. Bengal, Upper Burma, Siam and Yunnan.

26. **Syzygium Chanlos** (Gagnep.) comb. nov.

Eugenia Chanlos Gagnep. Not. Syst. **3**: 320. 1917, et in Lecomte, Fl. Gén. Indo-Chine **2**: 821. 1920.

Indo-China.

27. **Syzygium lineatum** (DC.) comb. nov.

Myrtus lineata Blume, Bijdr. 1087. 1826, non Sw.
Jambosa lineata DC. Prodr. **3**: 287. 1828.
Syzygium longiflorum Presl, Bot. Bemerk. 70. 1844, Walp. Ann. **1**: 314. 1848–1849.
Clavimyrtus lineata Blume, Mus. Bot. Lugd.-Bat. **1**: 116. 1849.
Clavimyrtus latifolia Blume, op. cit. 117.
Jambosa latifolia Miq. Fl. Ind. Bat. **1**(1): 429. 1855.
Jambosa Teysmanni Miq. l. c.
Jambosa rubricaulis Miq. op. cit. 432.
Eugenia lineata Duthie in Hooker f. Fl. Brit. Ind. **2**: 487. 1878.
Eugenia longiflora F.-Vill. Nov. App. 86. 1880; Gagnep. in Lecomte, Fl. Gén. Indo-Chine **2**: 822. 1920, pro parte; Craib, Fl. Siam. Enum. **1**: 650. 1931.
Eugenia Teysmanni Koord. & Val. Meded. Lands Plant. **40**: 164. 1900 (Bijdr. Boomsoort. Java **6**: 164).
Eugenia marivelesensis Merr. Philip. Jour. Sci. **1**: Suppl. 106. 1906.
Eugenia Miquelii Elmer, Leafl. Philip. Bot. **4**: 1441. 1912.
Eugenia longicalyx Ridley, Jour. Bot. **68**: 11. 1930.

Indo-China, Siam and Malaysia.

According to Art. 69 of the International Rules of Botanical Nomenclature, *Jambosa lineata* DC. is to be regarded as a new name and thus this specific name is the oldest available one for this species.

28. **Syzygium syzygioides** (Miq.) comb. nov.

Jambosa syzygioides Miq. Fl. Ind. Bat. **1**(1): 431. 1855.
Calyptranthus caryophyllifolia Blume, Bijdr. 1089. 1826, non Willd. 1796.

Syzygium nelitricarpium Teijsm. & Binnend. Nat. Tijdschr. Ned. Ind. **27**: 53. 1863 (fide Koord. & Val.).

Eugenia cymosa sensu Wight, Ill. **2**: 17. 1841, Ic. **2**: *t. 555*. 1843; Kurz, Jour. As. Soc. Bengal **46**(*2*): 67. 1877, For. Fl. Brit. Burma **1**: 486. 1877; Duthie in Hooker f. Fl. Brit. Ind. **2**: 482. 1878; King, Jour. As. Soc. Bengal **70**(*2*): 100. 1901 (Mater. Fl. Malay. Penin. **3**: 530); Gagnep. in Lecomte, Fl. Gén. Indo-Chine **2**: 823. 1920; Ridley, Fl. Malay Penin. **1**: 737. 1922; Craib, Fl. Siam. Enum. **1**: 637. 1931; non Lam. 1789.

INDO-CHINA, Burma, Siam and Malaysia.

Both Gagnepain and Craib indicate that the Indo-Malaysian collections commonly accepted to represent *Eugenia cymosa* Lam. do not represent that species. In our study of the Bornean species of *Syzygium* we investigated this matter. The type of *Eugenia cymosa* Lam. was a Mauritius specimen, now preserved in Lamarck's herbarium. It represents a species very different from the Indo-Malaysian form so long confused with it. Consequently we accept the specific epithet *syzygioides* for the Malaysian plant. A full discussion of the type of *Eugenia cymosa* Lam. will be found in our forthcoming treatment of the Bornean species of *Syzygium*.

29. **Syzygium Levinei** (Merr.) comb. nov.

Eugenia Levinei Merr. Lingnan Sci. Jour. **13**: 39. 1934.

Eugenia Millettiana sensu Dunn & Tutcher, Kew Bull. Add. Ser. **10**: 105. 1912; Gagnep. in Lecomte, Fl. Gén. Indo-Chine **2**: 823. 1920, non Hemsl.

INDO-CHINA, Tonkin, Province of Phu Tho, Phu Ho, *Pételot 1074, 1510*, August and September, 1923; near the Noire River, *Pételot 4319*, January, 1932. Annam, Kwangtung and Kwangsi.

A species for some time confused with *Eugenia Millettiana* Hemsl. but easily distinguished by the short and protruding glandular hairs which clothe the rachis and the branches of the inflorescence. See *Syzygium odoratum* (Lour.) DC., no. 5 above, for a note on Hemsley's species.

30. **Syzygium vestitum** sp. nov.

Arbor vel arbuscula; ramis teretibus, ramulis teretibus vel ad nodos modice complanatis, rufo-glanduloso-pilosis; foliis 8–20 cm. longis, 3.5–7 cm. latis, elliptico-oblongis, basi rotundatis vel obtusis, apice abrupte ac obtuse acuminatis, brunnescentibus subtus pallidioribus copiose nigro-punctulatis, costa supra canaliculata subtus prominente, rufo-puberula, venis primariis utrinque circiter 15 subtus prominulis, vena intramarginali circiter 3 mm. a margine conjunctis sparse rufo-puberulis; petiolo 6–10 mm. longo, rufo-piloso; inflorescentiis usque ad 14 cm. longis terminalibus ramosis, rachi ac ramis compressis rufo-

glanduloso-pilosis, alabastris sessilibus elongato-obconicis, 4–5 mm. longis apice 2–3 mm. diametro; calyce puberulo, lobis ± 1 mm. longis, rotundatis; petalis singillatim caducis, antheris glanduloso-mucronatis; fructibus ignotis.

INDO-CHINA, Annam, Mount Bana, *J. & M. S. Clemens 3296* (**type,** Arn. Arb. Herb.; isotype, New York Bot. Gard. Herb.), *4453*, May-July, 1927; Tonkin, Chapa, *Pételot 6145*, mountain ravine, about 1500 m. alt.

The reddish glandular-pilose indumentum of the branchlets and the panicle call to mind *Eugenia furfuracea* Craib and *E. Holttumi* Ridley. The first differs from our species in having leaves obovate-oblong or obovate-elliptic with a rounded apex and a cuneate base, also in showing a second intramarginal vein. The second species has more primary veins, a shorter petiole and minute subulate sepals. Although we have no specimens of either *E. furfuracea* Craib or *E. Holttumi* Ridl. for comparison, there seems to be no question from their descriptions that *S. vestitum* is a distinct species.

31. **Syzygium pachysarcum** (Gagnep.) comb. nov.

Eugenia pachysarca Gagnep. Not. Syst. **3**: 329. 1918, et in Lecomte, Fl. Gén. Indo-Chine **2**: 824. 1920.

INDO-CHINA.

32. **Syzygium Tramnion** (Gagnep.) comb. nov.

Eugenia Tramnion Gagnep. Not. Syst. **3**: 332. 1918, et in Lecomte, Fl. Gén. Indo-Chine **2**: 825. 1921.

INDO-CHINA.

33. **Syzygium touranense** sp. nov.

Arbor parva; ramulis leviter compressis atrobrunneis 1.5–2 mm. diametro; foliis ellipticis 5.5–9 cm. longis 2.7–5 cm. latis, basi cuneatis, apice obtuse attenuatis, subcoriaceis supra nitidis minute punctulatis fuscis, subtus pallidioribus minute glandulosis, venis primariis utrinque circiter 9–11 inter se 6–10 mm. distantibus supra manifestis subtus prominulis, 4–5 mm. a margine arcuatim anastomosantibus, venulis laxe reticulatis; petiolo ± 7 mm. longo; inflorescentiis terminalibus axillaribusque usque ad 4 cm. longis ramosis, rachi ramisque obtuse angulatis minute ac consperse pustulatis, floribus in ramulis ultimis pluribus dispositis, sessilibus; calyce post anthesin 4.5 mm. longo, apice 2.5 mm. diametro, parte expansa turbinata, basi in pseudopedicellum ad 2.5 mm. longum contracto, lobis margine membranaceis, 1 mm. longis, petalis singillatim deciduis, antheris vix 0.4 mm. longis minute glanduloso-mucronatis; fructibus ignotis.

INDO-CHINA, Annam, Tourane and vicinity, *J. & M. S. Clemens 4300* (**type**, Arn. Arb. Herb.; isotype, New York Bot. Gard. Herb.), May-July, 1927.

Possibly a relative of *S. Tramnion* (Gagnep.), *S. touranense* is best characterized by the rather broadly elliptic and recurving leaves with somewhat prominent and remote primary veins, and the floral clusters at the more or less divided (as if about to branch) tips of the branches of the inflorescence. The flower is distinctive in having calyx-lobes with pale membranous margins and a practically cylindric pseudostalk.

34. **Syzygium grande** (Wight) Walp. Rep. **2**: 180. 1843.

Eugenia grandis Wight, Ill. **2**: 17. 1841, Ic. **2**: *t. 614*. 1843; Kurz, For. Fl. Brit. Burma **1**: 489. 1877; Duthie in Hooker f. Fl. Brit. Ind. **2**: 475. 1878; Gagnep. in Lecomte, Fl. Gén. Indo Chine **2**: 826. 1921; Craib, Fl. Siam. Enum. **1**: 643. 1931.

Eugenia cymosa Roxb. Fl. Ind. ed. 2, **2**: 492. 1832, non Lam. (1789).

Jambosa firma Blume, Mus. Bot. Lugd.-Bat. **1**: 108. 1849.

INDO-CHINA, Burma, Siam, the Malay Peninsula, Borneo.

35. **Syzygium glomerulatum** (Gagnep.) comb. nov.

Eugenia glomerulata Gagnep. Not. Syst. **3**: 325. 1918, et in Lecomte, Fl. Gén. Indo-Chine **2**: 826, *f. 89*. 1921.

INDO-CHINA.

36. **Syzygium Tsoongii** (Merr.) comb. nov.

Eugenia Tsoongii Merr. Philip. Jour. Sci. **21**: 504. 1922.

Eugenia leucocarpa Gagnep. Not. Syst. **3**: 327. 1918, et in Lecomte, Fl. Gén. Indo-Chine **2**: 828. 1921, non Merr. 1916.

INDO-CHINA, Annam, Tourane and vicinity, *J. & M. S. Clemens 3380*, May-July, 1927; Province of Quang Binh, Ben Trien, along the River Song Dai, *Pételot 4676*, July, 1930; Quang Tri, *Chevalier 40207*.

KWANGTUNG, Hainan.

Eugenia Tsoongii Merr. and *E. leucocarpa* Gagnep., described independently, appear to be the same species. Although the specific designation *leucocarpa* is the earlier, nomenclaturally it is a later homonym and hence is not tenable.

37. **Syzygium compongense** (Gagnep.) comb. nov.

Eugenia compongensis Gagnep. Not. Syst. **3**: 323. 1918, et in Lecomte, Fl. Gén. Indo-Chine **2**: 828. 1921.

INDO-CHINA.

38. **Syzygium tinctorium** (Gagnep.) comb. nov.

Eugenia tinctoria Gagnep. Not. Syst. **3**: 334. 1918, et in Lecomte, Fl.

Gén. Indo-Chine **2**: 830. 1921.

INDO-CHINA.

39. **Syzygium sphaeranthum** (Gagnep.) comb. nov.

Eugenia sphaerantha Gagnep. Not. Syst. **3**: 333. 1918, et in Lecomte, Fl. Gén. Indo-Chine **2**: 830. 1921.

INDO-CHINA.

40. **Syzygium imitans** sp. nov.

Arbor ± 10 m. alta; ramulis leviter compressis; foliis oblongis vel anguste ellipticis usque ad 18 cm. longis ac 6.5 cm. latis, basi obtusis vel cuneatis, apice gradatim vel abrupte obtuso-acuminatis, acumine ± 1 cm. longo, subcoriaceis copiose pellucido-punctatis, olivaceis vel viridulis, costa supra canaliculato subtus prominente, venis primariis utrinque circiter 10–16 supra manifestis subtus prominulis arcuatim anastomosantibus distincte manifestam venam intramarginalem (nunc duplicem) 3–6 mm. a margine formantibus, venulis laxe reticulatis; petiolo ± 1.5 cm. longo; inflorescentiis terminalibus usque ad 10 cm. longis ac 13 cm. latis, e basi ramosis, ramis divaricatis, ultimis 2–6 mm. longis; floribus mediocribus, alabastris obovoideis, 8–11 mm. longis apice 6–8 mm. diametro; calycis lobis suborbiculatis, 2–3 mm. longis; petalis liberis; staminibus ± 1 cm. longis; antheris ellipticis; fructibus ignotis.

INDO-CHINA, Tonkin, Chapa, *Pételot 6143, 6144, 6147* (**type,** Arn. Arb. Herb.), in forests about 1500 m. alt. CHINA, Kwangsi, Shap Man Taai Shan, *Tsang 24111.*

This species so very closely resembles an unpublished Chinese species represented by *Lau 1894* from Hainan that we have described it with some hesitancy. It differs, however, in the obvious pellucid-punctations of the leaves, the very definite intramarginal vein and the less manifest secondary one, the longer petioles, and the somewhat more crowded inflorescence. The latter is due to the flowers being a little smaller (the stamens are about one-half as long), numerous, and usually at the tips of short branchlets (mostly about 2 mm. long). In the strictly Chinese species the ultimate branches of the inflorescence are rarely less than 1 cm. long. Possibly this is only a good illustration of the variability within a species, but until more material is available it seems best to regard it as a distinct species.

41. **Syzygium laosense** (Gagnep.) comb. nov.

Eugenia laosensis Gagnep. Not. Syst. **3**: 326. 1918, et in Lecomte, Fl. Gén. Indo-Chine **2**: 831, *f. 89, 90*. 1921.

INDO-CHINA.

Craib notes that in Harmand's collection of this species at Kew the leaf is scarcely separable from that of *Eugenia Thumra* Roxb. In Harmand's specimen at the Gray Herbarium the secondary venation is much more distinct than in any specimens labeled *E. Thumra* Roxb. and there is also a tendency to show a second submarginal vein.

42. **Syzygium Jambos** (Linn.) Alston in Trimen, Handb. Fl. Ceyl. **6**(Suppl.): 115. 1931.

Eugenia Jambos Linn. Sp. Pl. 470. 1753; Lour. Fl. Cochinch. 307. 1790; Roxb. Fl. Ind. ed. 2, **2**: 494. 1832; Duthie in Hooker f. Fl. Brit. Ind. **2**: 474. 1878; Gagnep. in Lecomte, Fl. Gén. Indo-Chine **2**: 834. 1921; Craib, Fl. Siam. Enum. **1**: 647. 1931.

Eugenia malaccensis sensu Lour. Fl. Cochinch. 306. 1790, non Linn.

Myrtus Jambos HBK. Nov. Gen. Sp. Pl. **6**: 144. 1823.

Jambosa vulgaris DC. Prodr. **3**: 286. 1828; Hook. Bot. Mag. **61**: *t. 3356.* 1834; Wight, Ic. **2**: *t. 435.* 1843.

Jambosa Jambos Millsp. Field Columb. Mus. Bot. **2**: 80. 1900.

INDO-CHINA, Tonkin, Province of Thai Nguyen, Lun Xa, *Pételot s. n.*, March, 1932. Indo-Malaysia. Widely cultivated.

42a. **Syzygium Jambos** var. **sylvaticum** (Gagnep.) comb. nov.

Eugenia Jambos var. *sylvatica* Gagnep. in Lecomte, Fl. Gén. Indo-Chine **2**: 835. 1921.

INDO-CHINA, Annam, Hue and vicinity, *Squires 157*. China.

43. **Syzygium Zimmermannii** (Warb.) comb. nov.

Eugenia Zimmermannii Warb. ex Craib, Kew Bull. **1914**: 124. 1914; Gagnep. Not. Syst. **3**: 335. 1918, et in Lecomte, Fl. Gén. Indo-Chine **2**: 835. 1921.

Eugenia pellucida Duthie in Hooker f. Fl. Brit. Ind. **2**: 485. 1878, pro parte (fide Craib).

INDO-CHINA, Annam, Mount Bana, *J. & M. S. Clemens 3110*, May-July, 1927. Burma, Siam (fide Craib).

44. **Syzygium Pierrei** (Gagnep.) comb. nov.

Eugenia Pierrei Gagnep. Not. Syst. **3**: 330. 1918, et in Lecomte, Fl. Gén. Indo-Chine **2**: 836. 1921.

INDO-CHINA.

45. **Syzygium crassiflorum** sp. nov.

Arbor; ramulis leviter compressis 3–5 mm. diametro, pallide brunneo-viridescentibus; foliis 24–38 cm. longis 4–6.5 cm. latis, lineari-lanceolatis, apice acutis, basi cordatis, coriaceis, impellucidis, olivaceo-viridibus subtus pallidioribus, costa supra canaliculata subtus prominente, venis primariis numerosis 9–12 mm. remotis, vena intramarginali 2 mm.

a margine disposita, venis secundariis manifestis, venulis laxe reticulatis; petiolo crasso circiter 4 mm. longo; inflorescentiis terminalibus pauci-(2–3?)floris; floribus magnis.

INDO-CHINA, Annam, *Clemens 3831,* (**type,** Arn. Arb. Herb.; isotype, New York Bot. Gard. Herb.), May-July, 1927.

There are two half-mature fruits on this collection. In one the hypanthium is 1.5 cm. × 1 cm. and the other is approximately 2.5 cm. in diameter. Each is attached by a pseudostalk about 1 cm. long and both are crowned by the large (?1.5 cm. long) lobes of the calyx. A number of the stamens are still attached, these are about 2.5–3 cm. long with elliptical anthers ± 1 mm. long.

Clearly this species is one of the group which Craib mentioned as centering around *Eugenia diospyrifolia* Duthie and *E. formosa* Wall., although it appears to be a distinct species. It differs from *Jambosa Korthalsii* Blume in the closer leaf-venation and the slightly compressed branchlets. Similarly it does not match *Jambosa confusa* Blume at least as interpreted from material representing *Eugenia dolichophylla* Koord. & Val. (*E. malayana* Gagnep.) from Java. *Jambosa insignis* Blume is also distinctly different in foliar characters.

46. **Syzygium samarangense** (Blume) comb. nov.

Myrtus samarangensis Blume, Bijdr. 1084. 1826.

Jambosa samarangensis DC. Prodr. **3**: 286. 1828.

Eugenia javanica Lam. Encycl. **3**: 200. 1789; Kurz, For. Fl. Brit. Burma, **1**: 494. 1877; Duthie in Hooker f. Fl. Brit. Ind. **2**: 474. 1878; King, Jour. As. Soc. Bengal **70**(*2*): 81. 1901 (Mater. Fl. Malay. Penin. **3**: 511); Gagnep. in Lecomte, Fl. Gén. Indo-Chine **2**: 837. 1921; Craib, Fl. Siam. Enum. **1**: 647. 1931; Merr. Lingnan Sci. Jour. **13**: 41. 1934, non *Syzygium javanicum* Miq.

INDO-CHINA, without definite locality, *G. W. Groff 5671,* May 16–18, 1920. Frequently cultivated. Indo-Malaysia.

47. **Syzygium Harmandii** (Gagnep.) comb. nov.

Eugenia Harmandii Gagnep. Not. Syst. **3**: 325. 1918, et in Lecomte, Fl. Gén. Indo-Chine **2**: 840, *f. 89*. 1921.

INDO-CHINA.

48. **Syzygium Boisianum** (Gagnep.) comb. nov.

Eugenia Boisiana Gagnep. Not. Syst. **3**: 318. 1917, et in Lecomte, Fl. Gén. Indo-Chine **2**: 840, *f. 87*. 1921.

INDO-CHINA, Tonkin, Province of Thai Nguyen, route from Hanoi to Thai Nguyen, *Pételot 5974,* February, 1933; Bot Nghang village, 54 kilometers on the route from Hanoi to Thai Nguyen, *Pételot 6202,* October, 1937; Son Bot, *Pételot 6218*.

49. **Syzygium campylocarpum** (Gagnep.) comb. nov.

Eugenia campylocarpa Gagnep. Not. Syst. **3**: 320. 1917, et in Lecomte, Fl. Gén. Indo-Chine **2**: 842. 1921.

INDO-CHINA.

50. **Syzygium Finetii** (Gagnep.) comb. nov.

Eugenia Finetii Gagnep. Not. Syst. **3**: 324. 1918, et in Lecomte, Fl. Gén. Indo-Chine **2**: 842. 1921.

INDO-CHINA.

51. **Syzygium stictanthum** sp. nov.

Arbor ± 6 m. alta; ramis teretibus, ramulis tetragonis vel sulcatis brunnescentibus; foliis pallide brunnescentibus, ellipticis vel oblongis 5–8 cm. longis 2.5–4 cm. latis, apice abrupte obtuseque acuminatis, basi acuminatis, supra nitidis nonnumquam minute nigro-punctulatis, subtus copiose ac minute nigrescente-glandulosis, costa prominula, venis primariis secundariisque creberrimis ascendentibus leviter elevatis sed non prominulis, vena intramarginali vix 0.5 mm. a margine disposita; petiolo ± 7 mm. longo; inflorescentiis terminalibus et in axillis foliorum superiorum dispositis, circiter 5 cm. longis, ramosis, rachi ac ramis 4-angulatis, floribus sessilibus (post anthesin), calycis tubo circiter 6 mm. longo apice ± 6 mm. diametro, lobis 2 mm. longis nonnumquam vix 2 mm. latis; antheris circiter 0.5 mm. longis ovato-ellipticis glandu-loso-mucronatis; fructibus ignotis.

INDO-CHINA, Laos, Province of Cammon, Xa Ngom, *Pételot 4675* (*Colani*) (**type**, Arn. Arb. Herb.; isotype, New York Bot. Gard. Herb.), December, 1930.

In leaf-outline and type of venation this species suggests *Syzygium cochinchinense* (Gagnep.) and *Cleistocalyx nigrans* (Gagnep.) Merr. & Perry. It differs from both, however, in that the veins are closer, a little less distinct and show less reticulations, also the under surface of the leaves is profusely and minutely glandular. The calyx (tube and lobes) is also copiously glandular and in the dried state longitudinally wrinkled. None of the flowers are in bud and we know nothing of the corolla. The calyx-lobes are somewhat irregular in shape and in size. Further flowering and fruiting stages are desirable to associate this species with its natural affinities.

ARNOLD ARBORETUM,
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SOME UNDESCRIBED SPECIES FROM MEXICO AND GUATEMALA

IVAN M. JOHNSTON

Prunus Skutchii, sp. nov.

Arbor usque 36 m. alta, trunco columnari basim versus ca. 15 dm. crasso cortice rugoso brunneo obtecto; ramulis maturis fuscis lenticellis tumidulis verrucosis, hornotinis laevibus; foliis glaberrimis vel rariter juventate in costa sparsissime inconspicuissimeque strigillosis; lamina subcoriacea oblonga vel elliptico-oblonga 12–15 cm. longa 6–9 cm. lata medium versus vel infra medium latiore, margine integerrima, basi suboblique rotunda vel obtusa, apice (saepe destructo) acuta vel breviter attenuata, subtus costa et nervis primariis arcuatis (nervis secondariis vix vel paulum conspicuis), ima basi ad latus utrumque costae glandulo elliptico 1–1.5 mm. longo instructa, supra viridiore laeviore; petiolo 15–20 mm. longo supra sulcato ca. 2 mm. crasso; racemis e nodis defoliatis erumpentibus solitariis; rhachi 5–9 cm. longa usque ad basim florifera sparse puberulente medium versus ca. 1 mm. crassa angulata; pedicellis gracillimis rectis 8–12 mm. longis puberulentis; hypanthio 4–4.5 mm. alto 5–6 mm. diametro crateriformi extus puberulente intus infra medium pilis 0.2–0.6 mm. longis villoso; lobis calycis subdeltoideis ca. 1.5 mm. longis; petalis albis ca. 10 late ovatis ca. 3 mm. longis latisque margine plus minusve dentatis facie superiore basim versus villulosis; staminibus ca. 30; filamentis glaberrimis 2–3 mm. longis; antheris oblongis 1.5 mm. longis; pistillo 5 mm. longo; ovario pilis sparsis adpressis villoso; stylo ca. 0.8 mm. crasso ca. 2.5 mm. longo; stigmate obliquo depresso ca. 1.5 mm. diametro; fructu ignoto.

GUATEMALA: Finca Moca, dept. Suchitepequez, 1140 m. alt., tree 36 m. tall in forest on ridge, trunk columnar and 15 dm. thick at breast height, covered with a rough dark brown bark, Jan. 8, 1935, *A. F. Skutch 2077* (TYPE, Arn. Arb.).

A species belonging to the subsection MESOCRASPEDON of Koehne, Bot. Jahrb. **52:** 307 (1915), and related to *P. Cortapico* Koehne of west-central Mexico. From this species it differs in its essentially glabrous herbage, broader leaves, long pedicels, more open hypanthium, villous ovary, etc. A collection from near Mirador, Vera Cruz (*Purpus 8426*)

is very similar to the plant described and is probably referable to the proposed species.

Prunus guatemalensis, sp. nov.

Arbor 18 m. alta, trunco ca. 40 cm. crasso; ramulis maturis cinereis lenticellis vix conspicuis transverse elongatis ornatis, hornotinis laevibus sparsissime inconspicueque puberulentis; foliis supra glaberrimis subtus pilis subfulvis 0.3–1 mm. longis villulosis; lamina coriacea rigida venosa oblonga vel lanceo-oblonga 10–19 cm. longa 4–8 cm. lata paullo infra medium latiore, margine integerrima subrevoluta, basi obtusa vel rotunda, apice acuta vel plus minusve attenuata, subtus (juventate conspicue et maturitate sparse) villulosa imam ad basim glandulis 2 notata, supra sublucida evidenter rugosa nervis et costa subtus prominentibus, supra conspicue impressis; petiolo 1–2 cm. longo usque 2 mm. crasso subglabro; racemis e nodis defoliatis erumpentibus solitariis; rhachi 5–8 cm. longa recta puberulenta medium versus ca. 0.5 mm. crassa; pedicellis 3–5 mm. longis decurvatis puberulentis; hypanthio hemisphaerico 2–3 mm. alto 2.5–4 mm. diametro marginem superiorem versus saepe plus minusve constricto extus puberulento intus infra medium sparse villuloso; petalis albis late ovatis 2–3 mm. longis 2–3-seriatis intus basim versus sparse villulosis; lobis calycis 1.3 mm. longis triangularibus; staminibus 30–40; antheris oblongis ca. 1.5 mm. longis; filamentis ca. 1.5 mm. longis glabris; ovario sparse villuloso; fructu ignoto.

GUATEMALA: Chichavac, dept. Chimaltenango, 2400–2700 m. alt., medium-sized tree in deep valley, about 18 m. tall with trunk 4 dm. thick at breast height, flowers white, July 29, 1933, *A. F. Skutch 504* (TYPE, Arn. Arb.).

A species evidently related to *P. Skutchii,* described above, from which it differs in having firmer more elongate conspicuously veined leaves which are hairy beneath, grayish mature branchlets with small non-tumid transverse slit-like lenticels, short pedicels, and a rounded hemispheric hypanthium which is frequently constricted about its summit. From *P. Cortapico* Koehne, of western Mexico, it differs in its sparser indument, presence of leaf-glands, puberulent racemes, multiseriate petals, etc.

Dussia grandifrons, sp. nov.

Arbor usque 30 m. alta, coma lata sparse ramosa, cortice trunci laevi griseo; foliis grandibus minute inconspicueque brunneo-pubescentibus, juventate conspicue denseque fulvo-tomentosis; rhachi 7–10 dm. longa subterete medium versus 4–6 mm. crassa; foliolis alternis 19–25 chartaceis 3–6 cm. distantibus supra viridibus sublucidis glaberrimis

subtus pallidioribus inconspicue pubescentibus apice breviter acuminatis, costa pallida conspicua, nervis primariis utrinque 20–25 rectis ascendentibus subparallelis 7–12 mm. distantibus cum nervis secondariis parallelis conjunctis pallidis prominulis, petiolulis 5–10 mm. longis 2–3 mm. crassis; foliolis supremis (3) supra medium latioribus deinde basim versus gradatim attenuatis 15–25 cm. longis 6–11 cm. latis basi acutis; foliolis infimis (4–6) abrupte minoribus ovatis vel ellipticis 6–13 cm. longis 3–8 cm. latis basi obtusis apice acutis vel acuminatis; foliolis intermediis (11–16) oblongis 6–8 cm. latis 15–25 cm. longis marginibus subparallelis basi abrupte contractis et truncatis vel subcordatis; panicula subterminali conspicue fulvo-tomentosula, ramis 10–15 saepissime simplicibus racemiformibus 25–50 cm. longis ascendentibus angulatis medium versus 2–3 mm. crassis, racemis ca. 50-floris 4–5 cm. crassis, bracteis conspicuis 7–10 mm. longis lanceolatis longe acuminatis 3–4 mm. latis late affixis; bracteolis basi calycis adpressis ca. 5 mm. longis 2–3 mm. latis obovatis tridentatis apice acuminatis; calyce ca. 0.8 mm. longo dense tomentello, basi solido valde obliquo costato in pedicellum 4–7 mm. longum plus minusve lateralem abrupte contracto; tubo cupulari infra dentes superiores leviter umbonato; lobis 2–4 mm. longis inaequalibus triangularibus, duobus superioribus supra medium confluentibus; petalis extus dense pallideque pubescentibus; vexillo persistente libero suborbiculato 15–17 mm. diametro rosaceo apice rotundo basi in unguem 4–5 mm. longum 1–1.5 mm. latum abrupte contracto; lamina alarum oblonga 10–12 mm. longa 4–5 mm. lata apice obtusa basi in unguem 3–4 mm. longum abruptissime contracta; lamina petalorum carinae 11–13 mm. longa 5 mm. lata oblonga basi obliqua apice obtusa, ungue 4–5 mm. longo; staminibus 10 glaberrimis basim versus connatis, anteriore imam ad basim biglanduloso a ceteris libero; antheris oblongis ca. 0.7 mm. longis; ovario dense adpresseque brunneo-villoso elongato 2–3-plo longiore quam lato breviter crasseque stipitato; stylo gracillimo basim versus plus minusve villoso alibi glaberrimo apice curvato (vix uncinato); stigmate minuto inconspicuo glabro; fructu ignoto.

GUATEMALA: Colomba, dept. Quezaltenango, 870 m. alt., in coffee-plantation with the original forest-shade, a tree 30 m. tall, crown open and spreading, bark smooth and gray, flowers pale pink with green streak down center of standard, Dec. 28, 1934, *A. F. Skutch 2027* (TYPE, Arn. Arb.).

A very distinct species of *Dussia* characterized by its very large, not distinctly bicolored leaves, broadly lanceolate long acuminate bracts, and obovate toothed bracteoles. According to Dr. Skutch the tree was nearly leafless at anthesis. The leaves collected were obtained from a basal branch which bore no flowers.

Brongniartia Abbottiae, sp. nov.

Frutex usque 1 m. alta ramosissima; ramulis gracilibus 0.5–1 mm. crassis pilis ca. 0.4 mm. longis mollibus haud appressis saepe brunneis (rariter plus minusve albidis) abundantibus vestitis vel subvelutinis, internodiis 5–15 mm. longis; stipulis ellipticis 5–6 mm. longis ca. 2.5 mm. latis oblique affixis foliolis subsimilibus; foliis numerosis; rhachi gracillima 3–4.5 mm. longa sparse pilosa; foliolis ellipticis 4–10 mm. (saepe 7–9 mm.) longis 2–6 mm. latis oppositis (5–)7-jugis ca. 1 mm. longe gracillimeque petiolulatis, supra sparsissime appresseque pilosis, subtus (costa excepta) glabris, margine plus minusve revolutis sparse ciliolatis, basi rotundis, apice rotundis et mucronulatis; floribus axillaribus rosaceis (in sicco albidis); pedicellis (stipite calycis incluso) gracilibus 3–5 mm. longis ebracteolatis; calyce sparse setoso; tubo calycis cupulato ca. 2 mm. crasso et profundo basi obconico piloso in stipitem ca. 1 mm. longum contracto; lobis anterioribus lanceolatis vel anguste triangularibus 2.5–4 mm. longis, duobus posterioribus confluentibus apice 0.5–1 mm. profunde bidentatis; lamina vexilli reflexa 8–9 mm. lata ca. 7 mm. longa rotunda apice emarginata basi in unguem ca. 2 mm. longum abrupte contracta; lamina alarum ca. 5 mm. longa 2 mm. lata ca. 2 mm. longe unguiculata; lamina petalorum carinae ad 4 mm. alta 6 mm. longa apice obtusa basi 2 mm. longe unguiculata; leguminibus submaturis compressis oblongis glabris ca. 15 mm. longis et 10 mm. latis supra basim ca. 3 mm. longe perobliqueque stipitatis; seminibus 2–3.

MEXICO: Taxco, Guerrero, low spreading bush about a meter tall, flowers brick-salmon, June 14, 1937, *Ruth Q. Abbott 211* (TYPE, Gray Herb.); Taxco, Aug. 12, 1937, *Abbott 351* (G).

A very distinct species for which I can find no close relative. The type collection is one of the many specimens collected in the region about Taxco by Mrs. Gordon Abbott. It is a pleasure to associate her name with such a well marked species of the region she is botanizing so thoroughly.

Acalypha Skutchii, sp. nov.

Arbor 6 m. alta trichotome ramosa; ramulis viridibus elongatis plus minusve sulcatis minute antrorseque strigulosis; foliis alternatis; petiolis gracilibus ascendentibus minute strigulosis, foliorum superiorum saepissime minus quam 2 cm. longis, foliorum inferiorum elongatis usque ad 12 cm. longis; lamina lanceolata vel elliptico-lanceolata 10–20 cm. longa 2.5–8 cm. lata, quam petiolus subduplo usque decemplo longiore medium versus vel paullo supra medium latiore apicem versus attenuata deinde longe acuminata basi acuta vel obtusa margine crenato-serrata undique sparse strigulosa tandem glabrescente minutissime abundantissi-

meque punctulata; nervis primariis pinnatis 8–10-jugis ascendentibus pallidis cum nervulis secondariis transversis conjunctis; stipulis subpersistentibus 10–18 mm. longis 2–4 mm. latis acuminatis; spicis unisexualibus; femineis terminalibus rigidis erectis 1–2 dm. longis (pedunculo 1–4 cm. longo incluso); floribus 1–10 mm. distantibus sessilibus; bracteis strigulosis late affixis ad anthesim 1–2 mm. longis maturitate 3–5 mm. longis medium versus digitate 7–11-lobatis tantum basi fructus vaginatis; stylis 3 perconspicuis rubris 0–10 mm. longis divergentibus paullo supra basim confluentibus laceratis, lobulis flagellatis 2–3 mm. longis; ovario pallide abundanterque strigosis maturitate sparse strigosis ca. 6 mm. longis; capsulis et seminibus ignotis; spicis masculis axillaribus flavis 8–10 cm. longis.

GUATEMALA: Volcan Zunil, dept. Quezaltenango, 1650 and 1620 m. alt., tree beside stream, Aug. 8 and 31, 1934, *A. F. Skutch 981* (TYPE, Arn. Arb.) and *917* (AA). MEXICO: Finca Mexiquito, Chiapas, July 1913, *Purpus 6951* (G).

A species belonging to the section DENTATAE, as defined by Pax in Engler, Pflanzenr. (Heft 85) IV, 147[xvii], p. 44 (1924), and apparently most closely related to *A. Ferdinandi* K. Hoffm. of Central America. The present plant, however, differs from its probable relative in its coarser stems, more elongate petioles, thinner leaf-blades not cordate at the very base, more abundantly flowered much denser pistillate spikes, and more deeply lobed bracts.

Sarcococca guatemalensis, sp. nov.

Frutex 15–25 dm. altus, glaberrimus, flavo-viridis, monoicus; ramulis lutescentibus costatis angulatis 2–4 mm. crassis rectis elongatis; foliis alternis 1–5 cm. distantibus; lamina lanceolata vel elliptica coriacea integerrima 5–10 cm. longa 15–45 mm. lata medium versus vel paullo infra medium latiori apice plus minusve acuminata basi acuta vel obtusa supra nitidula subtus opaca pallidiore manifeste medio-costata sed perinconspicue penninervata (nervis plus minusve 8–10-jugatis); petiolo 5–10 mm. longo saepe flavescente supra sulcato; floribus in glomerulas bracteatas 5–15-floras congestis, superioribus 1–2 femineis, ceteris numerosis masculis; glomerulis in axillis foliorum pedunculatis vel ad apicem ramuli subpaniculatis bisexualibus; pedunculis angulatis 2–10 mm. longis; bracteis 1–2 mm. longis carinatis triangularibus acuminatis margine ciliolatis; floribus masculis ebracteolatis 0.5–2 mm. longe angulateque crassi-pedicellatis; sepalis 4, biseriatis, exterioribus herbaceis 3–3.5 mm. longis ca. 1.5 mm. latis late affixis medium versus latioribus deinde apicem versus attenuatis margine ciliolatis dorso convexis, interioribus longioribus et latioribus submembraneis 3.5–4 mm.

longis 2.8 mm. latis late ellipticis basi rotundis in acumen ca. 1 mm. longum abrupte terminatis extus glabris intus plus minusve villosulis margine ciliolatis; staminibus 4 oppositisepalis; filamentis albis latis glaberrimis 3–5 mm. longis imam ad basim anguste connatis; antheris oblongis 1–2.5 mm. longis ca. 1 mm. latis paullo supra basim ad connectivum latum dorsaliter affixis; rudimento ovarii depresse tetragono ca. 0.5 mm. alto 0.8 mm. diametro; floribus femineis in medio glomeruli terminalis solitariis vel geminatis; pedicellis 1–5 mm. longis bracteolatis; bracteolis pluribus decussatis imbricatis triangularibus breviter acuminatis ca. 2 mm. longis ciliolatis; sepalis 4 bracteolis superioribus consimilibus; stylis 2 attenuatis ca. 2–2.4 mm. longis supra sulcatis; ovario 4-loculato; bacca alba.

GUATEMALA: Santa Elena, dept. Chimaltenango, 2700 m. alt., shrub 2.4 dm. tall in cypress-forest, flowers yellowish green, berries white, plant at anthesis, Feb. 26, 1933, *A. F. Skutch 288* (TYPE, Arn. Arb.); Chichavac, dept. Chimaltenango, 2520 m. alt., open oak-woods, shrub 2.4 m. tall, filaments white, perianth green, Aug. 18, 1933, *Skutch 553* (AA); Soloma, dept. Huehuetenango, 2910 m. alt., second-growth wood, shrub 1.5 m. tall, flower white, *Skutch 992* (AA).

The genus *Sarcococca,* of the Buxaceae has been known only from southeastern Asia and in Malaysia and has been unreported from America. The present species of Guatemala has a gross aspect very similar to the species of the Old World and particularly to the Indian *S. Hookeriana* Baill. and to the Chinese *S. ruscifolia* Stapf. From all of these, however, it is quickly distinguished by having the female flowers borne among the male flowers and terminal in the inflorescence, rather than below the male flowers and lateral as prevails in the Asiatic and Malaysian species. This difference is an important one in the closely related genus *Buxus,* a genus which differs from *Sarcococca* in the capsular rather than berry-like fruit.

Ilex quercetorum, sp. nov.

Arbor 15 m. alta; ramulis elongatis rectis, junioribus 1.5–2.5 mm. crassis fuscis puberulentis sulcatis angulatis, vetustioribus subgriseis subteretibus; foliis 1–3 cm. distantibus; stipulis minutis ca. 0.5 mm. longis anguste triangularibus; petiolo 3–5 mm. longo vix alato supra canaliculato quam lamina 12–14-plo breviore puberulento; lamina lanceolata 18–22 mm. lata 5–8 cm. longa medium versus vel paullo infra medium latiore utrinque attenuata coriacea laete viridi ad costam puberulenta ceterum glabra, apice acuminata, basi acuta, margine integerrima leviter revoluta; costa supra conspicue impressa canaliculata subtus prominente; nervis primariis inconspicuis; pedicellis fructiferis

axillaribus solitariis fuscis puberulentis 8–13 mm. longis angulatis; pedunculis vix evolutis; calyce fructus explanato 4 mm. diametro, lobis 4 latissimis brevibus apiculatis ciliolatis; bacca rubra globosa 8–10 mm. diametro stigmate prominulo 4-lobato ca. 1.3 mm. diametro coronata; nuculis 4 dorso bisulcatis ca. 5 mm. longis et 3 mm. crassis.

GUATEMALA: Nebaj, dept. Quiché, 1860 m. alt., oak-forest, Nov. 15, 1934, *A. F. Skutch 1663* (TYPE, Arn. Arb.).

This species is a member of the section CASSINOIDES Loes. The pedicel of the fruit is devoid of bractlets and is not articulated. The peduncle, hence, is absent and the flowers borne singly directly in the leaf-axils. Dr. Skutch states that the plant becomes a tree 15 m. tall and has a trunk 25 cm. thick at breast height. A number of trunks may arise together from the ground and form a large clump. The berries are bright red.

Ilex ampla, sp. nov.

Arbor 22 m. alta, glaberrima, coma ampla; ramulis rectis subteretibus nigrescentibus longitudinaliter striatis 3–5 mm. crassis; foliis magnis persistentibus; petiolo 12–15 mm. longo quam lamina 12–15-plo breviore recto in siccò ruguloso; stipulis deltoideis 2.5 mm. longis 2 mm. latis tarde deciduis; lamina oblonga vel ovato-oblonga saepe 16–18 cm. longa 6–9.5 cm. lata rigida coriacea apice obtusa (? vel subacuminata) basi rotunda vel subcordulata margine remote et haud conspicue crenata supra subnitida subtus opaca sub lente minutissime punctulata; costa supra insculpta subtus prominente; nervis primariis ca. 12–15-jugis prominulis imam ad basim sub angulo ca. 80° a costa divergentibus supra basim arcuate ascendentibus tantum juxta marginem anastomosantibus; nervis secondariis paucis; inflorescentia axillari solitaria racemiformi vix pedunculata cylindrica fructifera 3 cm. longa 12–15 mm. crassa 20–30-flora; rhachi ascendente 1–1.5 mm. crassa rigida; bracteis deltoideis ca. 1 mm. longis; pedicellis fructiferis ascendentibus rigidis 2–3 mm. longis solitariis vel ternatis in apice axis secondarii ca. 3 mm. longi bracteati; calyce fructifero explanato ad 2 mm. diametro, lobis 4 rotundis 1 mm. latis 0.5 mm. longis; corolla ignota; fructu 4–5 mm. longo 3–4 mm. crasso globoso-ellipsoideo atro-rubro baccato stigmate prominulo coronato, exocarpio tunicato hyalino; nuculis 4 angulatis 3 mm. longis ad 1.5 mm. latis dorso convexis longitudinaliter costatis 1-seminatis.

GUATEMALA: Colomba, dept. Quezaltenango, 900 m. alt., tree 22 m. tall with widely spreading crown, fruit dark red, Sept. 26, 1934, *A. F. Skutch 1320* (TYPE, Arn. Arb.).

This is a member of the section THYRSIFLORAE Loes., previously

known only from tropical South America. It is readily distinguished by its short cylindrical racemiform inflorescences as well as by its detached northern occurrence. The type is a specimen with ripe fruit. The corolla and male structures of the species are, accordingly, unknown.

Ilex gracilipes, sp. nov.

Frutex 2.5–3.5 m. altus; ramulis rectis ascendentibus vel patentibus, junioribus 1–1.8 mm. crassis sulcatis subangulatis sub lente plus minusve minute pubescentibus vel subglabris, vetustioribus cortice griseo sulcato-rugoso obtectis; foliis 3–10 mm. distantibus; stipulis ca. 1 mm. longis triangulari-subulatis; petiolo quam lamina 6–10-plo breviore 3–6 mm. longo minute pubescente vel subglabro 0.5–1 mm. late alato supra canaliculato; lamina lanceolato-ovata vel lanceolata 1.3–2.4 mm. lata 3–5 cm. longa subcoriacea, apice acuta vel breviter acuminatis, basi obtusa vel acuta, margine obscurissime undulata integra vel apicem versus sparsissime dentata revoluta, supra viridi lucente imam ad basim et ad costam minute puberulenta ceterum glabra vel ubique glabra, subtus pallida glaberrima sub lente abundanter minutissimeque punctulata; nervis primariis 7–12-jugis sub angulo 45°–90° a costa patentibus subrectis juxta marginem laminae arcuatis et anastomasantibus subtus prominentibus supra inpressis vel inconspicuis; nervis secondariis paucis; pedunculis fructiferis axillaribus solitariis puberulentis vel glabris unifloris vel rariter bifloris 3–10 mm. longis gracilibus rectis angulatis apice bracteas pedicelliferas minutas ca. 0.8 mm. longas gerentibus; pedicellis 5–10 mm. longis; calycibus fructiferis 4-meris patelliformibus, sepalis latissime erosis ca. 0.5 mm. longis et 1 mm. latis; corolla alba 5 mm. diametro ca. 2 mm. longa; petalis late ovatis; tubo ca. 0.5 mm. longo; bacca immatura subglobosa ca. 4 mm. diametro glaberrima 6-loculata stigmate hemispherico prominulato coronata.

GUATEMALA: Soloma, dept. Huehuetenango, 2220 m. alt., shrub 2.4–3.6 dm. tall, flowers white, fruit immature, Aug. 21, 1934, *A. F. Skutch 1060* (TYPE, Arn. Arb.).

A member of the section CASSINOIDES of Loesener, Monog. p. 131 (1901), and a relative of the Mexican species, from which it may be distinguished by its moderately firm leaves, slender elongate mostly solitary and uniflorous inflorescences, and 6-celled berry. The type-collection represents the female plant and shows the flowers and nearly mature berries. The leaves and flowers are borne only on the new wood. The species belongs, probably, closest to *I. coriacea* (Pursh) Chapm.

Sloanea ampla, sp. nov.

Arbor grandis ca. 40 m. alta; ramulis apicem versus 8–10 mm. crassis angulatis cinnamomeo-velutinis; petiolo velutino 4–13 cm. longo 3–5

mm. crasso recto terete; lamina folii grandi 2–3-plo longiore quam lata 35–55 cm. longa 12–20 cm. lata supra medium latiore, margine obscure grosseque sinuata, supra glaberrima viridi opaca, subtus (costa et nervis exceptis) glabra sublucida brunneo-viridi, apice obtusa, basi obtusa vel truncata; costa subtus pubescente brunnea prominente imam ad basim geniculata; nervis primariis prominentibus parallelis ca. 17-jugis, secondariis et tertiis prominulis glabris; stipulis asymmetricis herbaceis 2.5–4 cm. longis 13–20 mm. latis supra basim latioribus anguste triangularibus vel triangulari-lanceolatis basi oblique lateque truncatis margine integris vel rariter paucidentatis apice graciliter attenuatis; floribus ignotis; capsula ipsa globosa 4–6 cm. diametro, appendiculis teretibus 1 mm. crassis 2–5 cm. longis abundantissimis rigidis brunneis minutissime adpresseque strigulosis echinata, maturitate in segmenta lignoso-coriacea 4 vel 5 loculicide dehiscente; segmentis 8–12 mm. crassis 2.5–3 cm. latis vetustis subexplanatis intus cortice conspicue colorato rubro obtectis; pedicello fructifero 3–7 cm. longo 3–5 mm. crasso; calyce fructifero ca. 2 cm. diametro explanato, lobis ca. 10 inaequalibus triangularibus vel cuneatis plus minusve recurvatis; seminibus in loculis solitariis ellipsoideis leviter compressis ca. 25 mm. longis 12–17 mm. crassis arillo aurantiaco carnoso totum involutis.

GUATEMALA: Volcan Zuníl, dept. Quezaltenango, 1680 m. alt., Aug. 7, 1934, *A. F. Skutch 968* (TYPE, Arn. Arb.); Finca Moca, dept. Suchitepequez, 1050 m. alt., in forest, Jan. 10, 1935, *Skutch 2108*, fruit only.

The collector notes that this is a large tree which reaches forty meters in height. The trunk at breast height becomes 15–18 dm. thick. Its base is very irregularly and deeply ridged and furrowed, forming small plank-buttresses. The tree is "called Zulín in Quiché." The type from Volcan Zuníl consists of foliage and immature fruits. At Finca Moca Dr. Skutch collected mature fruit and alcoholic specimens of the mature seeds. Concerning the fruit he notes that it splits into four or five segments and reveals its red interior as it hangs apex downward from the tree. The seeds remain attached near the apex of the segments. The orange aril which entirely covers the seed is nibbled off by birds while they are still attached to the pod. The species is well marked by its very large leaves, unusually large stipules, and very large heavy bur-like fruit. This latter, including the abundant elongate slender appendages, becomes 8–10 cm. in diameter.

Oreomyrrhis daucifolia, sp. nov.

Herba 1–3 dm. alta, e radice subnapiformi 5–7 mm. crassa oriens, basi ramosa; ramis 5–8 subsimplicibus 1–2-foliatis 2–3 mm. crassis ascendentibus; internodiis elongatis usque ad 15 mm. longis; foliis flaccidis

tripinnatis, in planta juvenili omnibus subrosulatis, in planta florifera omnibus caulinaribus; rhachi minute retrorseque pubescente ca. 1 mm. crassa supra medium foliolata saepe 10–20 cm. longa; vagina 1.5–3 mm. longa subglabra basi 3–4 mm. lata; pinnulis primariis 5–10-jugis 6–20 mm. longis 3–10 mm. latis vix petiolulatis subtus sparsissime retrorseque pubescentibus; pinnulis secondariis 5–7-jugis 2–6 mm. longis 1–3 mm. latis; pinnulis ultimis pinnatisectis, lobulis ascendentibus 1–4 (saepe 2–3)-jugis linearibus vel anguste lanceolatis uninervatis 1–3 mm. longis 0.2–0.3 mm. latis apice attenuatis setuliferis, sinubus apertis; pedunculis valde elongatis 0.8–1.6 mm. crassis 8–20 cm. longis quam folia valde longioribus ramis 1–2-foliatis terminatis subscapiformibus apicem versus dense hirtellis basim versus subglabris; umbellis simplicibus 10–20-floris; involucro palmate trilobato 6–7 mm. longo, lobis pinnatisectis pinnulis secondariis illis folii similibus; pedicellis inaequalibus 1–5 mm. longis rectis; petalis "albis plus minusve purpureo-tinctis"; fructu 4–5 mm. longo 1–1.3 mm. lato infra medium latiore sub maturitate glabro purpureo; mericarpiis subpentagonalibus ca. 0.8 mm. crassis; valliculis saepe 3-vittatis.

GUATEMALA: Charcol, Sierra Cuchumatanes, dept. Huehuetenango, 3180 m. alt., alpine meadow, Sept. 15, 1934, *A. F. Skutch 1263* (TYPE, Gray Herb.).

This plant is one of that variable assemblage of montane plants, ranging from central Mexico to Fuegia and from New Zealand to Formosa, which most past authors have called *Oreomyrrhis andicola* (HBK) Endl. In recent years there has been a tendency to break up this aggregate. In fact a study of any large series does show that it consists of over a dozen segregate species which have ranges relatively local and of a pattern similar to that found in the associated species of other genera. True *O. andicola* is a plant of the cordilleras of northwestern South America. A closely related but evidently separable species is found on the peak of Orizaba in southern Mexico. This plant, *M. orizabae,* is evidently separable from *M. tolucana,* of the peaks of Toluca and Ixtaccihuatl further north in Mexico. These most northern relatives of *O. andicola* may be described and contrasted with the unusually distinct plant of Guatemala which I have described above.

Oreomyrrhis orizabae, sp. nov.

Herba pusilla imam ad basim ramosa; caulibus usque ad 5 (rariter 10) mm. longis saepissime subnullis; foliis flaccida bipinnatis; lamina griseo-viridi puberulenta; rhachi 3–4 mm. longa; lobis ultimis lanceolatis 1–2 mm. longis 0.3–0.9 mm. latis integris vel rariter 1–2-lobatis; sinubus saepe clausis; pedunculis scapiformibus 2–5 cm. longis; lobis involucri

2–3-lobatis reflexis; pedicellis 2–5 mm. longis; mericarpiis 2.5–3 mm. longis.

MEXICO: Orizaba, 3600–3700 m. alt., *Pringle 8546* (TYPE, Gray Herb.) and *Rose & Hay 5744* (G).

Oreomyrrhis tolucana, sp. nov.

Herba pusilla basim versus ramosa; caulibus usque ad 10 mm. longis saepissime subnullis; foliis subcarnosulis bipinnatis; lamina viridi; rhachi 2–3 cm. longa; lobis ultimis ellipticis vel late lanceolatis 1–2 mm. longis 0.5–1 mm. latis integerrimis; sinubus clausis; pedunculis 1–4 cm. longis scapiformibus; lobulis involucri oblongis vel ellipticis integris; pedicellis 1–3 mm. longis; fructu 2–3 mm. longo.

MEXICO: Toluca, 4050 m. alt., *Pringle 4236* (TYPE, Gray Herb.) and *Rose & Painter 7978* (G); Ixtaccihuatl, *Purpus 1679* (G).

Buddleia hypsophila, sp. nov.

Arbuscula; ramulis subangulatis laxe ramosis internodiis 1–6 cm. longis juventate griseis vel subaurantiacis dense minuteque stellato-pubescentibus; foliis oppositis; petiolis 0.5–2 cm. longis ca. 1.5 mm. crassis angulatis supra caniculatis quam lamina 5–8-plo brevioribus; lamina late lanceolata coriacea 5–10 cm. longa 12–30 mm. lata infra medium latiore, margine integerrima, apice acuta, basi abrupte rotundata vel obtusa, supra viridi sparsissime stellato-pubescente mox glabrescente opaca, subtus ochroleuca abundantissime minuteque stellata densissime tomentulosa; costa conspicua; nervis primariis supra conspicue impressis subtus prominentibus 9–15-jugis rectis tantum juxta marginem furcatis et anastomosantibus; nervis secondariis inconspicuiis vel subnullis; inflorescentia pyramidali terminali aphylla vel ramis inferioribus duobus e axillis foliorum 2–3 cm. longorum orientibus; ramulis oppositis ca. 4-paribus 1–3 cm. distantibus ascendentibus capitulis solitariis vel geminatis sessilibus vel usque 1 cm. longe pedunculatis terminatis, infimis 2–3 cm. longis, supremis 5–10 mm. longis; capitulis 10–15 mm. diametro 25–50-floris; calyce dense minute stellato-pubescente cupulato 2–3 mm. longo, lobis triangularibus 1–1.5 mm. longis; corolla "aurantiaca" in sicco cinnabarina 6 mm. longa extus supra medium dense minuteque pubescente intus in tubo et ad basim loborum sparse pilosa; lobis corollae 4 ca. 2 mm. longis et latis apice rotundis; limbo ca. 6 mm. diametro; tubo basi ca. 2 mm. diametro apice 3.5–4 mm. diametro; antheris 0.8–1 mm. longis; filamentis ca. 0.5 mm. longis ad apicem tubi affixis; ovario dense stellato-tomentuloso; fructu ignoto.

GUATEMALA: Volcan Santa María, dept. Quezaltenango, 3600 m. alt., July 27, 1934, small tree, flowers orange, *A. F. Skutch 843* (TYPE, Arn. Arb.).

A very attractive plant related to *B. megalocephala* Donn. Sm. but differing in having slightly smaller heads in a more compounded inflorescence, a denser paler indument, and much smaller leaves. The leaves are abruptly contracted at the base and merely acute at the apex, rather than long attenuate.

Cobaea Skutchii, sp. nov.

Gracillima; caulibus ca. 1 mm. crassis nodos versus inconspicue pubescentibus alibi glabris in sicco subangulatis; foliis pinnatis; rhachi gracillima 4-foliolata imam ad basim jugum foliorum reflexorum caulem amplectens et 3–4 cm. supra basim alterum jugum gerente apice in cirrhum gracillimum plus minusve ramosum producta; foliolis tenuiter membranaceis glaberrimis lanceolatis 7–10 cm. longis 25–35 mm. latis medium versus latioribus apice acuminatis basi abrupte (1–1.5 cm. late) truncatis vel subcordatis in petiolulos 1–2 cm. longos graciles abrupte contractis; floribus axillaribus solitariis ca. 20 cm. longe recteque pedunculatis; sepalis late ovatis imbricatis ca. 13 mm. longis 8–11 mm. latis infra medium latioribus apice attenuatis imam ad basim connatis, fructiferis ca. 16 mm. longis conspicue medio-costatis margine subcrispis; corolla viridi ca. 25 mm. longa quam calyx subduplo longiore extus supra medium inconspicue pubescente intus glaberrima; lobis corollae 6–7 mm. longis et latis apice rotundis erectis; staminibus ca. 6 mm. supra basim corollae affixis; filamentis 3 cm. longis conspicue (1 cm. longe) exsertis basim versus (5–7 mm. supra basim) conspicue villoso-ciliatis; antheris 7 mm. longis; stylo gracillimo 4 cm. longo glabro; capsula 4 mm. longa ca. 15 mm. crassa.

GUATEMALA: Palmar, dept. Quezaltenango, herbaceous vine climbing over thickets by stream, fl. green, 1221 m. alt., Oct. 14, 1934, *A. F. Skutch 1456* (TYPE, Gray Herb.).

A very well marked species because of its small greenish corollas, long exserted stamens, and very slender herbaceous stems.

ARNOLD ARBORETUM,
HARVARD UNIVERSITY.

NEW SPECIES OF BAUHINIA FROM CHINA

LUETTA CHEN

Bauhinia Bohniana, spec. nov.

Frutex ramis ramulisque erectis glabris, novellis dense minute fusco-pubescentibus. Folia subcoriacea, late ovato-orbicularia, 5–6 cm. longa et 5–7 cm. lata, supra cineraceo-puberula, subtus dense rufo-pubescentia, alte cordata, apice biloba lobis rotundatis tantum quartam partem laminae aequantibus, nervis 11 rufo-pubescentibus ad marginem anastomosantibus, petiolo dense adpresse tomentoso 2.5–3 cm. longo. Inflorescentiae racemosae, solitariae, ca. 7 cm. diam., pauciflorae, minute adpresse ferrugineo-tomentosae, bracteis lanceolatis acuminatis pubescentibus ca. 1 cm. longis 2 cm. latis, bracteolis similibus in apice pedicelli vel infra, pedicello et pedicellis 1.5–2 cm. longis pubescentibus; calyx tubo obconico 5 mm. longo 2.5 cm. lato dense pubescente rugoso, lobis 1.2 mm. longis 4 mm. latis lanceolatis acuminatis extus minute pubescentibus intus glabris; corolla ca. 3.5 cm. diam.; petala rosea, spatulata, ungue ca. 1 cm. longa villosa, lamina obovata obtusa ca. 15 mm. longa 13 mm. lata extus sericeo-pubescente intus glabra basi excepta; stamina fertilia 3, filamentis 3 cm. longis glabris, antheris ca. 4 mm. longis 2 mm. latis oblongis; stamina sterilia 6–7, gracilia, ad 2 cm. longa, glabra, antheris abortivis; ovarium stipitatum stipite ca. 1.2 cm. longo villoso, sutura pubescente, stylo glabro ca. 1 cm. longo, stigmate clavellato. Legumen ignotum.

YUNNAN: Yangtze watershed, Prefectural district of Likiang, eastern slope of Likiang Snow range, *Rock 2905*, May–Oct. 1922, (**type**, Arnold Arboretum); precise locality unknown, *Forrest 15419*, 1917–1919; Likiang, *Forrest s.n.*, May 1922; precise locality and date lacking, *Forrest 10345;* Yangtze watershed, *Rock 9045*, 1923–1924.

A species characterized by its pink flowers, their petals with a claw 1 cm. long and with an obovate obtuse villous limb about 1.5 cm. long and 1.3–1.5 cm. broad.

It is a great pleasure to dedicate this species to Dr. and Mrs. W. F. Bohn of Oberlin College who have been my special advisers and friends.

Bauhinia cateriviflora, spec. nov.

Frutex scandens, ramulis inflorescentiisque ferrugineo-pubescentibus. Folia membranacea, suborbicularia, 5–8.5 cm. longa et 5.5–9 cm. lata,

emarginata sinu tantum sextam partem laminae aequante, lobis rotundatis, basi subcordata vel truncata, utrinque sparse pubescentia, nervis primariis 9 conspicuis, costa in mucronem 2 mm. longum pubescentem exeunte, utrinque reticulata, petiolo 1.5–2.5 cm. longo pubescente. Racemi 1 vel 3 ad apicem ramulorum, multiflori, pubescentes, ad apicem pedunculi interdum cirrhis pubescentibus binis 3 cm. longis instructi, bracteis caducis et bracteolis binis anguste linearibus 6–7 longis pubescentibus; calyx tubo pubescente satis crasso ad basin leviter attenuato 3 cm. longo, lobis lanceolatis acuminatis 6–7 mm. longis sub anthesi reflexis extus adpresse pubescentibus intus glabris sinu excepto; petala alba, 1.5 cm. longa et 1 cm. lata, spatulata, extus sparse pubescentia, intus glabra, lamina late obovata 13 mm. longa et 10–15 mm. lata erosa apice rotundata basi in unguem 5 mm. longum attenuata; stamina fertilia 3, filamentis 1.6 cm. longis glabris, antheris oblongis 3 mm. longis; stamina sterilia 7, minuta, 4–7 mm. longa; ovarium stipitatum, plerumque glabrum, ad basin sparse pubescens, stylo 5 mm. longo glabro, stigmate capitato. Legumen ellipticum, tenue, glabrum, 19–20 cm. longum, 4.2 cm. latum, integrum, seminibus multis.

YUNNAN: Szemao, S. Mt. *Henry 12344*, (**type**, Arnold Arboretum), *Henry 12344a* (fruit); Meng-tsze, *Henry 10763;* Wen-Shan Hsien, *Tsai 51659*, Jan. 25, 1933; Ping-pien Hsien, *Tsai 60496, 61050*, July 20, 1934.

A species characterized by its suborbicular leaves which are thinly pubescent on both surfaces, and its 3 cm. long calyx-tube. *Tsai 60496, 61050,* and *Henry 10763* differ from the type in having less pubescent leaves, and less prominent reticulations.

Bauhinia chalcophylla, spec. nov.

Frutex ramulis inflorescentiisque minute ferrugineo-pubescentibus. Folia subcoriacea, ovata, 9–11 cm. longa et 7–9 cm. lata, margine undulata, basi cordata, apice biloba lobis tertiam partem laminae aequantibus obtuse acutis ad acutis plerumque sese tegentibus, supra sparse puberula, subtus breviter ferrugineo-pubescentia et reticulata, nervis 11–13 conspicuis ad marginem anastomosantibus, petiolo pubescente 3–4 cm. longo. Racemi plerumque 3, terminales, multiflori, bracteolis binis in medio pedicello pubescentibus lanceolatis ca. 3 mm. longis, pedicellis 2.5–3 cm. longis; alabastra ovalia, pubescentia; calyx tubo obconico ca. 5 mm. longo, lobis lanceolatis sub anthesi reflexis 1 cm. longis 2–5 mm. latis intus glabris extus pubescentibus; petala eburnea, spatulata, obtusa, basi in unguem 4 mm. longum 9–10 mm. latum attenuata, crenata, intus glabra, extus dense adpresse pubescentia; stamina fertilia 3, filamentis glabris 3–3.2 cm. longis, antheris ignotis; stamina sterilia 7, minuta, ca. 4–7 mm. longa; ovarium stipitatum vel subsessile, glabrum, stylo ca.

1.5 cm. longo, stigmate parvo capitato. Legumen oblongum, apice abrupte acuminatum, basi attenuatum, glabrum, ligneum, ca. 15 cm. longum et 4 cm. latum, seminibus 5–7.

YUNNAN: Talang, *Henry 13240,* (N. Y. Bot. Gard.)

A species characterized by the ovate, bluntly acute or acute lobes of its leaves and its typically terminal inflorescences usually composed of three many-flowered racemes. The fruits are ligneous and entirely glabrous.

Bauhinia didyma, spec. nov.

Scandens ramulis gracilibus glabris, cirrhis parvis involutis glabris solitariis quam 1.5 cm. brevioribus. Folia membranacea, ad basin bifida, lobis inaequilateraliter obovatis 1.3–2.2 cm. longis 1–1.5 cm. latis, apice rotundata, subtus axillis basalibus nervorum breviter minute rufo-barbatis exceptis utrinque glabra, utrinque reticulata, nervis 3 conspicuis; petiolo gracili glabro 1–1.5 cm. longo. Inflorescentiae racemosae, terminales, solitariae, sparse pubescentes; flores ignotae. Legumen tenue, glabrum, laeve, lanceolatum, margine integrum, ca. 10 cm. longum et 2.5 cm. latum, apice breviter acutum, basi obtusum obliquumque, pedicellis ca. 1.2 cm. longis, seminibus multis parvis.

KWANGTUNG: Yeungchun; scandent, flower white, fruit green, *C. Wang 38777,* Nov. 16, 1935 (Oberlin College).

A species characterized by its paired leaflets which are free to the very base as in *Bauhinia binata* Blanco, and entirely glabrous except for the scanty, short, rufous pubescence at the very base on the lower surface.

Bauhinia euryantha, spec. nov.

Frutex scandens ramis ramulisque erectis angulatis pubescentibus, cirrhis pubescentibus solitariis vel binis in ramulorum nodis. Folia subcoriacea, late ovata vel ovata, 8.5–10 cm. longa et 6.5–10 cm. lata, basi alte cordata, apice biloba lobis tertiam partem laminae aequantibus acutis plerumque sese tegentibus, supra sparse pubescentia, subtus breviter ferrugineo-pubescentia, nervis 9–11 conspicuis subtus reticulatis, petiolo robusto dense brunneo-tomentoso ad 4.5 cm. longo. Racemi 3 terminales, rufo-pubescentes, bracteolis linearibus 3–4 mm. longis pubescentibus, pedicellis 2–2.8 cm. longis; calyx tubo plus minusve cylindrico 7 mm. longo, lobis anguste lanceolatis acutis ca. 7 mm. longis et 2–2.5 mm. latis subtus pubescentibus supra glabris; petala alba vel flava, spatulata, ad basim in unguem pubescentem 1–2 mm. longum attenuata, lamina ca. 8 mm. longa et 6 mm. lata intus glabra, extus margine excepta adpresse pubescente; stamina fertilia 3, filamentis gracilibus glabris ad 3 cm. longis, antheris ignotis; stamina sterilia 5,

minuta, ca. 5 mm. longa; ovarium stipitatum stipite 2 mm. longo, glabrum, stylo gracili 10 mm. longo, stigmate minute capitato. Legumen immaturum stipitum, oblanceolatum, glabrum.

YUNNAN: Yong Shan Hsien, in ravine, in secondary forests, a woody vine 10 m. high, *H. T. Tsai 51222*, July 27, 1932 (Fan Memorial Institute).

A species characterized by its broadly ovate to ovate leaves which are pubescent on both surfaces, and its acute lobes. It is closely allied to *B. chalcophylla* Chen, the differences being indicated in the diagnosis.

Bauhinia hainanensis Merrill & Chun in herb., spec. nov.

Scandens, ramis et ramulis inflorescentiisque erectis breviter minute rufo-tomentosis, ramis ramulisque angulatis, cirrhis robustis 3.5 cm. longis solitariis in axillis foliorum superiorum. Folia subcoriacea, orbicularia, late et plus minusve irregulariter ovata, ca. 16 cm. longa et 18 cm. lata, margine crasso leviter revoluto, basi alte cordata, apice biloba lobis rotundatis tertiam partem laminae aequantibus, supra glabra ima basi ad petiolum excepta, subtus breviter villoso-pubescentia, minute reticulata, nervis 11–13 prominentibus subtus dense pubescentibus; petiolo robusto dense pubescente ad 5.5 cm. longo. Inflorescentiae laxe paniculatae axibus secundariis racemosis, dense adpresse ferrugineo-tomentosae, bracteolis brevibus ca. 3 mm. longis, pedicellis pubescentibus 1–1.5 cm. longis, alabastris late ovalibus adpresse tomentosis; calyx tubo obconico ca. 3 mm. longo et 3 mm. lato basi attenuato pubescente, lobis ovatis breviter acutis ca. 6 mm. longis et 3 mm. latis extus tomentosis; corolla ca. 1.5 cm. diam.; petala roseo-alba, in unguem brevem ca. 1 mm. longum attenuata, lamina obtusa 8–9 mm. longa et 7 mm. lata emarginata intus basi excepta glabra extus dense pubescente; stamina fertilia 3, filamentis gracilibus glabris ca. 2.5 cm. longis, antheris oblongis 2.5 mm. latis; stamina sterilia 2, parva ca. 7 mm. longa; discus carnosus; ovarium stipitatum, glabrum, stylo ca. 5 mm. longo. Legumen ignotum.

HAINAN: Yaichow, alt. 100 ft., climbing on shrubs; flowers pinkish white, fragrant, anthers deep red, *N. K. Chun & C. L. Tso 44559*, collected in 1932 (Arnold Arboretum).

A species characterized by its terminal, rather open and erect, ferruginous-pubescent panicles, the flowers numerous, racemosely arranged in the upper half of the ultimate branches, the branches often marked with scars of fallen pedicels. The enlarged parts of the buds are ovoid or ellipsoid, slightly longer than the tube.

Bauhinia pernervosa, spec. nov.

Scandens, ramis angulatis plus minusve pubescentibus mox glabratis.

Folia subcoriacea, orbiculari-ovata, 8–9 cm. longa et 9–10 cm. lata, basi cordata, apice biloba lobis quartam partem laminae aequantibus, supra glabra, subtus plus minusve pubescentia, nervis 11–13 subtus prominenter elevatis pubescentibus ad marginem anastomosantibus, petiolo minute sparseque pubescente 3–4 cm. raro ad 5 cm. longo. Racemi 2 terminales, breves, ferrugineo-pubescentes, multiflori, bracteis bracteolisque anguste linearibus acutis 5–7 mm. longis pubescentibus, pedicellis 1.5–1.7 cm. longis pubescentibus; calyx tubo 2 cm. longo sparse pubescente, lobis lanceolatis breviter acutis ca. 6 mm. longis extus sparse adpresse pubescentibus intus glabris ad basim glandulosis; corolla 2.5 cm. diam.; petala intus extusque glabra, ungue 2–3 mm. longo, limbo orbiculari ca. 11 mm. longo et 10 mm. lato; stamina fertilia 3, filamentis ca. 11 mm. longis glabris, antheris oblongis 3.5 mm. longis; stamina sterilia 7, minuta, ca. 4–5 mm. longa; ovarium subsessile glabrum, stylo ca. 3 mm. longo, stigmate discoideo. Legumen oblongum, utrinque obtusum, tenue, glabrum, 15–20 cm. longum et 2–5 cm. latum, margine incrassato, seminibus multis.

YUNNAN: Mengtse, *Henry 10763a*, (**type**, Arnold Arboretum); *Henry 10763c*, fruiting specimen (N. Y. Bot. Gard.) and *Henry 10763a* (U. S. National Herbarium and Arnold Arboretum). These specimens are all from the same locality.

A species characterized by its leaves being orbicular-ovate, the strongly elevated nerves on the lower surface, especially prominent in old leaves. It is closely allied to *B. cateruiflora* Chen, differing in its floral structure as indicated in the diagnosis.

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NOTES ON CHINESE EUPHORBIACEAE

LEON CROIZAT

THE MATERIAL used in the preparation of these notes is derived from the collections of the Arnold Arboretum (A) and of the Gray Herbarium (G) of Harvard University, of the New York Botanical Garden (NY), the University of California (UC), and the Fan Memorial Institute of Biology, Peiping (FI). In addition to the specimens cited, the very extensive collections of the Arnold Arboretum, New York Botanical Garden and University of California have been consulted without in every case referring to specimens by number.

The writer gratefully acknowledges the loan of type-specimens from the Royal Botanic Gardens of Kew (K), the contributions of photographs and fragments of types from the Conservatoire et Jardin Botaniques, Geneva, and the communication of data and seed by F. C. Greatrex Esq., Nagasaki, Japan.

ANTIDESMA Burm. ex L.

Antidesma hainanense Merr. Philip. Jour. Sci. **21:** 347. 1922. — Gagnep. in Lecomte, Fl. Gén. Indochin. **5:** 507. 1926.

Antidesma Fleuryi Gagnep. Bull. Soc. Bot. France, **70**: 121. 1923.

KWANGSI: Shap Man Tai Shan, Shang-ze District, *Tsang 22210* (A).

Previously unrecorded for continental China. The ♀ specimen is in flower, and closely matches *Poilane 6347* (A) from Annam, which is apparently a specimen cited by Gagnepain. The leaf nerves in this species are unusually strong throughout, impressed above, pubescent and reddish brown. In its pubescent ovary and fruit, *A. hainanense* resembles *A. Fordii* Hemsl. (*A. yunnanense* Pax & Hoffm.), from which it differs in all vegetative characters.

MALLOTUS Lour.

Mallotus barbatus Muell.-Arg. Linnaea, **35:** 184. 1865; in DC. Prodr. **15**(2): 957. 1866. — Pax & Hoffmann, Pflanzenr. **63 (IV. 147. VII):** 164. 1914.

Mallotus barbata Hemsley, Jour. Linn. Soc. Bot. **26:** 438 (Enum. Pl. Sin. II). 1894.

Mallotus Esquirolii Léveillé, Rep. Spec. Nov. **9:** 461. 1911.

Mallotus Leveillanus Fedde, Rep. Spec. Nov. **10:** 144. 1912. — Pax & Hoffmann, Pflanzenr. **63 (IV. 147. VII):** 165. 1914. — Rehder, Jour. Arnold Arb. **14:** 232. 1933.

Mallotus Leveillei Fedde ex Léveillé, Fl. Kouy-Tchéou, 165. 1914.

The specific characters of *M. Leveilleanus* are described by Pax & Hoffmann, ". . . indumento ramulorum et petiolorum pulverulento-stellato nec molliter echinato, stylis papillosis nec plumosis . . ." The illustration of *M. barbatus* by the same authors was made apparently from *Henry 9525b* (A), which they cited. I am unable to separate this specimen from a *Cavalerie* sheet, Kweichow (A), which represents *M. Esquirolii*. The indument of *Mallotus* is usually variable in thickness, especially in the hairier species. The specimens of *M. barbatus* in which the indument becomes less dense occur with states of pubescence intermediate between those which Pax & Hoffmann ascribe to *M. barbatus* and to *M. Leveilleanus*.

Mallotus barbatus Muell.-Arg. var. **pedicellaris,** var. nov.

A typo pedicellis fructigeris praesertim ad basim racheos elongatis bracteolatis ad 5 cm. longis recedit.

SZECHUAN: Chung-hsien, in thickets, *Fang 680* (A).

Mueller-Arg. in his consideration of *M. barbatus* describes the pedicel as long as the fruit, which agrees with the note of Pax & Hoffmann ". . . pedicelli ♀ sub fructu fere 1 cm. attingentes." In this new variety the fruits are pendulous, especially at the base of the cyme, and the pedicels bear bracteolar scars. This character may be suspected, as such, to represent an occasional elongation of the pedicel. However, in another specimen, *Handel-Mazzetti 10364* (A) Kweichow, unfortunately with only young fruits, elongated and bracteolate pedicels are also in evidence suggesting the varietal validity of the character. Metcalf has proposed the var. *congesta* (Lingn. Sci. Jour. **10:** 487. 1931), for a form that has sessile or subsessile fruits on a short congested inflorescence. The present new variety and var. *congesta* are very doubtfully conspecific, and it is probable that a better knowledge based on more ample collections of Chinese *M. barbatus* will introduce further changes in the treatment and limits of the species.

Mallotus nepalensis Muell.-Arg. Linnaea, **34:** 188. 1865; in DC. Prodr. **15**(2)**:** 964. 1866. — Hook. f., Fl. Brit. Ind. **5:** 428. 1887, p.p. — Pax & Hoffmann, Pflanzenr. **63 (IV. 147. VII):** 165. 1914, p.p.

The binomial was based upon a Wallich specimen which I have not seen. However, photographs and fragments of *M. orcophilus* Muell.-Arg. *α ochraceo-albidus* and *β floccosus* from the type-collections in the

herbarium of the Botanical Garden of Geneva were communicated by Prof. Hochreutiner; also, isotypes, *Thomson 1857* (♂ spec.) sub *Rottlera* from Sikkim 5–6000′ (G), and *Hooker & Thomson* (♀ spec.) sub *Rottlera* 5 from Khasia, (K); *Henry 10925, 13697* (NY) and *13060* (A), from Yunnan cited by Pax & Hoffmann were seen. This material has been considered by Hooker f. and by Pax & Hoffmann to represent *M. nepalensis*, or its varieties.

According to Mueller-Arg., the differences between *Mallotus nepalensis* and *M. oreophilus* α *ochraceo-albidus* (the type of the species) are, (a) capsular indument crowded in *M. oreophilus*, open in *M. nepalensis*, (b) limb subrhombic-ovate, subangustate at the base in *M. oreophilus*, triangular-ovate, subcordate in *M. nepalensis*, (c) limb indument ochraceous becoming darker in *M. oreophilus*, fulvous-ferrugineous in *M. nepalensis*, (d) stamens about 80 in *M. oreophilus*, 120 in *M. nepalensis*.

I have no material by which to judge the last character. The other characters may or may not be specific. Chinese specimens are available which answer the concept of *M. nepalensis* according to Mueller's description. It seems advisable to distinguish these specimens from others which agree with the types of *M. oreophilus* α *ochraceo-albidus*. Accordingly, to *M. nepalensis* I refer *Tsai 60944, 60954, 61017, 62332, 62552* collected at Ping-pien Hsien, Yunnan (A), with triangular-ovate occasionally subcordate leaves, and a thick tomentum tending to be orange-yellow. Two new locality records, *Pételot 1363*, Tonkin, Chapa (UC), and *Steward & Cheo 667*, No Kan, Lin Yuin Hsien, Kwangsi (NY, A) belong here, although the former has a paler indumentum, and may represent an intermediate with var. *ochraceo-albidus*.

Mallotus nepalensis α **ochraceo-albidus** (Muell.-Arg.) Pax & Hoffmann, op. cit. 166.

This variety is well represented in various herbaria under the names *M. apelta, M. tenuifolius*, etc. It differs from the former in floral characters and from the latter in the tomentum. *Wang 20909, 23096, 23147* (A), *Fang 2103, 7914* (A), from Szechuan, and *Tsai 52677* (A) from Yunnan belong here. A peculiar reniform limb is found on *Fang 2103* and *7914*, collected respectively at Omei-shan and at Kuan-Hsien. *Henry 10925, 13697* (NY) from Yunnan have leaves that tend to be like those of the species.

Mallotus nepalensis Muell.-Arg. var. **kwangtungensis**, var. nov.

A typo indumento subtiliore, foliis saepissime tricuspidatis sublatioribus quam longis diagnoscitur.

KWANGTUNG: Lokchong *C. L. Tso 20532* (**type**, NY), *21117* (A, NY).

This variety is more interesting because of the extension of the range for the species far to the east rather than on account of its variation from the species. The new variety may be found to intergrade with *M. japonicus* from which it differs typically in the thicker capsular indumentum, in the even, thicker, whitish pubescence, and in the stout simple inflorescence.

Mallotus tenuifolius Pax, Bot. Jahrb. **29:** 429. 1900. — Y. Chen, Man. Chin. Trees Shrubs, 618, fig. 1937.

Mallotus apelta tenuifolius (Pax) Pax & Hoffmann, Pflanzenr. **63 (IV. 147. VII):** 171. 1914.

Mallotus oreophilus β floccosus Muell.-Arg. Linnaea, **34:** 188. 1865; in DC. Prodr. **15**(2)**:** 964. 1866.

Mallotus nepalensis Hook. f., Fl. Brit. Ind. **5:** 428. 1887, p. p.

Mallotus nepalensis β floccosus (Muell.-Arg.) Pax & Hoffmann, Pflanzenr. **63 (IV. 147. VII):** 166. 1914.

Mallotus japonicus Pax & Hoffmann, op. cit. 169. — Handel Mazzetti, Symb. Sin. **7:** 214. 1931, quoad spec. Hupeh et Szechuan.

Broadly interpreted, the species is represented by geographical forms that range from Khasia in northeastern India to Chekiang, in China, at the western and eastern limits doubtless intergrading with *M. nepalensis* or with *M. japonicus*. Earlier taxonomic considerations of *M. tenuifolius* lack, in my opinion, a definite understanding of its specific limits. The concepts of *M. nepalensis* and of *M. japonicus* have been over-extended. The result is that *M. tenuifolius* has been deprived of its proper phytogeographic background by this over-extension. Characteristic of this notion is the treatment of Handel-Mazzetti who has rejected the validity of *M. tenuifolius*, distributing its forms between *M. nepalensis* and *M. japonicus*. Other authors have recorded conflicting opinions: Pax & Hoffmann have reduced *M. tenuifolius* to variety of *M. apelta* which was probably due to the lack of adequate material. Chen Yung contributes a fair character-sketch of *M. tenuifolius*, which he accepts as occurring in Chekiang, Hupeh and Szechuan.

The type is *Rosthorn 2262*, Szechuan, Nanchuan-hsien, of which there is an excellent photograph in the herbarium of the Arnold Arboretum. The original description and the photograph agree with two topotypes, *Fang 1222* (A), and *Chu 1483* (FI). The species is represented in American herbaria by numerous collections that indicate that its geographic center lies in Hupeh rather than in Szechuan. I am unable to separate from the typical form several specimens identified as *M. nepalensis* var. *floccosus*, or *M. nepalensis*, such as *Henry 13060* (A), *13060a* (NY), *Forrest 15877, 18150, 26702* (A) from Yunnan; *Forrest 19870, 19244* (A), *Rock 10207* (A, UC) from Eastern Tibet (Sikang);

Handel-Mazzetti 9014 (A) from Yunnan; *182* (A) from Kweichow; *777* (A) from Hunan. The greatest difference that I note between these specimens and material that more closely matches the type is a stouter and usually longer inflorescence in the cited numbers of Henry, Forrest, Rock and Handel-Mazzetti. The character, however, is not absolutely valid if one judges from all the available material; it is suggested that it may depend, as Wilson remarks (Sargent, Pl. Wils. **2**: 525. 1916), upon the vigor of the shoot. In no case can the pubescence on the lower surface of the leaf be described as a continuous tomentum. It varies in thickness and apparently in persistency, being almost absent in *Chu 1483*, and more conspicuous in the Tibetan specimens, which also have rounder leaves. With better material it may be found convenient to segregate these Tibetan specimens from the type.

Numerous specimens from Szechuan, e.g., *Farges 98* (A); *Silvestri 1302* (A); Hunan, *Handel-Mazzetti 46* (A); Kweichow, *Tsiang 4951* (A); Kiangsu, *Ching & Tso 420* (A), I judge to be within the limits of this species, although on the average they have smaller and less pubescent leaves than the specimens collected in Tibet and Yunnan. It is indicated that even in its purely Chinese range *M. tenuifolius* includes a number of forms resulting from altitudinal and local geographic segregations.

Mallotus tenuifolius Pax var. **floccosus** (Muell.-Arg.), comb. nov.

Mallotus orcophilus β floccosus Muell.-Arg. in DC. Prodr. **15**(2): 964. 1866.

KHASIA: *Hooker & Thomson* (*Rottlera No. 5*) (♀ spec.) (K), **type.**

In my understanding the variety is essentially represented by the Khasian plant with an elongated ovate leaf, a fairly thick indument, and strong nervules. It is advisable to maintain it distinct on geographic considerations, although, aside from the form of the leaf and the length of the inflorescence, I cannot find in the single available specimen, characters that sharply separate it from forms intergrading with the type of the species.

Mallotus tenuifolius Pax var. **subjaponicus,** var. nov.

A typo foliis saepius cuspidatis, petiolis valde elongatis, indumento interdum nullo, cymis validioribus recedit.

FUKIEN: in monte Tienhwa-schan, ad occ. urbis Dingdschou ("Tingchow"), substr. arenaceo, loco lapidoso, leg. *Wang-Te-Hui 391* (A, fruit), **type.** — KIANGSI: Lushan Mountains, 700–800 m., tree, *Chung & Sun 160* (A, fruit).

The new variety in vegetative characters, especially in the leaf is very similar to *M. japonicus* Muell.-Arg. for which it is usually mistaken in

the herbarium. It differs from that species in its unbranched inflorescences, its larger capsules (seed 5 × 5 mm.), and in its softer and finer capsular indument. In these characters it approaches *M. tenuifolius* of which it typically represents the eastern form.

Mallotus japonicus (Thunb.) Muell.-Arg. Linnaea, **34**: 189. 1865; in DC. Prodr. **15**(2): 966. 1866. — Hayata in Jour. Coll. Sci. Tokyo **20**(3): 44, *pl. 3j.* 1904. — Pax & Hoffmann, Pflanzenr. **63 (IV. 147. VII)**: 169. 1914, excl. spec. Hupeh, Szechuan. — Y. Chen, Man. Chin. Trees Shrubs, 618, *fig.* 1937.

Hutchinson was of the opinion (in Sargent, Pl. Wils. **2**: 526. 1916) that *M. japonicus* does not occur in Hupeh and Szechuan. Handel-Mazzetti believes, on the contrary (Symb. Sin. **7**: 214. 1931) that the range of the species extends to those provinces, and that Hutchinson incorrectly suggested that *M. tenuifolius* differs from *M. japonicus* in having an unbranched inflorescence. To justify this belief Handel-Mazzetti remarks in part that Chekiang specimens, like Japanese material, occur with branched inflorescences.

On the strength of numerous specimens seen, I may state, (a) *M. japonicus* does not occur in Hupeh and Szechuan. All the material from those provinces identified as *M. japonicus* belongs to *M. tenuifolius;* (b) the inflorescence is branched in *M. japonicus* and simple in *M. tenuifolius.* The character is diagnostically fully as important as Hutchinson and Chen Yung, who uses it in the key, state it to be. It is not absolute because specimens from Japan are occasionally found with an unbranched inflorescence like *Oldham 725,* Nagasaki (NY); (c) *M. japonicus* is represented in China by specimens fully as typical of the species as Japanese plants themselves. It seems certain that Handel-Mazzetti refers to one of these specimens, not to *M. tenuifolius* in disputing Hutchinson's statement. I cannot find the slightest difference between *Siebold in hb. Zuccarini* (NY), *Maximowicz, Iter Secundum, Nagasaki* (NY) and *R. C. Ching, 2085, 2025* (UC), *Chiao 853* (UC), *Faber s. n.* (A) from Chekiang; *Tso 1574* (A) from Kiangsu. I am not aware that *M. japonicus* reaches farther inland than Kiangsu, which Chen Yung indicates as the northwestern limit of the species.

It is interesting to note that in Formosa forms of *M. japonicus* occur which, in their vegetative characters, strongly suggest *M. tenuifolius, Warburg 9951* (A), *Gressitt 282* (A), *Henry 504* (NY), while in Fukien and Chekiang *M. tenuifolius* var. *subjaponicus* is found with the vegetative characters of *M. japonicus.* Thus in Kiangsu, Chekiang and Formosa an intergrading of forms may be believed to have taken place that marks the range as a single floristic unit with some marked Japanese

affinities. The opinion which I have elsewhere expressed (Sinensia, 6: 658. 1935) that plants with Chekiang range are necessarily distinct from Japanese endemics is not always tenable. The mouth of the Yangtze River is indicated at least as a secondary center of dispersal of plant biota that reach the Japanese archipelago at one end, Indo-China and the Himalayan region at the other. Numerous critical and transitional forms of the Euphorbiaceae occur in the Chekiang-Formosa range, and it is often open to question whether a Japanese species that is reported from the Chinese mainland is as wholly Japanese as the record expressed by the publication indicates.

Mallotus Lianus, sp. nov.

Arbor vel frutex 2–12 m. altus, cortice rubro-brunneo e speciminibus ipsis, in notulis collectoris et griseo-albido. Innovationes, axes florigeri petiolique tomento rubro-brunneo, tarde atque ex parte tantum deciduo, induti. Folia integerrima, breviter ac abrupte apiculata, orbiculari-ovata et cordata vel, rarius, subquadrangulari-ovata et late cuneata, 10–13 × 9–12 cm. magna, pallide olivacea vel brunnea, supra mox glabrescentia, subtus tomento rubescente subtili pro more persistente induto, glandulas hypophyllas lutescentes suboccultante; nervis utrinque 5–6, venulis subparallelis conspicuis; petiolo 5–8 cm. longo; glandulis 2 ad petioli apicem in limbo conspicuis. Inflorescentiae ♂ laxae, simplices vel multifidae, in speciminibus suppeditantibus immaturae; perianthii lobis subspathulatis, circiter 2 mm. longis, patentibus vel reflexis, facie interna glabris; staminibus 50–80; filamentis basi puberulis. Inflorescentiae ♀ simplices vel multifidae, ramulis erectis vel subpatentibus, quam axis florigerus longiores vel eum aequantes, ad 25 cm. longae, ad 8 cm. latae; perianthii lobis triangulari-acuminatis, patentibus vel reflexis, 2 mm. longis, facie interna glabris; ovario subgloboso, 3–4 mm. lato; pedicello circiter 2 mm. longo. Capsula processubus subulatis laxis armata secus coccorum commissuras confertioribus, primum stellato-floccosis, serius glabrescentibus, matura 7–8 mm. lata; pedicello 5 mm. longo; processubus ad 5 mm. longis; semine subgloboso, atro-brunneo, facie ventrali depressiusculo, 5 × 5 mm. lato, oculo armato obscure ruguloso.

KWANGTUNG, Tsing Wan Shan: Wong Chuck I and vicinity (Wung Yuen District) *Lau 2290* (♀ fl.; **type**) (A); Kwangtung, s. l., *Fenzel 123* fruit (UC); Yam Na Shan, Yit Nga Shan (Mei-Kaying District) *Tsang 21469* (♀ fl.) (NY). FUKIEN: Yenping, Cha-ping, on slopes, a shrub 2 m. high, flower light yellow, alt. 730 m. *Ching 3889* (immature fl.) (A). CHEKIANG: Pang Yung, in open, partly shaded forests, a small tree, 20 ft. tall, 6 in. girth, bark smooth, whitish grey, *Ching 2020* (♂ fl.) (A) (NY).

Mallotus Lianus is a fairly well characterized species for the genus in China. In the herbarium it has been identified as *M. ricinoides*, occasionally as *M. japonicus*. Its nearest affinity is undoubtedly with the latter species, which it resembles in the nature of capsular indumentum and in the total sum of vegetative characters. Specimens in which the leaves are glabrescent, *Tsang 21469*, Kwangtung (A); Yam Na Shan (Yit Nga Shan), Mey (Kaying District); *H. Hu 127*, Chekiang (A): Swen Chi, at first sight suggest *M. japonicus*. From this species, however, *M. Lianus* differs in the normally persistent and thicker red tomentum, which to the majority of taxonomists has suggested an inexistent affinity with *M. ricinoides*, in the less membranous limb, the much longer ♀ inflorescence, its plumose styles, larger ovary, and in the thicker capsular indumentum. I have not seen specimens of *M. ricinoides* from China, and only one collection of it from Annam, *Poilane 1685* (UC). *Mallotus Lianus* abundantly differs from that specimen in its lax, stiffer and glabrescent capsular indumentum, in its pedicellate, smaller capsule, and in its nearly smooth seed. While *M. ricinoides* and *M. apelta* belong to one affinity, *M. albus*, *M. Lianus*, *M. japonicus*, *M. nepalensis* and *M. tenuifolius* may be understood as members of a separate group. The path of migration of the five last species is suggested to lie along two main tracks: (1) India, Yunnan, Tonkin (*M. albus*); Kwangtung, Chekiang (*M. Lianus*); Chekiang, Formosa, Japan (*M. japonicus*); (2) northeast India, Yunnan, Tonkin, Kwangsi (*M. nepalensis*); and northeast India, Sikang [Eastern Tibet], Szechuan, Hupeh, Chekiang (*M. tenuifolius*). Whether the geographic sequence of migration is truly the one given here I may not say, and rather doubt. It conveniently emphasizes the systematic position of *M. Lianus* as geographically and taxonomically intermediate between *M. albus* and *M. japonicus*, and the importance of the Chekiang and Yunnan node in Chinese floristics, at least insofar as these nodes concern the Euphorbiaceae. It is very significant to find *M. philippensis* endemic in northwest India as well as species of *Macaranga* having Chinese and eastern Asiatic, not African affinities, in a narrow strip of land with comparatively abundant rains along the west coast of Deccan (cf. maps in Pflanzenr. **63 (IV. 147. VII)**: *t. 1*, 1914, and in Gamble, Man. Ind. Timbers, 1881). This distribution essentially tends to confirm an east to west distribution of *Mallotus*. The valley of the Yangtze River is the northern boundary on Chinese soil of the domain in which these distributional currents regardless of their direction, have operated.

As stated, I have not seen specimens of *M. ricinoides* from China. Mueller-Arg. cites *Croton mollissimus* Geisel., from China, in the syn-

onymy of *M. ricinoides*, from a specimen in Vahl's herbarium which is the type of Geiseler's species. If he correctly interprets Geiseler's type there can be no question of its being identical with *M. Lianus*, because the capsules of *Croton mollissimus* according to Mueller-Arg. (in DC. Prodr. **15**(2): 964. 1866) are ". . . sessilibus, dense et longe molliter echinatis, aculeis dense stellato-floccosis . . ." The description of *Croton mollissimus* in Geiseler's work (Croton. Monogr. 74. 1807), however, suggests that the type of this alleged *Croton* may not represent a *Mallotus* at all, and only very doubtfully a *Croton*. Even the Chinese origin of the specimen may be questioned. Geiseler speaks of "*caulis herbaceus*. Rami tomentosi, sulcati, incani. Folia petiolata alterna 3 vel 4 pollicaria, acuminata, acuta denticulata, *utrinque tomentosa mollissima*, supra ferruginea subtus incana, nervosa, venoso-reticulata. Petiolum parum intra marginem insertum. Glandulae supra oblongae planae in regione apicis petioli. Racemus terminalis spithameus, pedunculi partiales sparsi tripollicares. Flores copiosi subsessiles conferti incani, *masculis cum femineis mixti*. Bracteae setaceae florum longitudine. Capsulae tectae setis flexibilibus furfuraceo-tomentosis copiosissimis. *Styli fusci penicellati*." The diagnostic characters in italics essentially exclude *Mallotus*, and I do not find any Chinese euphorbiaceous species to which Geiseler's description satisfactorily applies.

The new species is dedicated to Dr. Liang Chin Li, Keeper of the herbarium of the Fan Memorial Institute of Biology, Peiping, in grateful acknowledgment of his friendly communication of essential data and material.

Mallotus apelta (Lour.) Muell.-Arg. Linnaea, **34:** 189. 1865; in DC. Prodr. **15**(2): 963. 1866. — Pax & Hoffmann, Pflanzenr. **63 (IV. 147. VII):** 171. 1914, excl. var. — Hutchinson in Sargent, Pl. Wils. **2:** 525. 1916, p. p.

The species is perhaps best understood as the northern representative of *M. ricinoides*, sensu lato, and the much needed typification of the latter species should not be attempted without a critical consideration of all the forms so far included under *M. apelta*. Pax & Hoffmann separate (op. cit. 163) *M. ricinoides* from *M. apelta* using the length of the inflorescence, which in the former may be 30 cm. long, and is supposed in the latter to be 12 cm. or shorter. In reality specimens of undoubted specific identity are found which reverse the supposed character, such as *Noerkas 355*, Celebes (*M. ricinoides* : inflorescence in fruit not exceeding 20 cm.) (NY), and *Tsang & Fung 205*, Hainan (*M. apelta* : inflorescence in fruit exceeding 30 cm.) (A). Metcalf has indicated (Lingn. Sci. Jour. **10:**

489. 1931) that *Ching 7111* from Kwangsi (A, UC) may be distinct from *M. apelta* on account of its peculiar capsular indument and of its long cyme. The specimens that Metcalf understands as *M. apelta, Levine 1176, Tsiang 1434, 1541* (A) conform to the type, as far as I can judge from the photograph of Loureiro's specimen in the Paris Museum of Natural History. I find, however, that *Demange 1187* (A), from Tonkin has an inflorescence of a length not exceeding 30 cm., and a capsular indument intermediate in nature between that of *Ching 7111* and of *Tsiang 972* (A) from Kwangtung, the latter having a cyme in fruit exceeding 35 cm. in length. In *Henry 13640* (NY), from Tonkin, the capsular indument perfectly matches that of *Ching 7111* and the fruiting cyme, though broken off, exceeds a length of 50 cm. *Fan & Li 4* (A), from Hunan, has the very same capsular indument of *Ching 7111*, but a fruiting cyme only 17 cm. long. These findings bear out Wilson's statement (in Sargent, Pl. Wils. **2:** 525. 1916) that the length of the inflorescence of *M. apelta* varies much, and depends upon the vigor of the shoot. Unquestionably, in some specimens the capsular indument is short, and thickly villous (*typical form*), suggesting that of *M. albus*, and in others long and lanose in aspect (*Ching 7111*), similar to that of *M. ricinoides*. The intergrading between extreme states, however, is so complete that the notion of attempting a segregation is not encouraged when the material available at this time in the herbarium is sorted for the purpose. It is suspected, considering all specimens, that the southern ones tend to have a longer inflorescence, and that edaphic factors are at play, possibly favoring the ultimate segregation of distinct strains within the common, or nearly common, area of present distribution. Larger collections and extensive field work particularly are needed to define the issue of practical classification of these forms.

Mallotus Paxii Pamp. Nuov. Giorn. Bot. Ital. **17:** 414. 1910.

Mallotus apelta var. *a chinensis* (Geisel.) Pax & Hoffmann, Pflanzenr. **63 (IV. 147. VII):** 171. 1914. — Handel-Mazzetti, Symb. Sin. **7:** 214. 1931.

Mallotus Stewardii Merr. ex Metcalf, Lingnan Sci. Jour. **10:** 488. 1931.

The synonymy of *M. Paxii* and *M. Stewardii* is established by the specimens and by the literature. The possibility that *Croton chinensis* Geisel. is the same as *M. Paxii* is excluded because *M. Paxii* does not occur in the southern maritime provinces of China whence Geiseler's specimen undoubtedly came. To my knowledge *M. apelta* occurs in Indo-China, Hainan, Kwangtung, Fukien, Kiangsi, Kiangsu, Hupeh, Hunan, Szechuan. *Mallotus Paxii* is found in the same areas with the exception of Indo-China, Hainan and Kwangtung. The classification of

♂ specimens of the two species rests upon what may be called intangibles of habit, that is to say largely on the opinion of the individual taxonomist. Occasionally ♀ specimens are found which are exceedingly critical, like *Sun 1373,* Anhwei (A). This notwithstanding *M. Paxii* is better treated, I believe, as a distinct species. *Mallotus Castanopsis* Metc. has clear specific rank but if *M. Paxii* is subordinated to *M. apelta* it may not be kept distinct for it intergrades with *M. Paxii.* Although barely outlined north and south a specific range exists and *M. Paxii* is not found in the south. It is also likely that comprehensive subordinations of inadequately understood forms are undesirable on general grounds. In the present conditions of the botanical exploration of China a moderately narrow, or even a narrow concept of taxonomic limits best serves the purpose of making generally available the data obtained by the study of herbarium specimens. The notion of Huber (Bull. Herb. Boiss. ser. 2, **6:** 345. 1906) and of Lanjouw (Euphorb. Surin. 40. 1931) that the ends of classification are furthered in certain cases by narrow concepts is not without merit.

Mallotus Roxburghianus Muell.-Arg. var. **glabra** Dunn, Jour. Linn. Soc. Bot. **38:** 365. 1908.

The material available is represented by the type collection, Yenping, Buong-Kang, *No. 3627* Hongkong Herb., *Dunn 1136* (A), which is sterile. I find in this specimen neither the characteristic pubescence of *M. Roxburghianus* nor the limb-glands almost invariably present in *Mallotus* species of this section. Such differences may be indicative of a variety, although taken together they are scarcely suggested as less than specific. To my knowledge *M. Roxburghianus* is not recorded at intermediate points between northeastern India and eastern China, and I have not seen as yet a duplicate of Dunn's collection that can be identified as a *Mallotus.* Dunn's specimen may prove to be a *Macaranga.*

Mallotus albus (Roxb.) Muell.-Arg. Linnaea, **34:** 188. 1865; in DC. Prodr. **15**(2)**:** 965. 1866. — Hook. f., Fl. Brit. Ind. **5:** 429. 1887. — Pax & Hoffmann, Pflanzenr. **63 (IV. 147. VII):** 168. 1914. — Gagnep. in Lecomte, Fl. Gén. Indoch. **5:** 353. 1925.

The only specimens I have seen from China are five sheets of *Henry's* collection, *11991c, 11991d, 11991e* (NY), all apparently from Szemao in Yunnan, and cited by Pax & Hoffmann under this species. The ♂ and ♀ inflorences are branched, very seldom simple. The leaves are usually smaller as a rule in southern Indian specimens, up to 1 foot broad in one Yunnan collection. The indumentum is mostly rusty brown, rarely whitish. The capsular processes are stiff, short, heavily tomentose-

floccose, very moderately spreading. It may be suspected that the lone record of *M. macrostachyus* for Tonkin (Gagnep. op. cit. 357) is based upon a critical specimen of *M. albus* which but for its inflorescence cannot be distinguished with certainty from that more southern species. *Mallotus albus* is best separated from *M. apelta* by the thick texture of the leaf, which is usually repand-dentate and reminiscent of *Macaranga denticulata* and *M. indica*. It differs from *M. ricinoides* in the shorter and stiffer capsular indumentum and from *M. paniculatus* (*M. cochinchinensis*) in habit and inflorescence.

Mallotus repandus (Willd.) Muell.-Arg. Linnaea, **34**: 197. 1865; in DC. Prodr: **15**(2): 981. 1866. — Pax & Hoffmann, Pflanzenr. **63 (IV. 147. VII)**: 181. 1914.

Mallotus contubernalis Hance, Jour. Bot. **20**: 293. 1882.

The isotype of *M. contubernalis, Sampson & Hance 17694* (K) is a specimen of *M. repandus* fully within the limits of the species as represented by *Thwaites 2115* from Ceylon (NY), which is cited by Mueller-Arg. under *M. repandus α genuinus*. The Hance specimen has the usual yellowish capsules of *M. repandus*, not a fruit "densely clothed with rufous glandular tomentum," as Hance describes it. It is difficult to understand why Hance's *Mallotus* characterized in the presentation as having dicoccous capsules and leaves ultimately glabrate has been accepted by Pax & Hoffmann as the type of a species with glabrous leaves and tricoccous capsules.

The distinction established by Mueller-Arg. between *M. repandus α genuinus* (technically the type of the species) and *β scabrifolius* is rejected by Pax & Hoffmann (op. cit. 182), apparently because numerous intermediates occur. Wilson also observes (in Sargent, Pl. Wils. **2**: 526. 1916) that in this *Mallotus* the pubescence is most variable. In my opinion a valid varietal difference can be established rather upon the total sum of characters than on the single factor of pubescence. The existence of glabrescent intermediates does not detract from the fact that a specimen of the type with subrhombic leaves, 7 cm. long or less, with persistently pubescent petioles and venation, differs from a specimen of the variety which has ovate cordate leaves, mostly longer than 7 cm., and soon glabrous petioles and venation. The type so understood is matched by *Lau 61* (A) and *1526* (NY) from Hainan; *McClure s. n.* (UC), *Tsiang 900* (A), *Oldham 478* (NY) from Kwangtung; *Faurie 409* (A), *Mori 607* (UC), *Henry 714* (NY) from Formosa. The last three specimens are interesting: *Faurie 409* has manifestly pubescent petioles but strongly glabrescent to glabrous limbs, being intermediate between the type and the variety in regard to pubescence; *Mori 607* has

an exceedingly branched cyme, and *Henry 714* together with dicoccous fruits bears at least one tricoccous capsule. Wright (NY), Hongkong, cited by Mueller-Arg. as typical of α *scabrifolius* is matched by *Levine 662* (A) from Honan Island; *McClure 2033* (UC) from Kwangtung; *Ching 1597, 2177* (UC) from Chekiang.

The limits of *M. repandus*, its varieties and allied species will be discussed in the summary following the notes of *M. Millietii*.

Mallotus repandus (Willd.) Muell.-Arg. var. **megaphyllus**, var. nov.

A typo foliis majusculis late ovatis cordatis ad 19 × 13 cm. longis latisque pubescentibus vel glabrescentibus, cymis ♀ abbreviatis oligocarpicis bene recedit.

INDO-CHINA: Laos, Mong Hsing, *Kingdon Ward 8922*, **type** (A ♀). YUNNAN: Mengtze, large climber, *Henry 13696* (A ♂); Tonkin, *Balansa 4791* (NY ♀).

The last named specimen is referred with doubt to *M. repandus* by Pax & Hoffmann [Pflanzenr. **63 (IV. 147. VII)**: 182. 1914]. *Handel-Mazzetti 437* (A) from Fukien; *Tsiang 2374* (A) from Kwangtung; *Ching 1597* (A) from Chekiang, are perhaps closer to the new variety than to the type. The range, Yunnan-Chekiang through Kwangtung and northern Indo-China (Tonkin, Laos), appears not to lack floristic significance. The valley of the Red River, especially, is suggested as the main line of diffusion of species that occur in southern Yunnan and Hainan, and that are unrecorded elsewhere in China.

Mallotus illudens, nom. nov.

Mallotus contubernalis sensu Pax & Hoffmann, Pflanzenr. **63 (IV. 147. VII)**: 180. 1914. — Handel-Mazzetti, Symb. Sin. **7**: 214. 1931. — Non Hance.

Mallotus repandus sensu Hutch. in Sargent, Pl. Wils. **2**: 526. 1916, p. p.

The differences between this species and *M. repandus* are pertinently summarized by Pax & Hoffmann in ". . . ambitu foliorum, glabritie, inflorescentiis simplicibus, ovario triloculari . . ." I do not agree with those authors, however, that *M. illudens* resembles *M. philippensis* and suspect that they intended to refer to *M. chrysocarpus* because this often resembles the latter species. *Mallotus illudens* intergrades with *M. repandus* var. *scabrifolius*, the ♂ specimens of either being mostly indistinguishable in the herbarium. The specific character, basically, is the tricoccous fruit, and in part the geographic range.

Typical specimens of *M. illudens* are *Chung 6642* (A) from Fukien; *Wang 239* (NY) from Kiangsi; *Ching 3086* (A) from Anhwei; *Tsiang 4866* (A) from Kweichow; *Ching 5599* (A) from Kwangsi; *Handel-*

Mazzetti 514 (A) from Hunan; *Yü 689, Wang 21868* (A), *Farges 827* (UC) from Szechuan; *Tsai 52199* (A), *Ducloux 214* (NY) from Yunnan. The center of distribution, to judge from the total number of available collections that best represent species, is the Hupeh-Szechuan region.

Mallotus chrysocarpus Pamp. Nuov. Giorn. Bot. Ital. n. s. **14:** 413. 1910.

Mallotus repandus var. *chrysocarpus* Hand.-Mazz. Symb. Sin. **7:** 214. 1931.

Mallotus repandus sensu Pax & Hoffmann, Pflanzenr. **63 (IV. 147. VII):** 180. 1914. p. p., non Muell.-Arg.

In the herbarium this *Mallotus* is easily recognized by its ovate to elliptic-lanceolate leaves being softly pubescent beneath, in certain specimens somewhat resembling those of *M. philippensis*. The capsule will probably be found to be larger than that of *M. repandus* and to have a thicker indument. It is tricoccous, as in *Chu 1880* (FI), from Szechuan, or dicoccous as in *Wilson 3542* (A), *Henry 1494* (A), from Hupeh. I have seen no specimens outside of Szechuan and Hupeh.

Mallotus Millietii Lévl. Fl. Kouy-Tchéou, 165. 1914. — Rehd. Jour. Arnold Arb. **14:** 233. 1933.

A very distinct species, easily identified from ♀ specimens, not rarely found in herbaria but seldom correctly named. Henry recognized it, *in sched.*, from *M. repandus*, but it was left to Rehder to contribute the first clear summary of its characters. In pubescence *M. Millietii* is near *M. chrysocarpus;* in leaf outline it resembles robust specimens of *M. illudens*. The fruit, however, is peculiar and unmistakable. In *M. repandus* and *M. illudens* the capsule is scarcely larger than 10 mm., smooth or rugose when dry, usually dull yellow, with a very fine, dust-like indumentum. In *M. Millietii* the epicarp appears under the naked eye to be scurfy-lepidote, bright yellow and orange. Under the lens close and short villous processes are evident which are heavily stellate-floccose. The fruit, when ripe, is seldom less than 15 mm. broad.

The species occurs in Kwangsi, *Steward & Cheo 602, 387* (A), and more widespread, it seems, in Yunnan, *Henry 10669* (A, NY), *10700* (A), *10700a* (A, NY), *Forrest 7524, 12027* (A).

Mallotus Millietii var. **atricha**, var. nov.

A typo foliis glabris recedit.

KWANGSI: Tan-ngar, 10 li E. of Hoo Chi, a scandent shrub 18 ft. long, common in thickets alt. 1700 ft., *Ching 6396* (A **type,** NY, UC).

It is suggested that *Mallotus Millietii, M. chrysocarpus, M. illudens* and *M. repandus* are descended from a common parent form, the last

two being so close that they might be considered conspecific under a normally broad taxonomic concept. *Mallotus chrysocarpus* appears to be a leaf-form of *M. repandus* judged by the specimens available but the evidence is on the whole in favor of its being nearer to *M. Millietii* than to any other members of the group. In my opinion these four species afford a classic instance of the segregations that take place in China within a group having Indo-Malayan affinities. Aside from more or less relevant differences in fruit, habit, and pubescence it may be suspected that these four species have a geographic background, as follows:

Mallotus repandus. — A southern form, essentially dicoccous, ranging from India to New Caledonia. In China it occurs almost exclusively in the maritime or southern provinces, Hainan, Kwangtung, Kwangsi. The Hainan specimens, particularly, are undistinguishable from Indian and Malayan material. *Mallotus repandus* intergrades with *M. illudens* through var. *scabrifolius*. This variety, interpreted on the basis of *Wright* (NY), Hongkong, cited by Mueller-Arg., occurs as far north as Chekiang. *Mallotus repandus* var. *megaphyllus* is restricted to northern Indo-China and Yunnan, although transitional forms towards the type-species occur probably as far north as Kiangsi.

Mallotus illudens. — A northern form, essentially tricoccous, and apparently typically Chinese. Its distribution is prevailingly continental, throughout China south of the Yangtze River.

Mallotus chrysocarpus. — A suggested mutation or extreme form of *M. Millietii* with which it has the pubescence and the leaf-shape in common. Larger collections and field work are needed to define its characters, range, and affinities. Not represented in the material examined outside of Hupeh and Szechuan.

Mallotus Millietii. — Very strongly characterized by its large capsule and capsular indument. In the latter character with a tendency to be intermediate between Sect. Echinus and Sect. Philippenses. So far as known, collected only in Yunnan and Kwangsi.

Several specimens in our herbarium, unfortunately too incomplete for description indicate that further additions to the varieties and species of *Mallotus* Sect. Philippenses may be expected from Sikang (east Tibet) and Yunnan.

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NOMENCLATURAL NOTES ON HYPERICUM

Henry J. Lott

The statement by Clos, "Peu de genres ont été soumis à plus de vicissitudes que le grand genre *Hypericum* . . ." (Bull. Soc. Bot. France, sér. 3, **1:** 290. 1894) is hardly an exaggeration. The complicated nomenclature which has resulted from these vicissitudes is the probable explanation of the large number of invalid binomials cluttering the literature of this genus. In the following notes of species of *Hypericum* native to southeastern United States, *H. spathulatum* Keller is reduced to synonymy; *H. arborescens* Chap., a little known synonym of *H. fasciculatum* Lam., is discussed; and the names of two common species, *H. aureum* Bartr. and *H. petiolatum* Walt., are shown to be invalid.

Hypericum frondosum Michaux, Fl. Bor. Am. **2:** 81 (1803). — Poiret, Encycl. Suppl. **3:** 699 (1813). — Muhlenberg, Cat. Pl. Am. Sept. 68 (1813). — Choisy in DC. Prodr. Syst. Nat. **1:** 544 (1824).

Hypericum aureum Bartram, Travels, 383 (1791). — Non Loureiro, Fl. Cochinch. **2:** 472 (1790).
Hypericum ascyroides var. β Poiret, Encycl. Suppl. **3:** 694 (1813).
Hypericum amoenum Pursh, Fl. Am. Sept. **2:** 375 (1814).
Hypericum Rugelianum Kunze in Linnaea, **24:** 177 (1851).
Hypericum prolificum var. *aureum* Koehne, Deutsch. Dendrol. 416 (1893).

Hypericum frondosum is manifestly the oldest valid name for this species which has long been known to both botanists and horticulturists as *H. aureum*. Muhlenberg was the first to dispose of Bartram's name as a synonym of *H. frondosum*, but unfortunately he was not followed by later botanists.

Hypericum galioides Lam. var. **pallidum** Mohr in Contrib. U. S. Nat. Herb. **6:** 621 (1901).

? Hypericum ambiguum Elliott, Sketch Bot. S. Car. Ga. **2:** 30 (1824).
Hypericum galioides Lam. var. *ambiguum* (Elliott ?) Chapman, Fl. S. United States 40 (1860), ? p. p.
Hypericum spathulatum R. Keller in Bot. Jahrb. **58:** 195 (1923). — Non Steudel, Nomencl. Bot. ed. 2, **1:** 789 (1841). — **Syn. nov.**

An isotype of Keller's species in the herbarium of the Arnold Arboretum is identical with *Hypericum galioides* var. *pallidum*. Some writers

do not recognize this variety at all, and others, such as Small, maintain it as a distinct species under the name *H. ambiguum*. The validity of the epithet *ambiguum* is questionable, for it is doubtful whether this is the plant which Elliott had in mind. Mohr, pointing this out, made the change from var. *ambiguum* to var. *pallidum*.

Hypericum sp.

Hypericum revolutum R. Keller in Bot. Jahrb. **58**: 194 (1923). — Non Vahl, Symb. Bot. **1**: 66 (1790).

I have seen an isotype of Keller's *Hypericum revolutum* in the herbarium of the Arnold Arboretum. It seems close to *H. galioides* Lam., but the material at hand is insufficient to decide whether it is conspecific with this species or not. However, if it should prove to be distinct, a new name will be necessary, for Keller overlooked Vahl's previous use of the same specific name.

Hypericum fasciculatum Lamarck, Encycl. Méthod. **4**: 160 (1797).

Hypericum nitidum Lamarck, Encycl. Méthod. **4**: 160 (1797).

Myriandra nitida Spach in Ann. Sci. Nat. Bot. sér. 2, **5**: 365 (1836); Hist. Nat. Vég. **5**: 436 (1836).

Myriandra Brathydis Spach, Hist. Nat. Vég. **5**: 436 (1836), excl. syn. *Hypericum aspalathoides* Willd.

Hypericum arborescens Chapman, Fl. S. United States, ed. 2, suppl. 2, 680 (1892). — Non Vahl, Symb. Bot. **2**: 86, t. 43 (1791).

Hypericum arborescens Chapman in Biltmore Herb. Distrib. Dupl. Chapman Herb. no. 5735[a], as synonym of *H. fasciculatum* Lam.

As indicated above, a printed label attached to specimens distributed as duplicates of the Chapman Herbarium, bears Chapman's reduction of *Hypericum arborescens* to *H. fasciculatum*. The great similarity between the original description of *H. arborescens* in the second and that of *H. fasciculatum* in the third edition of his Flora, and the fact that he does not mention *H. arborescens* in the third edition are added evidence that Chapman no longer thought *H. arborescens* to be a species distinct from *H. fasciculatum*. This decision of Chapman is foreshadowed in the following excerpt from a letter to Professor Sargent dated June 4, 1895:

"My *Hypericum arborescens*, as a new species I give up, for I find, to my surprise, that it is not confined to this vicinity, but is more or less common in other parts of this state, and as far westward, at least, as Mobile. Which one of the described species it may prove to be, I am unable, for want of a library, to even guess, unless it be Lamarck's own *H. fasciculatum*. It is found along old Bartram's route, and may have been one of his gatherings.

"The genus is in labyrinthine confusion so far as our species are con-

cerned and our botanists who have examined the types seem to vary in their conclusions.

"I have measured the tallest of the specimens in the locality near here, and found some a little over fifteen feet, while some twenty miles west I am confident I have seen them taller — possibly twenty feet."

Hypericum Walteri Gmelin, Syst. Nat. **2:** 1159 (1791), as *Hypericon Walteri.*

Hypericum petiolatum Walter, Fl. Carol. 191 (1788). — Non Linnaeus, Sp. Pl. ed. 2, 1102 (1763), nec Linnaeus f. Suppl. 345 (1781).
Hypericum axillare Michaux, Fl. Bor. Am. **2:** 81 (1803).
Hypericum campanulatum β? Poiret, Encycl. Suppl. **3:** 696 (1813).
Elodea petiolata Pursh, Fl. Am. Sept. **2:** 379 (1814).
Hypericum paludosum Choisy, Prodr. Monogr. Hypéric. 43 (1821); in DC. Prodr. Syst. Nat. **1:** 546 (1824).
Martia petiolata Sprengel, Syst. Veg. **3:** 333 (1826).
Elodea floribunda Spach in Ann. Sci. Nat. Bot. sér. 2, **5:** 169 (1836); Hist. Nat. Vég. **5:** 367 (1836).
Elodea axillaris Spach in Ann. Sci. Nat. Bot. sér. 2, **5:** 170 (1836); Hist. Nat. Vég. **5:** 368 (1836).
Triadenum petiolatum Britton in Britton & Brown, Ill. Fl. **2:** 437, fig. 2465 (1897).
Elodes petiolata Gray, Manual, ed. 5, 86 (1867).
Gardenia petiolata Farwell in Am. Midl. Nat. **8:** 35 (1922).

The name generally employed for this species is *H. petiolatum*, but Walter's use of the specific epithet *petiolatum* is clearly antedated by *H. petiolatum* Linn. and *H. petiolatum* Linn. f. Gmelin, noticing Walter's error, created the *nomen novum, H. Walteri,* as follows: "Walteri, 52 H. foliis petiolatis, staminum corporibus ad medium connatis. Walt. Flor. Carol. p. 191." To my knowledge, Steudel's Nomenclator Botanicus (ed. 2, **1:** 789. 1841) is the only place where the name *H. Walteri* appears after the eighteenth century outside of Index Kewensis. Steudel incorrectly attributed the binomial to Raeuschel,[1] and doubtfully referred it to *H. paludosum* as a synonym. The acceptance of *H. Walteri* necessitates the following nomenclatural change:

Hypericum Walteri Gmel. var. **tubulosum** (Walter), comb. nov.

Hypericum tubulosum Walter, Fl. Carol. 191 (1788).
Elodea tubulosa Pursh, Fl. Am. Sept. **2:** 379 (1814).
Elodea pauciflora Spach in Ann. Sci. Nat. Bot. sér. 2, **5:** 169 (1836); Hist. Nat. Vég. **5:** 366 (1836).
Elodes tubulosa Watson, Bibl. Index N. Am. Bot. **1:** 124 (1878).
Triadenum longifolium Small in Bull. Torr. Bot. Club, **25:** 140 (1898).

[1]Raeuschel merely listed the name *H. Walteri* without citation in the third edition of his Nomenclator Botanicus.

Gardenia longifolia Farwell in Am. Midl. Nat. **8**: 34 (1922).
Hypericum petiolatum Walter var. *tubulosum* Fernald in Rhodora, **38**: 436 (1936), excl. syn. *Elodea Drummondii* Spach.

Hypericum Walteri has always been descr'bed as having connate filaments which separate at or, more commonly, above the middle. Inasmuch as I have not had opportunity to examine sufficient material of this species and its variety to determine satisfactorily the value of this character, I have hesitated to dispose definitely of *Elodea Drummondii*, for Spach (Ann. Sci. Nat. Bot. sér. 2, **5**: 166. 1836) places it and *E. virginica* Nutt. (= *Hypericum virginicum* Linn.) together in a section characterized as "Androphori filamentis 3–4-plo breviores."

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CYTOLOGICAL EVIDENCE ON THE STATUS OF THE GENUS CHAMAECRISTA MOENCH

HAROLD A. SENN[1]

With one text-figure

THERE HAS BEEN considerable diversity of opinion concerning the generic status of certain species of the large genus *Cassia* L. Linnaeus (1737) established the genus *Cassia* and in 1753 included five species in a section "Chamaecristae foliolis numerosis." According to the International Rules of Botanical Nomenclature, 1935, it has been proposed that *Cassia fistula* L. be selected as the type species of the genus. One species of the Linnaean section Chamaecristae, *Cassia nictitans* L., and *Cassia Absus* L. of the section Sennae were later distributed among three species of a new genus *Grimaldia* by Schrank (1805, 1808). Moench (1794) described the genus *Chamaecrista* differentiating it from *Cassia* chiefly by the occurrence of 5 fertile stamens in the former and 7 in the latter.

Colladon (1816) revised the genus *Cassia* distinguishing the sections Absus and Chamaecrista from the rest of the genus by their acuminate calyces and bibracteolate pedicels. These sections were separated by the structure of the anthers. In Chamaecrista the anthers were glabrous and biporous whereas in Absus the anthers had villous longitudinal lines and dehisced by longitudinal slits. Colladon considered the sections of the genus as very distinct and of potential generic value. These sections as set forth by Colladon were maintained by DeCandolle (1825) who enumerated 6 species under Absus DC. and 80 under Chamaecrista Breyn. Both of these sections were included in the genus *Chamaecrista* Moench by Meyer (1835). Kunth (1824) considered Chamaecrista as a distinct section characterized by pinnate leaves of one to many leaflets, usually with glandular petioles, and by solitary flowers on axillary or supra-axillary, bibracteolate peduncles.

Vogel (1837) included DeCandolle's sections Absus, Baseophyllum, and Chamaecrista in a new section of *Cassia*, Lasiorhegma Vogel. This section was characterized by anthers with 2 villous clefts, dehiscent throughout part of their length, and by a dehiscent compressed pod.

Bentham (1871) distinguished three subgenera of *Cassia*, the subgenus

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Lasiorhegma being divided into three sections, chiefly on the characters of the inflorescence. Of these Chamaecrista consisted of herbs or shrubs with axillary or supra-axillary peduncles bearing 1–4 flowers. Greene (1897, 1899) re-established the section Chamaecrista as a genus which he characterized by: "(1) Flowers axillary or supra-axillary and solitary or few and fascicled, never terminally clustered as in *Cassia*. (2) Buds slender conical and acuminate (always subglobose or ovoid and obtuse in *Cassia*). (3) Sepals plane, slenderly acuminate, thin-membranous (in *Cassia* firm herbaceous, obtuse, concavo-convex). (4) Flower on a twisted pedicel, its banner and keel petals thus made to appear lateral, and one wing enlarged and placed lowermost, the other reduced and becoming uppermost. (5) Pods thin compressed, very promptly dehiscent, never subterete, and indehiscent as in most or all Cassias." Greene listed 32 species which he regarded as belonging to *Chamaecrista*.

Britton and Rose (1930) regarded the section Chamaecrista as a distinct genus of the tribe Cassieae, characterized by linear elastically dehiscent legumes, short funicles, unequal petals and usually glandular leaves. They included 111 species in this genus. Recently Standley (1937, p. 514) has again placed the species of *Chamaecrista* in the genus *Cassia*.

This group of species has thus had a varied taxonomic history being regarded either as a distinct section of the large genus *Cassia* or as a distinct but closely related genus *Chamaecrista* of the tribe Cassieae. In determining the sectional or generic status of a group of species such as this, evidence from comparative anatomy, genetics, or cytology may be of considerable value. Consequently the following chromosome number data are presented in the hope that they may be useful in further studies of the generic status of the group. Senn (in press) has pointed out that in the Leguminosae aneuploidy is frequently an intergeneric relationship. In contrast euploid series are usually found within genera. In the Cruciferae, a family with a much higher frequency of polyploidy, Manton (1932) has also found that aneuploidy is the usual relationship between genera. Long series of polyploid numbers do not commonly occur in Leguminosae, the percentage of polyploid species being remarkably low.

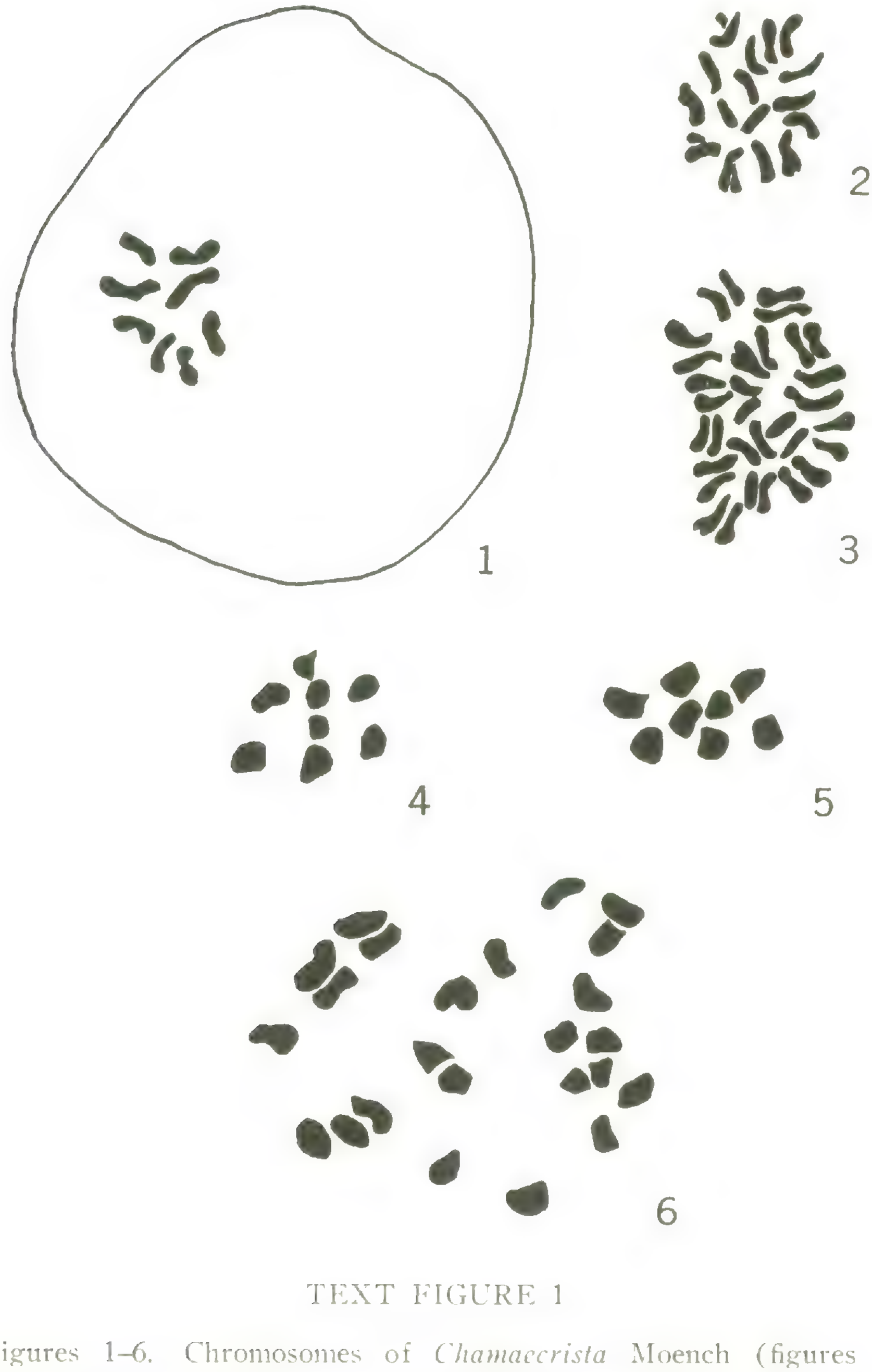
There is some disagreement concerning the numbers in certain species of *Cassia* but it is well established that the following n numbers occur: 6, 8, 12, 13, 14, 16, 24, and possibly 10 (Senn, in press). Of these the n numbers 8, 16, 24, an orthoploid series, occur only in the subsection Chamaecristae verae Benth., whereas the other numbers are distributed throughout the subgenus Cathartocarpus Pers. and the sections Onco-

lobium Vog., Prososperma Vog., and Chamaesenna DC. of the subgenus Senna (Roxb.) Benth.

Cytological material has been available for three species of the Chamaecrista group. *Chamaecrista procumbens* (L.) Greene (*Cassia nictitans* L.) collected at Charlottesville, Virginia, had $n = 8$ at IIM in pollen mother cells (figure 1). Somatic mitoses in root tip cells showed $2n = 16$ (figure 2), accompanied by somatically doubled cells in which there were 32 chromosomes (figure 3). *Chamaecrista fasciculata* (Michx.) Greene (*Cassia Chamaecrista* Walt.) from The Blandy Experimental Farm, Boyce, Virginia, also showed $n = 8$ in pollen mother cells (figure 4). Material of this species collected at Bremond, Texas (*L. O. Gaiser and P. Snure 11,* U. S. Route No. 6 near Bremond, Texas, Aug. 28, 1936) was also diploid with $n = 8$ in pollen mother cells (figure 5). *Chamaecrista Aeschinomene* (DC.) Greene (*Cassia Aeschinomene* DC.) (*H. A. Senn 113,* roadside, Soledad, Santa Clara Prov., Cuba, June 23, 1937) proved to be hexaploid with $n = 24$ at IM in pollen mother cells (figure 6). Some so-called secondary association was present in some nuclei suggestive of the polyploid nature of the species. Herbarium specimens representing the collections from which the chromosome numbers were determined have been deposited at the Gray Herbarium, Harvard University.

Chromosome numbers have also been reported for certain other species of this sectional or generic group. Kawakami (1930) listed two types of *Cassia mimosoides* L., one having $n = 8$ and the other $n = 16$. He also reported *Cassia Leschenaultiana* DC., which is regarded by Bentham (1871) as conspecific with *Cassia mimosoides* L., as having $n = 24$. This is commonly regarded as a rather polymorphic species and there may well be some correlation between the chromosomal races and the morphological variation in the species. Sugiura (1931) reported the chromosome number of *Cassia dimidiata* as $2n = 16$, thus adding another diploid species to the 8 series. The exact identity of *C. dimidiata* is not clear since no authority was given. According to Bentham (1871) *C. dimidiata* Roxb. is conspecific with *C. mimosoides* L. and *C. dimidiata* Klein with *C. Kleinii* W. et Arn. *Cassia Kleinii* W. & A. is a species closely related to *C. mimosoides* L. so that in either instance the species for which the chromosome count was reported comes within the group under consideration.

Before far-reaching conclusions are drawn many more species of *Cassia* should be examined cytologically but the above evidence indicates that a well marked polyploid series with a base number 8 in contrast to the other numbers 6, 13, 14, exists within the genus. The group of species comprising this series falls within the limits of the genus *Chamae-*



TEXT FIGURE 1

Figures 1–6. Chromosomes of *Chamaecrista* Moench (figures 1–5 × 2560; figure 6 × 2160). 1. *C. procumbens* (L.) Greene II M, second plate omitted, $n = 8$. 2. Same, somatic metaphase, $2n = 16$. 3. Same, somatically doubled nucleus, $4n = 32$. 4. *C. fasciculata* (Michx.) Greene, Charlottesville, Va., I M, $n = 8$. 5. Same, Bremond, Texas, I M, $n = 8$. 6. *C. Aeschinomene* (DC.) Greene I M, $n = 24$.

crista Moench and seems to provide some evidence in support of the maintenance of this group of species as a valid genus. The occurrence of a genus with a base number 8 in the Caesalpinioideae is also of especial interest since Senn (in press) has reported this number to be the probable base number for the subfamily Papilionatae.

The writer is grateful to Dr. Thomas Barbour, Curator of the Atkins Institution of the Arnold Arboretum, Soledad, Cuba, for the privilege of visiting the Institution in the summer of 1937 at which time material of *Chamaecrista Aeschinomene* (DC.) Greene was collected.

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THE EFFECT OF COLCHICINE ON SOMATIC CELLS OF TRADESCANTIA PALUDOSA

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With plates 219 and 220

VARIOUS CHEMICALS have been used to induce polyploidy in plant cells. The work of Nemec (1904), Kemp (1910), Sakamura (1920), van Regemorter (1926) and Peto (1935) have shown that tetraploid cells may be produced by the use of chloral hydrate. Sass (1937) observed tetraploid cells in the roots of corn seedlings as a result of poisoning by ethyl mercury phosphate. Dustin, Havas and Lits (1937) were the first to report the production of polyploid cells in the roots of wheat, shallot and tulip by the use of colchicine. Similar results have been obtained by Eigsti (1938) in the roots of *Allium Cepa, Raphanus sativa, Zea Mays* and *Triticum vulgare*. Blakeslee (1937–38) and Nebel and Ruttle (1937–38) have shown that entire tetraploid plants may be obtained as a result of colchicine treatment. In an earlier paper, now in press, the writer has reported the production of diploid and tetraploid pollen grains in *Tradescantia paludosa* by the use of colchicine.

Cut ends of flower stalks of *Tradescantia paludosa* Anderson and Woodson were immersed in 0.1 per cent colchicine for twenty-four, forty-eight and sixty-six hours. The treated flower stalks were then transferred to tap water and placed in the greenhouse. Stems of intact plants were treated with colchicine by making a tongue-like slit in the stem just below the second node from the tip and inserting the slit part in a micro test tube containing the solution. After forty-eight hours the cut surfaces were bound together. Fixations were made at intervals over a period of thirty days. Pistils were fixed in a solution of absolute alcohol (seventy parts) and glacial acetic acid (thirty parts) for twenty-four hours, after which they were stored in 80 per cent alcohol. Preparations were made by first boiling the pistils for a few seconds in one cc. of alcohol acetic to which several drops of 5 per cent hydrochloric acid had been added. The pistils were flattened and mounted according to the Belling's aceto-carmine technique as modified by Zirkle. Entire flowers were fixed in Karpechenko's modification of Navaschin and in formalin acetic alcohol. The fixed material was imbedded in paraffin. Sections were cut from ten to thirty microns in thickness and stained with Delafield's haematoxylin or with safranin and fast green.

The primordium for the pistil is recognized early in the development of the flower of *Tradescantia paludosa*. The continued division of the cells of the primordium results in the development of a structure which has approximately the same number of cells in the ovary wall and style as are present at maturity. Increase in size is due to an enlargement and maturation of these cells. In the style, this growth is brought about primarily by cell elongation. The ovule develops more slowly. Equatorial plates in which there are twelve chromosomes and two fragments are frequently visible. (Plate 219, figure 1.)

Microscopic examination of cells of the ovaries were made the first day after treatment with colchicine and at intervals for thirty days after treatment. Division figures with more than the normal number of chromosomes were not observed in the ovule tissue until the fifth day after treatment, although they are found earlier in the stamen hairs. Their occurrence in the pistil is sporadic which may be accounted for in part by the varying ages of the individual cells at the time of treatment and by the fact that all of the cells are not affected equally by the colchicine. They are found most abundantly in the developing ovule tissue.

The chromosomes of the tetraploid cells (Plate 219, figure 2) are normal in appearance and arrangement. Spindle fibers are not visible. The split chromosomes separate, but fail to go to the poles due to the absence of a spindle mechanism. The inhibition of spindle formation by colchicine has been reported by Nebel and Ruttle (1938), Eigsti (1938) and by the writer in a previous paper. The chromosomes become vacuolate and a large granular nucleus is formed. This is often amœboid-like in shape with a poorly defined nuclear membrane. Cells are often seen in which there are two or more restitution nuclei of different sizes; each surrounded by its own nuclear membrane. The restitution nucleus or nuclei of the tetraploid cells undergo a resting period for several days during which time the cell increases considerably in size.

Chromosome division again occurs normally except for the formation of the spindle fibers and the migration of halves of the chromosomes to the poles (Plate 219, figure 3). The chromosomes of the octoploid cell reorganize into a restitution nucleus. It is evident that these processes, division of chromosomes and reorganization of the restitution nuclei, may be repeated a number of times, as cells with approximately 96 (Plate 219, figure 4), 192 (Plate 219, figure 5) and 384 chromosomes were observed. Figure 6, plate 220 probably represents a 128-ploid condition although the chromosomes are too aggregated to be counted accurately.

As the chromosome number is doubled by suppressed nuclear division,

there is an increase in the size of the cell. This increase in cell size, however, is not proportional to the increase in chromosome number. The relationship between chromosome number and cytoplasmic volume is especially striking. In the highly polyploid cells the chromosomes occupy almost the entire cell with a relatively small amount of cytoplasm (Plate 220, figure 6).

The continued increase in cell size ultimately results in the production of a structure with larger but fewer cells. In longitudinal sections of ovules in the region of the embryo sac, there are approximately one-sixth as many cells sixteen days after treatment as in the control. Other parts of the flower affected by colchicine, especially the pedicel and style, show a similar condition. In a cross section of a pedicel of a treated plant there are approximately the same number of cells as in the control (Plate 220, figures 10, 11), while in a longitudinal section there are only about one-half as many cells. The same condition is found in the style (Plate 220, figures 8, 9).

It was observed that cells of styles and pedicels affected by the colchicine increase in size primarily in width. Growth in length is inhibited. This effect is seen very clearly in the style whose primordium at the time of treatment possessed approximately the same number of cells as found in the mature style. Measurements show that the elongation of the style may be retarded as much as one-half, while the diameter increases approximately one-fourth more than that of the normal. The presence of bulbous enlargements just above the node of Tradescantia stems treated by the tongue method also indicate that growth of the cells is accelerated in width in the region of elongation.

The appearance of giant polyploid cells in the treated parts of plants indicates that embryonic cells are affected by the colchicine for at least five or six division cycles of the chromosomes. The polarity of the cell is disturbed, spindle fibers are not formed, and nuclear division is suppressed. Certain concentrations of colchicine produce this effect in somatic cells over an indefinite period of time. These cells apparently never recover. Throughout all nuclear divisions the chromosomes are shorter and appear to be more rigid than normal. Apparently the prolonged metaphase induced by colchicine results in more compact coiling of the minor spirals of the chromonemata.

The doubling of the chromosome complement is accompanied by a growth of the cell, the direction of which appears to be affected by the colchicine. Growth in length is inhibited while growth in width is increased. The individual cells and even the entire flower exhibit a stouter growth.

The effect of the colchicine on both nuclear division and cellular differentiation appears to be caused by a change in the normal cytoplasmic organization. Spindle fiber formation is suppressed and normal cellular differentiation is inhibited. In both cases normal polarity in the cell is suppressed.

SUMMARY

Cut ends of flower stalks were placed in 0.1 per cent colchicine for twenty-four, forty-eight and sixty-six hours. Tongue-like slits were also made in the flowering stems of potted plants and inserted in the colchicine solutions for forty-eight hours. Observations of somatic cells were made over a period of thirty days. All treatments show that colchicine affects the cytoplasm, suppressing spindle fiber formation and normal cellular differentiation. Tetraploid, octoploid, 16-, 32-, 64-, and 128-ploid cells are found in the ovule tissue. Polyploid cells increase in size, primarily in width. Normal cell elongation is inhibited. All structures of the flower develop in changed proportions.

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EXPLANATION OF PLATES

PLATE 219

Somatic cells from ovules of *Tradescantia paludosa* treated with 0.1 per cent colchicine. Photographs of aceto-carmine preparations. × 1200.

Figure 1. Normal diploid cell. Metaphase.
Figure 2. Tetraploid cell, 9 days after treatment.
Figure 3. Octoploid cell, 10 days after treatment.
Figure 4. 16-ploid cell, 13 days after treatment.
Figure 5. 32-ploid cell, 15 days after treatment.

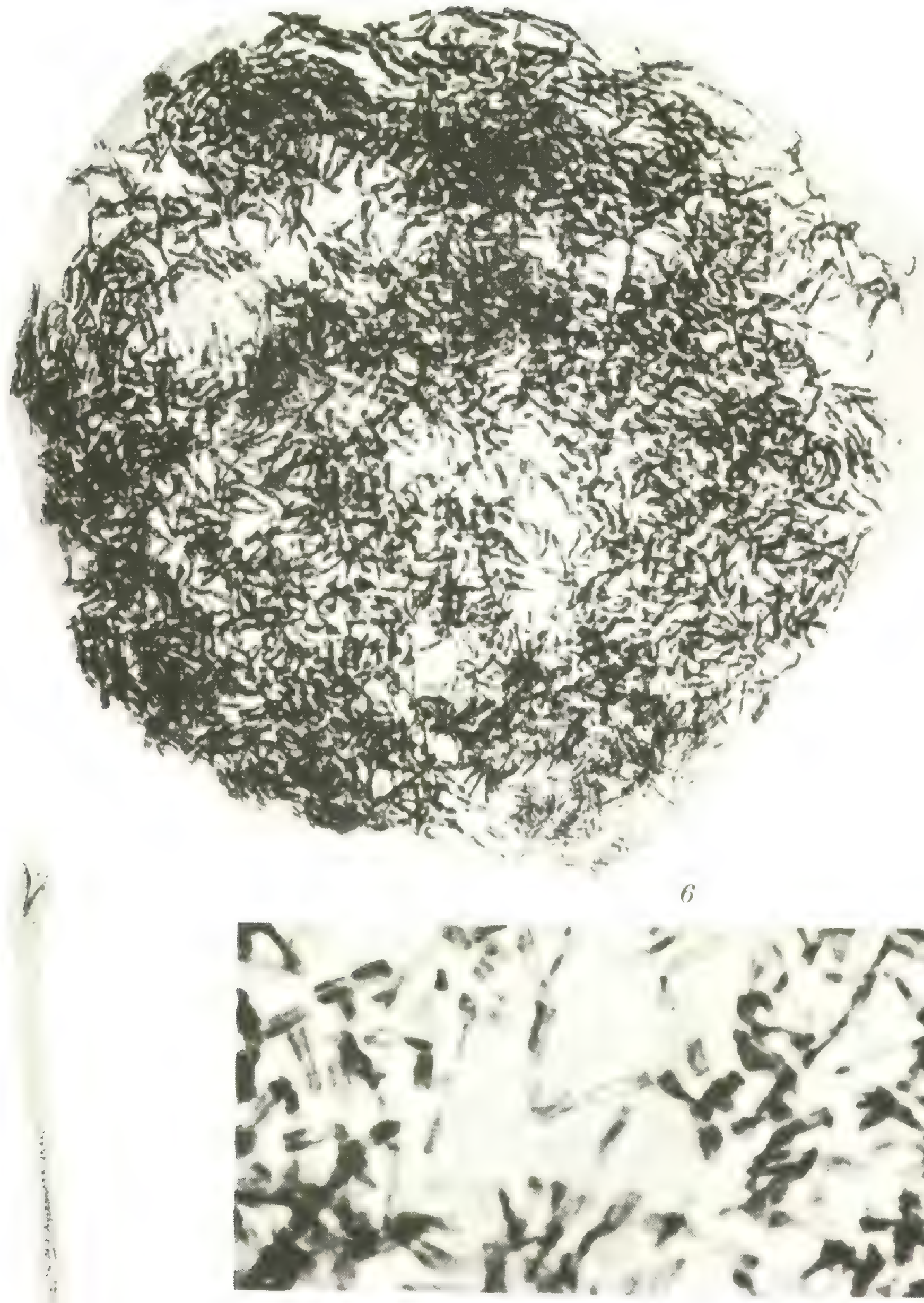
PLATE 220

Figure 6. 128-ploid cell, 18 days after treatment. × 300.
Figure 7. Portion of 128-ploid cell. × 1200.
Figure 8. Longitudinal section of normal pistil. × 11.
Figure 9. Longitudinal section of pistil 19 days after treatment. × 11.
Figure 10. Cross section of normal flower pedicel. × 11.
Figure 11. Cross section of flower pedicel 19 days after treatment. × 11.

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THE EFFECT OF COLCHICINE ON SOMATIC CELLS OF TRADESCANTIA PALUDOSA

FULL-TONE — MERIDEN

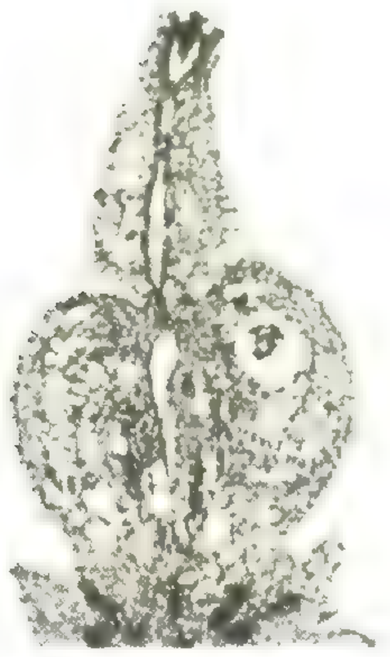


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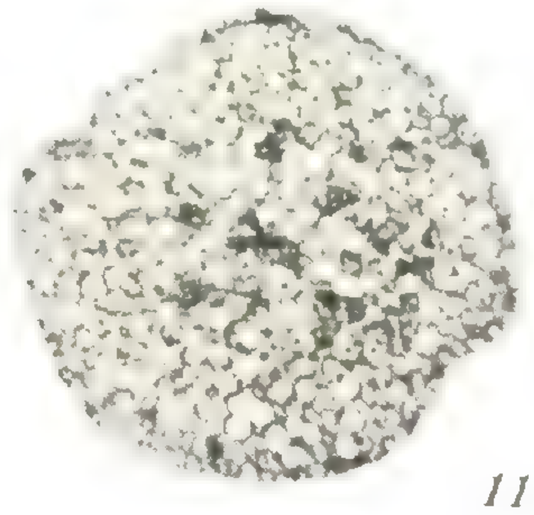
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11

THE EFFECT OF COLCHICINE ON SOMATIC CELLS OF TRADESCANTIA PALUDOSA

FULL-TONE — MERIDEN

PUCCINIASTRUM ON EPILOBIUM AND ABIES

J. H. Faull

Approximately 40 species of *Epilobium* are recorded among the hosts that are susceptible to infection from rust fungi of the genus *Pucciniastrum*. Persoon (15) cited the first one in 1801 when he described *Uredo pustulata* n. sp. on *Epilobium montanum* L. Various other mycologists have had a share in making up the rest of the list. Turning from the impressive list of host plants to the rusts involved we find that little progress has been made towards a delineation of their specific characters if they comprise more than one species, an elucidation of their life histories, a determination of their host restrictions or an appraisal of their economic importance. These desiderata can be realized only through experimentation. This is true even with reference to the taxonomic considerations because, with one exception, the diploid phase alone is known and that phase presents little morphological diversity, one form compared with another.

With respect to previous experimental work on the Pucciniastrum-Epilobium rusts, the few investigations so far published have been almost solely restricted to life-history studies of the form on *E. angustifolium* L. Klebahn (9–13) was the first to demonstrate that this has its haploid phase on *Abies* and that it is limited in its choice of Epilobium hosts. To it he gave the name *Pucciniastrum Abieti-Chamaenerii* because he considered it different from Persoon's *Uredo pustulata*. While his experimental results have been accepted and confirmed, his taxonomic interpretation, as might be expected, is still in dispute. Thus, Sydow (18) agrees with him and, out of hand, refers all of the Pucciniastrum rusts on species of the subgenus Chamaenerion to *P. Abieti-Chamaenerii* Kleb., and all on those of the subgenus Lysimachion to *P. Epilobii* Otth (interpreted by Sydow as *Uredo pustulata* Pers.). Arthur (1) and Hiratsuka (6, 7), on the other side and on no sounder grounds, refer all of both groups to just one species of *Pucciniastrum,* although the former does concede that this may comprise two biological strains or perhaps two varieties. Moreover, Arthur (1) extends the host list to include *Godetia* and *Clarkia,* with the modifying statement that the rust on these hosts "possibly" constitutes "a third variety." There the matter has rested — (a) two described species which may or may not be the same; (b) one life history; (c) proof of some specific host restriction

within the genus *Epilobium;* and (d), according to the point of view, one host list or two host lists, tabulated in either instance without knowledge of the haploid phases and mostly without clarifying cross-inoculation tests.

As a contribution towards an enlarged understanding of the Pucciniastrum-Epilobium rusts, the researches presented in this paper were threefold in purpose — (1) to work out the complete life history of a rust from one selected host of each of the two subgenera of *Epilobium*, that is, one from a Chamaenerion and one from a Lysimachion; (2) to make a complete morphological comparison of these rusts; (3) to compare their biological behavior and the relative susceptibility of their respective hosts as revealed by suitable cross-inoculation experiments. The hosts selected were *Epilobium* (Chamaenerion) *angustifolium* L. and *E.* (Lysimachion) *adenocaulon* Haussk. In designating the corresponding rusts it is convenient to adopt tentatively the nomenclature of Sydow's Monographia Uredinearum, but without any assumption that it is correct or final.

A. THE RUST ON EPILOBIUM (CHAMAENERION) ANGUSTIFOLIUM

Pucciniastrum Abieti-Chamaenerii Kleb. on *Epilobium angustifolium* is very abundant throughout a large part of the northern hemisphere. It is especially common wherever *E. angustifolium* occurs in the neighborhood of certain species of *Abies*, a circumstance explained by the facts that it has its haploid phase on *Abies* and that both kinds of hosts are very susceptible to infection. Incidentally it should be noted that in some instances young plants of *Abies* suffer much damage from the rust. It would make an interesting and perhaps profitable survey to determine the effect of this rust in some localities on the natural reproduction of *Abies*.

Forty years ago or thereabouts, an excellent study of the life history of *P. Abieti-Chamaenerii* was made by Klebahn (9–13). He readily secured infection on *Abies alba* Mill. and then carried the rust back to *E. angustifolium*. He also inoculated *E.* (Lysimachion) *montanum* L., *E. roseum* Schreb., *E. tetragonum* L. and *E. hirsutum* L. with aeciospores and urediospores respectively; but the results were completely negative. Fischer (4) fully confirmed the findings of Klebahn with respect to the alternation of *P. Abieti-Chamaenerii* between *A. alba* and *E. angustifolium*. Tubeuf (19) followed with inoculation experiments in which he used aeciospores naturally occurring on *A. alba*. These he sowed on *E.* (Chamaenerion) *angustifolium*, *E. Dodonaei* Vill., *E.* (Lysi-

machion) *parviflorum* Schreb. and *E. hirsutum;* infection resulted on the first two only. Bubák (2) also was successful in obtaining infection on *E. angustifolium* by using naturally occurring aeciospores from *A. alba.* In America, Fraser (5) demonstrated that *A. balsamea* (L.) Mill. is a congenial host for *P. Abieti-Chamaenerii* and he made successful reciprocal cultures. Likewise, Weir and Hubert (20–22) secured infection of *A. lasiocarpa* Nutt. after inoculations with telial material from *E. angustifolium;* they were equally successful in culturing back to *E. angustifolium.* Finally, Hiratsuka (6), in Japan, cultured *P. Abieti-Chamaenerii* of *E. angustifolium* origin on *A. Mayriana* Miyabe et Kudô.

Obviously it would be superfluous now merely to confirm again Klebahn's results. But for the purpose of the present comparative research it was essential to obtain both authentic haploid material and detailed experimental data. Accordingly careful, controlled culture work was undertaken. Complete data on the cultures made are compiled in Tables 1 and 2.

I gratefully acknowledge the assistance of Dr. G. D. Darker and Dr. E. H. Moss in making the cultures recorded in Tables 1–4.

TABLE 1

PUCCINIASTRUM ABIETI-CHAMAENERII FROM EPILOBIUM ANGUSTIFOLIUM TO ABIES BALSAMEA

1. *Thirty-seven inoculation experiments* were made under properly controlled conditions. All experiments gave positive results. All controls remained free from infection. Celluloid tubes were used as moist chambers.

2. Inoculations were begun immediately after the unfolding of the new needles. The dates ranged from June 13 to July 4.

3. The telial material used as inoculum was overwintered in net bags out of doors. Just before being used it was placed in a moist chamber and kept there 3 or 4 days, that is, until the teliospores began to germinate.

4. The spermogonia were first observed in from 10 to 14 days after inoculation. *The average was 11.6 days.*

5. The peridermia were first observed in from 15 to 20 days after inoculation. *The average was 17.1 days.*

6. The peridermia usually began to rupture the day following their first appearance.

7. The production of peridermia was practically completed in from 19 to 34 days after inoculation. *The average was 22 days.*

8. The number of infected needles per experiment ranged from 3 to 148 and the percentage of infection from 2 to 75. *The averages were 46 and 25 respectively.*

TABLE 1 (Continued)

9. All infected needles produced spermogonia; but some did not produce peridermia.

10. The number of needles with peridermia varied from 3 to 125. *The average was 40.*

11. The average number of peridermia per needle varied from 22 to 41. *The grand average was 33.*

12. The culture materials, with one exception, are preserved as specimens in the J. H. Faull Herbarium under numbers 8141–8155 and 8515–8535. They are accompanied with the detailed data in tabular form, summaries of which are given above.

TABLE 2

PUCCINIASTRUM ABIETI-CHAMAENERII FROM ABIES BALSAMEA TO EPILOBIUM ANGUSTIFOLIUM

1. *Sixteen inoculation experiments* were made under properly controlled conditions. All experiments gave positive results. All controls remained free from infection.

2. Aeciospores used as inoculum were produced on *Abies balsamea* following inoculations on that host with telial material from *Epilobium angustifolium*, except for a field source of the aeciospores, apparently of *E. angustifolium* origin, in three experiments.

3. Five of the experiments were made on undisturbed plants; eleven were made on detached leaves in Petri dishes.

4. The dates of inoculation ranged from July 5 to July 14.

5. In the experiments on rooted plants the number of inoculated leaves ranged from 4 to 14, *a total of 45 leaves.* All were infected and uredia formed on all but one of them.

6. The uredia were first observed in from 9 to 10 days after inoculation, and these matured in from 11 to 12 days after inoculation.

7. Telia formed in all of the experiments and on a total of at least 19 leaves.

8. Telia were first observed in from 23 to 30 days after inoculation. *The average was 27 days.*

9. In the experiments on detached leaves all were infected and all produced uredia.

10. The uredia were first observed in from 7 to 8 days after inoculation and these matured in from 8 to 9 days after inoculation.

11. The number of uredia per leaf varied from 50 to 219. *The average was 82.*

12. Parallel experiments throughout were made by inoculating *Epilobium adenocaulon.* In no case did infection result from inoculations with the rust of *E. angustifolium* origin.

TABLE 2 (Continued)

13. The culture materials are preserved as specimens in the J. H. Faull Herbarium under numbers 8167, 8221–8224 and 8556 (1–11). They are accompanied with the detailed data in tabular form, summaries of which are given above.

B. THE RUST ON EPILOBIUM (LYSIMACHION) ADENOCAULON

Heretofore there appears to be no published account of the life history of any *Pucciniastrum* originating on an *Epilobium* of the subgenus Lysimachion. The only known pertinent reference of positive value on the subject is a brief statement by Rhodes et al. (16) to the effect that "Bethel (in Mss.) in 1914 obtained uredinia on *Epilobium adenocaulon* from aeciospores from *Abies concolor*."

For the present research, *E. adenocaulon* was chosen because of its abundance in the same region as that in which my experimental material of *E. angustifolium* grew. Moreover, both hosts were everywhere heavily rusted. Relative to the rust on *E. adenocaulon* it has been somewhat of a surprise to learn from the literature that its telia are held to be rare or entirely lacking. Thus Weir and Hubert (21) state that "the fact that this form of the rust" (that is, *P. pustulatum*) "on *E. adenocaulon* produces no telia is evidence of its continuation in the uredinial stage and also explains the absence of a corresponding aecial stage upon Abies." Weir and Hubert are in error on both counts. Out of 11 field collections in my own herbarium all 11 of them carry telia. These come from Alberta, New Brunswick, Ontario, Quebec, Wisconsin and Wyoming. Seven of them were collected in the month of August — two in the first half of the month and one of them as early as August 1. Three were collected in September, the latest on September 14, and one was collected on July 12. Moreover, the telia in many of the collections are conspicuous and often exceedingly abundant on leaves as well as on stems. Likewise telia developed in such of my cultures as were left intact for little more than 30 days. As for the impression that the haploid phase does not occur on *Abies*, that is groundless. *Abies* is highly susceptible to the *Pucciniastrum* on *E. adenocaulon*, as can be inferred from the data embodied in Table 3. Attention is also drawn to the fact that Bethel, as referred to above, apparently found a natural occurrence of this rust on *Abies concolor*.

The rust for my experiments, for convenience designated here by the name *Pucciniastrum Epilobii* Otth apud Sydow, originated in the telial stage on *E. adenocaulon*. Cultures were first made on *Abies balsamea* and then aeciospores thus obtained were sown back on to controlled,

rust-free plants of the original host, *E. adenocaulon*. The data are summarized below in Tables 3 and 4.

TABLE 3

PUCCINIASTRUM EPILOBII FROM EPILOBIUM ADENOCAULON TO ABIES BALSAMEA

1. *Thirty inoculation experiments* were made under properly controlled conditions. All experiments gave positive results. All controls remained free from infection. Celluloid tubes were used as moist chambers.

2. Inoculations were begun immediately after the unfolding of the new needles. The dates ranged from June 9 to July 3.

3. The telial material used as inoculum was overwintered in net bags out of doors. Just before being used it was placed in a moist chamber and kept there 3 or 4 days, that is, until the teliospores began to germinate.

4. The spermogonia were first observed in from 9 to 15 days after inoculation. *The average was 11.1 days.*

5. The peridermia were first observed in from 18 to 29 days after inoculation. *The average was 20.1 days.*

6. The peridermia usually began to rupture the second day following their first appearance.

7. The production of peridermia was practically completed in from 24 to 44 days after inoculation. *The average was 29 days.*

8. The number of infected needles per experiment ranged from 8 to 121 and the percentage of infection from 4 to 57. *The averages were 49 and 24 respectively.*

9. All infected needles produced spermogonia; but some did not produce peridermia.

10. The number of needles with peridermia varied from 2 to 112. *The average was 39.*

11. The average number of peridermia per needle varied from 20 to 37. *The grand average was 27.*

12. The culture materials are preserved as specimens in the J. H. Faull Herbarium under numbers 8156–8157, 8513–8514 and 9585 a-z. They are accompanied with the detailed data in tabular form, summaries of which are given above.

TABLE 4

PUCCINIASTRUM EPILOBII FROM ABIES BALSAMEA TO EPILOBIUM ADENOCAULON

1. *Ten inoculation experiments* were made under properly controlled conditions. All experiments gave positive results. All controls remained free from infection.

2. Aeciospores used as inoculum were produced on *Abies balsamea* fol-

TABLE 4 (Continued)

lowing inoculations on that host with telial material from *Epilobium adenocaulon*.

3. Six of the experiments were made on undisturbed plants; four were made on detached leaves in Petri dishes.

4. The dates of inoculation ranged from July 11 to July 29.

5. In the experiments on rooted plants all inoculated leaves became infected and all bore uredia.

6. The uredia were first observed 7 to 11 days after inoculation. *The average was 8.7 days.* These matured in 9 to 12 days after inoculation. *The average was 9.7 days.*

7. Telia formed within 34 days after inoculation.

8. In the experiments on detached leaves all were infected and all produced uredia.

9. The uredia were first observed in from 9 to 10 days after inoculation, and these matured in from 10 to 11 days after inoculation.

10. The number of uredia per leaf on the rooted plants varied from 63 to 800. *The average was 214.* The number of uredia on the detached leaves varied from 52 to 230. *The average was 165.*

11. Parallel experiments throughout were made by inoculating *Epilobium angustifolium.* In no case did infection result from inoculations with the rust of *E. adenocaulon* origin.

12. The culture materials are preserved as specimens in the J. H. Faull Herbarium under numbers 8220, 8557 (1–5) and 9595 (1–4). They are accompanied with the detailed data in tabular form, summaries of which are given above.

C. OBSERVATIONS ON BIOLOGY AND MORPHOLOGY OF THE TWO RUSTS

It is plain from the data recorded above (Tables 1 and 3) that the Pucciniastrum rusts on *Epilobium angustifolium* and *E. adenocaulon*, respectively, can readily and abundantly infect the new foliage of *Abies balsamea*. Similarly, they can as easily be carried back from *A. balsamea* to their original Epilobium hosts. But all attempts to establish the rust of *E. angustifolium* origin on *E. adenocaulon*, whether by means of aeciospores or urediospores, completely failed. So, too, it was impossible to bring about infection of *E. angustifolium* with the rust of *E. adenocaulon* origin. In other words, these rusts are physiologically differentiated from one another with respect to their infective capacity. Along with this biological specialization there also exist, as we shall now see, certain differences in habit and in form.

Since comparisons of the growth habits of rust fungi are not taxo-

nomically usable unless the environmental growth factors have been identical, the observations noted here are perforce restricted to the haploid phase, that is, to the phenomena manifested on the common host, *Abies balsamea*. Obviously comparisons are pointless that are based on the diploid phase occurring on separate specific hosts, such for example as those advanced by Sydow (18) in justification of his recognition of *Pucciniastrum Abieti-Chamaenerii* and *P. Epilobii* as distinct species. With respect to the rusts of the present research, the differences observed on *Abies balsamea* may be summarized as follows. (1) The rust from *Epilobium angustifolium* produces peridermia within an average of 17 days after inoculation; the rust from *E. adenocaulon* requires an average of 20 days. (2) The average time for approximately complete development of its crop of peridermia is 22 days in the case of the first and 29 days in the case of the second. (3) The average numbers of peridermia per infected needle are 33 and 27 respectively. (4) In general the *E. angustifolium* rust occurs more frequently and more severely on the needles of the upper part of the current season's growth; the *E. adenocaulon* rust is localized more often on the lower part of the current season's growth.

Turning next to comparisons of form, it has been found that some differences exist between the *E. angustifolium* and the *E. adenocaulon* rusts. The spermogonia were studied comparatively by Hunter (8). The materials examined by her were taken from the cultures reported above. They were suitably fixed when fresh, embedded in paraffin and sectioned. Hunter concluded that the spermogonia of the respective forms cannot be distinguished from one another with certainty. The aecia, on the other hand, do show some differences. As a rule those of the rust originating on *E. angustifolium* are narrower, varying from 0.012 to 0.025 mm. in diameter; the peridium is fragile and soon breaks down; the aeciospores average about 15 × 19 μ and they are very finely warted. The peridermia of the rust originating on *E. adenocaulon* vary from 0.02 to 0.04 mm. in diameter; the peridium is quite persistent; the spores average about 14 × 18 μ and are subcoarsely warted. As for the diploid phase, the teliospores of the two rusts show much the same range of organization, size and form. But the urediospores of the *E. angustifolium* rust are broader than those of the *E. adenocaulon* rust. They average about 16 × 19 μ in size as compared with about 14 × 19 μ for the latter. The walls, too, of the peridial cells are quite distinctive. They measure up to 1.5 μ in thickness for the *E. angustifolium* rust and up to 2.5 μ for the *E. adenocaulon* rust.

With these physiological and morphological data in hand, we can

now deal with the taxonomy of the Pucciniastrum rusts on *Epilobium angustifolium* and *E. adenocaulon* on surer grounds than has heretofore been possible. Unquestionably they should be nomenclatorially differentiated, whether as forms or varieties with trinomial designations, or as species with binomials. The latter is certainly the simpler procedure and in practice the more expedient at present. For my own part I am inclined to accept the Sydow point of view, as also that of Klebahn and certain others, in recognizing two distinct species of *Pucciniastrum* on *Epilobium,* and to tentatively refer the one species to Chamaenerion hosts and the other to Lysimachion hosts. Just what names should be adopted, however, is another matter.

As for the Lysimachion rust, Sydow chose the name *Pucciniastrum Epilobii* Otth; but he did so apologetically because it seemed probable that Otth's material was the rust on *E. angustifolium.* Of course DeCandolle (3) had long since coined the name *Uredo Epilobii* for the Pucciniastrum rust on the Lysimachion host *E. tetragonum.* But doubtless Sydow, in accordance with his own interpretation of the International Rules of Nomenclature, did not feel bound to accept DeCandolle's specific name because DeCandolle, in connection therewith, made no mention of teliospores. But why not accept the name *Pucciniastrum pustulatum* (Pers.) Dietel in part? Persoon's name likewise referred to a rust on a Lysimachion host (*E. montanum*). True he, too, made no mention of teliospores, but the specific name would seem to have been validated by Dietel, quite in accord with Sydow's legalistic conceptions, even though Dietel did extend its applicability to the rust on Chamaenerion hosts.

As for the Chamaenerion rust, the nomenclatorial tangle is perhaps even more involved. But as the specific names referred to above were based, though fortuitously so, on Lysimachion host material, they can well be dropped from consideration. Actually Rostrup (17) was the first to claim that the Chamaenerion rust was not identical with the Lysimachion rust. Accordingly he gave to it the specific name "Chamaenerii," but without description. That brings us to Klebahn (13). From his experimental results he reached the same conclusion as Rostrup and described the Chamaenerion rust under the name *Pucciniastrum Abieti-Chamaenerii.* Sydow accepted Klebahn's findings and this choice appears to be entirely justifiable.

SUMMARY

1. Approximately 40 species of *Epilobium* (Chamaenerion and Lysimachion) have at one time or another been listed as hosts of Puccinias-

trum rusts. Investigators in Europe, America and Japan have demonstrated that the form on *E. angustifolium* passes to *Abies*. It also passes to two other species of Chamaenerion. Inoculations on several species of Lysimachion gave negative results. No other significant experimental work has been done. In consequence, taxonomic conclusions have been clouded and certain economic considerations subject to surmise.

2. This paper records for the first time the complete life history of a *Pucciniastrum* from a Lysimachion host (*E. adenocaulon*). It develops its haploid phase on *Abies balsamea*.

3. Tests made at the same time show that the *E. angustifolium* rust does not cause infection of *E. adenocaulon;* nor does the *E. adenocaulon* rust cause infection of *E. angustifolium*.

4. This specialization in infective capacity is accompanied by differences in habit on the common host *Abies balsamea* and by morphological distinctions for both the aecia and the uredia of the respective rusts.

5. These rusts, therefore, should be nomenclatorially differentiated, whether as forms or varieties, or as distinct species. Specific recognition is preferable. For the rust on *E. angustifolium*, the name *Pucciniastrum Abieti-Chamaenerii* Kleb. seems to be acceptable, and the name *P. pustulatum* (Pers.) Diet. in part, for the one on *E. adenocaulon*. Further culture work may show that the former is restricted to Chamaenerion hosts and the latter to Lysimachion hosts.

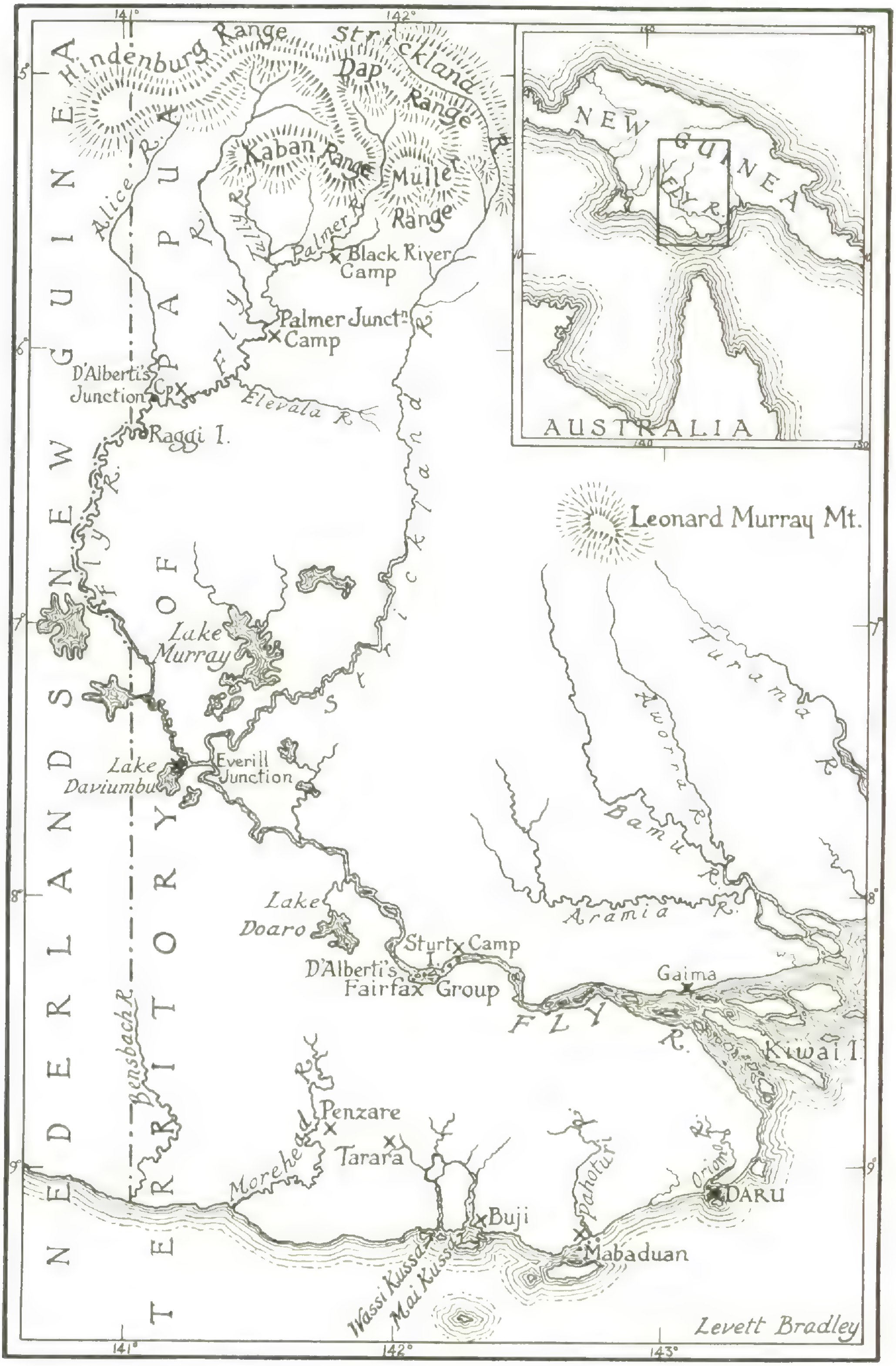
6. Field experience and controlled cultures prove that *Abies balsamea* is highly susceptible to these rusts. They often cause severe damage to young trees of *A. balsamea* where the corresponding rusted Epilobium hosts occur.

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MAP OF THE FLY RIVER REGION, BRITISH NEW GUINEA

BOTANICAL RESULTS OF THE ARCHBOLD EXPEDITIONS, IX

NOTES ON THE VEGETATION OF THE FLY AND WASSI KUSSA RIVERS, BRITISH NEW GUINEA

L. J. Brass

With plates 221–223 and map

The following notes are based on observations made in the course of the aërial reconnaissance flights and ground operations of the 1936–37 Archbold Expedition to New Guinea. They are to be regarded as supplementary to a general account of the expedition prepared for publication by Messrs. Richard Archbold and A. L. Rand. In the present account an attempt is made to give a broad outline sketch of the vegetation of the territory visited and brief descriptions of the principal plant communities. The plant names cited rest on sight determinations made by the writer in the field. Identifying numbers, e.g. *Calamus* 7492, represent botanical field catalogue numbers of the expedition.

The areas under more particular discussion are the drainage basins of the Fly and Wassi Kussa Rivers; but in order to show these areas in their proper perspective, the view is extended to include the whole of the Western Division of the Territory of Papua, formerly known as British New Guinea. This comprises an area of roughly 40,000 sq. miles, mostly ridgy or hilly lowlands, of which approximately two-thirds is occupied by the Papuan part of the Fly River basin. It is bordered on the east by the Delta Division of Papua, and to the west is Dutch New Guinea. The high backbone range of the island forms the approximate boundary with North-east (Mandated) New Guinea on the north. To the south are the Arafura and Coral Seas, and between them the island-studded Torres Straits, which separate the island of New Guinea from Australia.

Daru Island, seat of administration for the Western Division, may be taken as a convenient station for broad comparisons of climate in terms of rainfall and more especially as some sort of basis for indicator types of vegetation. Average annual rainfall at Daru is 73.93 inches or 1868 mm. (10 year period 1927–36). The vegetation is tall savannah-forest composed of *Eucalyptus* spp., *Tristania suaveolens* and varieties of *Melaleuca Leucadendron*, with *Themeda triandra* and *Ophiurus exaltatus*

dominating the ground cover. The presence of primary savannah vegetation under such moderately high rainfall might be explained by the marked seasonal nature of the rains; precipitation for the driest half-year, June to November, being only 23.5% of the annual total.

Practically the whole area of the Western Division is occupied by rain-forests and savannah grasslands and their primary developmental units. Little disturbance has been caused by native populations. This is due to the fact that sago, manufactured from the pith of a swamp-forest palm (*Metroxylon*), and obtained without damage to the forests, is the staple article of food over most of the country. Agriculture is practiced chiefly by the more scattered peoples, and that by shifting patch methods which as a rule leave only temporary holes in lowland forest and have little effect whatever upon savannah types of vegetation. In the mountains, however, at elevations of 1000 to 2000 m., considerable areas of deforested valley land, overrun by tall grass (*Miscanthus japonicus?*), were seen from the air.

Dense rain-forests extend from the high mountains to the sea on the eastern boundary, across which, in the Delta Division, rainfall reaches the very high average of 240 inches (6296 mm.) at Kikori. With a change to climatic dryness west of the Bamu River estuary the rain-forests, considered as an unbroken body, are deflected inland along the north bank of the Aramia tributary of that river and thence up the east bank of the Fly, which they appear to cross in a resumed westerly trend at about 7° S. latitude. Between the Aramia and the parallel north bank of the Fly River estuary is a confused, mostly swampy area of fragmented dry-land rain-forest, successional swamp-forests and open swamps of reeds and sedges, besides numerous small patches of savannah-forest and apparently natural open savannah. Aërial observations show that the southern limits of the great rain-forests, and therefore the higher rainfall area of the Western Division, conform to the outline of a hill system of moderate elevation and hitherto unsuspected extent drained by the Turama, Bamu and Aramia Rivers and lateral feeders of the Strickland and Fly. The rain-forests are predominantly Malaysian in character and origin and contain many genera and not a few species of wide geographical range.

Very different conditions prevail in the triangle of roughly 10,000 sq. miles enclosed between the west bank of the Fly, below the "Dutch Bend," and the southerly border of Dutch New Guinea. Direct observations by the expedition cover less than half this area, but all the available information points to it being essentially a dry area of low ridges and extensive flat lands supporting savannah or savannah-forest types of

vegetation. The westward continuation of these savannahs covers a large area in Dutch New Guinea. Lam[1] mentions a rainfall of about 60 inches (1528 mm.) for Merauke, situated near their western limit. Rain-forests find opportunity for establishment as fringing strips along the streams and in isolated patches on ridges, where, under favorable conditions, they contrive to hold their own against the climatic grasses. The savannah formation represents an extension to New Guinea of the "open forests" of the Australian continent. Differentiation from the parent type has been so slight that it is doubtful if the rather extensive collections of the expedition contain a single true savannah tree of a species not already known from Australia. The savannahs and savannah-forests referred to above differ only in tree spacing and local variation in composition. Their dominant grasses are the same, and so are the trees. The view is taken that, regardless of tree population, the grasses control the habitat and therefore dominate throughout.

Little can be said of the mountain flora of the area under discussion. The expedition plant collections are all from elevations under 250 m. The mountains of the northern border rise to about 4000 m., and on them may be expected to occur the various mountain plant formations known to exist elsewhere in New Guinea, viz. mid-mountain forest (Fagaceae), mossy-forest (*Xanthomyrtus-Phyllocladus*), subalpine forest (*Vaccinium-Dacrydium*), and alpine grassland (*Aulacolepis-Poa-Danthonia*). Mossy-forest was distinguished in a number of places above 1500 m. on the slopes during the expedition's aërial exploration of the ranges, and alpine grassland observed at about 3300 m. on the Dap Range. Also, the discovery in rain-forest of two species of *Quercus* on the Black River may be taken to indicate the presence of mid-mountain oak forests at appropriate levels between the upper limits of the rain-forests and lower limits of the mossy-forests.

The rivers bring down great quantities of free earthy matter which is deposited in the form of mud in the tidal zone. East of the Fly, extensive swampy plains appear (from the air) to have been formed of this material, and it is spread in at least a thin veneer along the whole length of the drier western coast. Occasional sandy stretches carry sand-beach vegetation characterized by *Calophyllum Inophyllum* and *Ipomoea pes-caprae;* but these are unimportant gaps in the mangroves which otherwise fringe the coast. The mangrove forests seem seldom to exceed a few hundred metres in width. They are commonly reduced to a narrow, half-starved strip on meagre soils in the west, while an excess of fresh water severely limits their development and area in the great estuaries and coastal swamps of the east.

[1]Blumea, **1**: 123 (1934).

Freshwater swamp-forests of several types occur. One of the most important swamp-forest species, a large tree (n. 6465) forming extensive pure stands remarkable for their brown appearance from the air, is apparently confined to the coast. Others, such as Anacardiaceae? 7117, seem peculiar to the interior. *Melaleuca Leucadendron* extends from the coast far inland, appears to represent a stage in the development of both savannah- and rain-forest, but does not penetrate far into the higher rainfall area. Most important, perhaps, in respect of area, are the sago forests, which occur from almost sea level to roughly 1000 m. elevation in the mountains. Extensive open swamps of reeds, sedges and floating grass, broken by lagoons, are a feature of the Aramia River and the middle course of the Fly.

According to the latest and perhaps most reliable maps, the Fly is about 72 km. (45 miles) wide at the mouth, and, on the evidence of the mangroves, it is subject to tidal rise and fall as far as Ellengowan Island, a distance of 320 km. (200 miles) from the sea. This section, the "lower river," is densely forested along the banks. The banks are of grey mud and silt-loam, sharp-cut or sloping according to the erosive or accresive action of local currents, with here and there contrasting banks of red clay indicating pimples of dry ground or the presence of ridges concealed behind the narrow flood-plain. Numerous shifting islands, covered with forest, obstruct the channel and protrude fan-wise from the mouth.

The density and all pervading appearance of the mangroves about the river mouth gives a false impression of the extent of these forests inland from the banks. They constitute the bulk of vegetation on the smaller estuarine islands and particularly the newer ones, and in the aggregate their area is great, but the larger islands, such as Kiwai and Purutu, are permanently swampy in the interior and covered with sago forests, with mangroves and transitional rain-forest round the edges. As the water becomes brackish within the river the mangroves are partially replaced by *Nipa fruticans* as fringe vegetation. At 40 km. from the mouth the water is quite fresh and *Sonneratia lanceolata* (freshwater or firefly mangrove) assumes prominence on the mudbanks. Ellengowan Island marks the apparent limit of this species and of a gregarious *Pandanus* also peculiar to tidal mudbanks. The absolute limit for littoral plants other than mangroves, e.g. *Hibiscus tiliaceus*, must, however, be extended inland a further 300 km.

Mixed rain-forest follows the mangroves directly in flood-plain succession; very tall, specialized forests, adapted to a high watertable, in which much prominence is attained by a few characteristic species. Chief among these are towering, flat-topped *Terminalia* 8027, *Ficus* 8047 with

pale brown bark and cauliflorous receptacles, *Octomeles sumatrana*, and species of Meliaceae and Anacardiaceae. *Pandanus Copelandi* supplies an abundant low substage on muddy ground, and a graceful betel-nut palm (*Areca macrocalyx*) grows in great numbers elsewhere. Typical tall palms include *Gulubia costata* and *Phytococcus* sp., and a most aggressive scrambling *Calamus* (n. 7326) forms impassable tangles along the river banks. Other distinguishing features of the flood-plain forests are the paucity or entire absence of herbaceous ground cover, the generally clean-washed appearance of the soil surface, prominent buttressing, and the development of elaborate systems of aërial roots by some common trees. *Myristica* 8008, with its spreading Rhizophora-like aërial roots, might easily be mistaken for a mangrove, especially as it dominates the forest in sections subject to flooding by normal high tides, and has associated with it *Bruguiera gymnorrhiza*, the only species of Rhizophoraceae found at any distance above the estuary.

At Gaima Camp, 72 km. (45 miles) from the coast on the left bank, we found a country of flat though well drained low ridges, intersected by swampy watercourses filled with sago-palms, reeds and sedges. The dry land positions are shared about fifty-fifty by rain-forest and savannah-forest. Though tall and well grown in some parts, the rain-forests show poor structural development, are poor in species, and reflect in their general aspect conditions of rainfall/evaporation unfavorable for a proper development of this type of vegetation. *Eugenia* 8314, *E.* 8283, *E.* 8014, *Calophyllum* 8337 and *Alstonia* 8335, all with thick, rough or corky bark, may be mentioned as characteristic large trees. *Pandanus* 8052, with narrow leaves, is a striking feature of the lower substage; prickly juveniles of *Calamus* 7492, sole representative of the "lawyer canes," forms a thick undergrowth in many parts; and one or two hardy ferns typify a sparse and scattered ground flora. *Eurycles amboinensis* is conspicuous in moist grassy borders, and produces a fine show of white umbellate flowers after the onset of the November storms.

The Gaima savannah-forests may be regarded as reduced outposts of the western savannah formation; the first definite record of its extension east of the Fly. They vary considerably in density and height growth and to a certain extent in composition. *Eucalyptus* is not present. The principal tree is a silver pubescent form of *Melaleuca Leucadendron* (n. 8247) with grey papery bark more fibrous than is usual in the species. This forms picturesque open stands 25 to 30 m. high. The dominant grass is *Ophiurus exaltatus*, 2 m. high when flowering, with which occurs a limited assortment of smaller grasses, sedges and flowering herbs. It should be mentioned that the polymorphic *Melaleuca Leucadendron* is

represented by at least six forms in Western Papua; two of them swamp trees, the others inhabitants of dry savannah.

Besides frequent sago-swamps in or adjacent to rain-forest, and odd plots of *Melaleuca* swamp-forest, there occur inland from the river large open swamps which furnish good examples of pure stocking by *Scleria oryzoides*, a large brownish sedge of wide range as a lowland swamp dominant in the Western Division. One large swamp, partly dry through evaporation shrinkage, carried a very distinctly zoned population of *Restio* 8354, *Lepironia* 8355, *Scleria oryzoides*, and finally *Hanguana malayana* in the deepest parts habitable by other than floating plants.

The main lower river camp of the expedition was situated opposite Sturt Island (Fairfax Group), 120 km. above Gaima and on the same side of the river. This was in ridgy country rising to about 80 m., swampy in the hollows, and entirely rain-forested, if the term is used in a broad sense to include priseral communities. Only small patches of secondary forest were found. Inland succession in the hydrosere appears to be from reed-swamp to sago, *Melaleuca*, and *Erythrina* swamp-forest, in that order. The freshwater mangrove and river flood-plain forests which lead up to fully developed rain-forest have already received mention. Fine stands of flood-plain forest cover the river islands in this locality.

Melaleuca Leucadendron var. 8147 is the local representative of the species. It forms quite pure forests of close-spaced slender trees 30–35 m. high, in which a curious gloom results from shading by the climbing fern *Stenochlaena* 8148, whose appressed rhizomes and glistening radial fronds encase each tree in a columnar mass to a height of 20 or 25 m. A solitary moss species, growing on peaty mounds of fern roots raised around the butts of the trees, and on decaying wood, constitutes the normal ground flora. Swamp-forests dominated by *Erythrina* 8107 differ radically in character in having a high, broken canopy, beneath which flourish subsidiary trees of various ranks and species (e.g. *Sarcocephalus* 8233, *Lagerstroemia* 8160, *Hibiscus tiliaceus*) and a tall sedge undergrowth of *Hypolytrum* 8118 from 2 to 3 m. high. Both types were practically dry in October. In the sago forests the ground is always wet, if not actually under water. Shading is generally fairly complete and undergrowth limited to scattered broad-leaved sedges. Patches of open water are often green with a film of floating *Lemna*. The air is heavy with the sour pungent smell of the pithy sago stems, which collapse and rot in the swamp after ripening fruit and shedding their immense prickly leaves; and objectionable gases bubble to the surface of stagnant pools

and are released in quantity upon any slight disturbance of the underlying mud.

Common large trees of the main ridge forests include *Pterocarpus indica*, and species of *Eugenia*, *Dysoxylum*, *Flindersia*, *Ficus*, Lauraceae and Leguminosae. *Garcinia* is well represented in the lower tree layers, and Annonaceae in the liane flora. An open undergrowth characterized by palms, chiefly *Licuala* 8168 and *Orania* 8184, offers little obstruction to progress through the forest. The few epiphytic ferns and orchids found in the locality are almost restricted to trees overhanging the river, and the xeromorphic character and extreme scarcity of herbaceous undergrowth further emphasizes the dryness of the climate.

An approach to monsoon-forest conditions is reached on the drier ridge crests, where thickets of semi-scandent bamboo or high substage stands of clumped bamboo are overtopped by *Acacia Mangium*, *Kleinhovia hospita* (also in swamps), *Cassia Bartoni*, and the very large deciduous trees *Bombax malabathricum* and *Aleurites moluccana*.

Above Ellengowan Island are the swampy reed plains of the "middle river" region, through which the river cuts a tortuous course for approximately 290 km. (180 miles) from its point of emergence from the outer foothill rain-forests of the headwater range. Rain-forests lie close to the river or even touch upon its banks for much of the distance up to the Strickland junction on the east side. On the west side the swamp continuity is broken occasionally by extensive plains covered with scrubby *Banksia dentata* and an inland tea-tree (*Melaleuca Leucadendron* var. *Cunninghamii?*), indicating sour, wet, but not permanently swampy ground. Above the Strickland the swamps seem equally broad and carry similar vegetation on both sides of the river. In this section a series of large lagoons, only partly shown on the maps, lies parallel to the western side. Some of these lagoons are old cut-offs of the river, and others, of irregular outline, seem to occupy natural basins in a country of partially drowned lateritic ridges, savannah covered for the most part, and rising to a maximum of about 30 m. The magnificent pink lotus, *Nelumbium speciosum*, spread over acres of quiet grass marsh, is a notable feature of the lagoon area. Savannahs of tall fan-palms (*Livistona Brassii* and perhaps also *L.* 8645) are another striking feature of this section.

Much the largest part of the area, as seen from the river, consists of flat expanses of reeds stretching out several miles to a low horizon of timbered ridges. Continuous brakes of a primitive sugarcane (*Saccharum* 6582), 3–5 m. high, line the river. The banks of grey silt rise seldom more than 1 to 1.5 m. above what would appear normal river

level, and tend to be elevated in natural levees behind which waters from freshets and floods (we saw no signs of high flooding) are impounded to form the swamps. Strips of waterlogged rain-forest occur on the levees. Other strips and patches scattered about the plains, together with groves of tall bamboo probably planted by natives, indicate the position of rare island ridges and of former levees, for the river is constantly changing its course and forming new bends and cut-offs. Various slender trees (e.g. *Melaleuca Leucadendron*, Rubiaceae 7678, Anacardiaceae? 8292) combine with the reeds to form swamp-savannahs and under more favorable conditions, swamp-forests with reeds for undergrowth. Other swamp trees, richly branched and hung with a yellow *Ipomoea* and other vines, form attractive park communities in the vicinity of rain-forest. Swamps of *Scleria oryzoides*, and deeper ones covered with floating grass (*Leersia* 6585), occupy considerable areas. This rampant *Leersia* is generally present along the riverbanks as an outer strip fronting the cane brakes, and it plays a very important part in choking the entrances to cut-offs and in the subsequent reclamation of these old channels. On the other hand, by blocking the mouths of affluent streams and inducing a rapid deposition of water-borne silt therein, it helps to initiate and maintain swamp conditions behind the levees.

The expedition camp at Lake Daviumbu, situated in the lagoon area about 6 km. above the junction of the Strickland, furnished examples of all types of open marsh and swamp, besides rain-forest on the ridges and much larger areas of dry savannah. The lake is a fine sheet of clear, brown-black water up to about 6 km. in length and 4 km. in greatest width, containing numbers of picturesque islands, forested or covered with bamboo, on which the semi-nomadic natives plant small gardens of sweet-potatoes, bananas and tobacco, and establish dry-season camps subsidiary to their central island village. The shoreline is irregular with deep bays which tail off into swamp-forests of tea-tree and sago or are filled with floating grass. The bottom of the lake is remarkably uniform at soundings round about 2 fathoms.

A certain poverty in species of aquatic and amphibious plants is in some measure compensated by the abundance in which most of them occur as individuals. About 40 species appear in the collections; the most important in respect of local area being the deep water *Leersia* previously mentioned. *Leersia* 7601 and *Oryza* 7564 (wild rice) also occur plentifully as floating grasses, the former constituting a lakeshore fringe up to 100 m. wide, the latter practically confined to positions undisturbed by currents or wave action. Floating plants of the open water comprise several *Nymphaea* spp. with white, blue or pink flowers,

and *Limnanthemum indicum*. Hydrocharideae (*Blyxa, Vallisneria*), and in quiet water several species of *Utricularia*, occur in great abundance as submerged aquatics.

In the tradewind season large quantities of hydrocharids, broken and uprooted by choppy seas, drift about the lake to be eventually deposited on the shores or cast up on the outer edge of the floating grass fringe. After windy spells this drift may be seen floating off shore in long booms held together by grass stems rolled back by the waves. Further wave action either destroys the booms or adds to their bulk. In the latter case colonization is effected by sedges and *Isachne* 7602, which form the nucleus of remarkable floating islands of plants normally amphibious, ferns, and even woody plants and orchids, apparently of dry land terrestrial and epiphytic stock but encountered nowhere else in the locality. Species of the floating communities include *Hypolytrum* 7634, with broad leaves erect to 2 m., *Cyperus* 7631, *Heleocharis* 7630, *Fuirena* 7632, *Hanguana malayana, Stenochlaena* 7648 tangled and matted to a height of 1.5 m., *Dryopteris* 7629, *Nephrolepis* 7706, *Acrostichum aureum?* (n. 7722), *Rubiaceae* 7650 (shrub) and *Nepenthes* 7707. It is possible to walk about dry-footed on the most stable islands. They retain as a rule their original position in relation to the shore, apparently anchored in 1 to 1½ fathoms by the roots of the larger plants; but from the position of some it is evident that they have at some time broken their moorings and, after drifting about the lake, become stranded on shoal ground. The buoyant substratum consists of peaty plant remains, chiefly roots and rhizomes of ferns, and the air-filled roots of the living plants.

The Daviumbu rain-forests are of poor quality. An abundance of "outskirt" species within the forests testifies to the unsuitability of the climate for rain-forest, and the virtual absence of genera such as *Freycinetia* and *Calamus* (1 species each), and the extreme poverty in epiphytes and herbaceous undergrowth provides further proof of dry conditions. The forests consist of a few large rough-barked supercanopy trees (notably *Eugenia* 7491 and *Calophyllum* 7589) widely spaced and rising incompletely above a very mixed canopy layer, 20–25 m. high, including *Eugenia* spp., *Elaeocarpus* spp., *Artocarpus* 7496, *Flindersia* 7517, *Gnetum gnemon, Rhodamnia* spp., *Podocarpus Blumei*. There is a rich assortment of trees in ill defined lower layers; and a varied complement of large lianes, such as *Gnetum latifolium, Calamus* 7492, *Entada scandens*, and *Mussaenda, Uncaria, Tetracera, Hugonia* species. *Pandanus* spp. (four) and red-flowering *Barringtonia?* 7475 characterize a tall undergrowth of slender small trees, beneath which is in some parts

a fairly plentiful low ground layer of the harsh fern *Syngramma?* 7455.

Mention may be made here of a peculiar low forest community which is frequently to be found inhabiting temporary swamps and the edges of fluctuating waterholes in the dry area of the Western Division. The tree species concerned is deciduous *Barringtonia* 7914, with which is sometimes associated *Mangifera* 8462. The *Barringtonia* bears pendent racemes of red flowers and small quadrangular fruit, and is typically a compact thrifty-looking tree about 4–6 m. high. Fleshy sun-epiphytes such as *Hydnophytum, Myrmecodia, Dischidia, Hoya,* the ferns *Polypodium sinuatum* and *Cyclophorous acrostichoides, Dendrobium Smilliae* and other orchids, crowd its branches. The community is conspicuous at Lake Daviumbu as a shoreline fringe or scattering of small epiphyte-laden trees. The level of the lake fluctuates slowly in accordance with the state of the river, with which it is connected by narrow channels. Many of the great lagoons of the Aramia and Middle Fly are similarly connected and serve as storage reservoirs regulating the flow of the rivers.

With the exception of *Eucalyptus,* all the genera and most of the species of coastal savannah trees extend to this far inland locality. Local variations in type range from very open or quite treeless wet plains to 20 m. high pure forests of *Tristania suaveolens* fringing the lake. On the drier ridges are open tall-grass low-tree savannahs with a tree stocking of *Banksia dentata, Melaleuca Leucadendron* var. *sanguinea, Grevillea glauca,* and stunted *Tristania suaveolens, T. longivalvis, Parinarium nonda, Careya australis, Deplanchea tetraphylla,* etc., up to 7–8 m. high. *Ophiurus exaltatus* is the chief species on a mixed cover of upright, tufted grasses. On low-lying country the tuft grasses are replaced by a frightfully matted growth of *Ischaemum* 7528, dead and rotting underneath and tunnelled by the tracks of wallabies and wild pigs. Extensive low ridges carry little else besides this grass and gnarled *Banksia* and *Grevillea* 3–5 m. high. The savannahs of wet, hummocked plains are somewhat distinct from other local types of grassland. Here the chief trees are *Fagraea racemosa* and *Timonius* sp., xerophytic *Pandanus* 7931 is common, and innumerable white heads of an *Eriocaulon* and the pitchers of *Nepenthes* spp., raise themselves above the grass. Treeless wet plains in the vicinity of Kakati sub-camp carry a partial cover of *Ischaemum* and smaller associate grasses and especially sedges growing on the hummocks, while other sedges and many small herbs, e.g. *Eriocaulon, Utricularia, Centrolepis, Goodenia, Xyris, Polygala, Burmannia, Drosera,* occupy the mucky brown soil of the interspaces. The Kakati collections may be expected to yield a number of additions to the known grassland flora of Western Papua.

For a long distance above the commencement of the upper river rain-forests the river is flanked by old cut-offs and fringed with grass and reeds along the banks. Much of the country is low and apparently subject to flooding, for the large *Calamus* and familiar flood-plain trees of the lower river occur in quantity. Gradually the grass and reeds of low banks are replaced by woody plants, and from about D'Albertis Junction to the first rapids at Macrossan Island these form densely interlocked shrubberies, about 3 m. high, over which it is easier to scramble than to cut a way through. *Uncaria?* 7439, *Laportea* 7434 with stinging leaves, *Mussaenda* sp., *Macaranga* 7435, and a species of Acanthaceae constitute the bulk of these shrubberies. The country above Macrossan Island is definitely hilly, beaches of sand and gravel appear in the river, the banks are higher, and a general change in character is observable in the vegetation. Flood-resistant eugenias with horizontal branches and lanceolate leaves occupy the beaches; and rocky promontories are crowded with these small trees, elatostemas and ferns. Canegrass thickets reappear at the Black-Palmer Junction, where beaches of loose limestone gravel are occupied by tall growths of *Saccharum* 6957.

Though greatly improved in height and volume, and enriched by the entrance of hill species, the ridge forests at Oroville Mining Camp, about 48 km. (30 miles) above D'Albertis Junction, are essentially similar to those of the middle and lower river. Species of *Eugenia,* a genus prominent at Lake Daviumbu, Sturt Island and Gaima, here attain actual dominance and lend their own peculiar character to the forests. They are, therefore, forests of rough-barked, semi-hardwood trees. The trees stand wide apart, develop massive branches, and approach 40 m. in height. Underneath is a very open low substage and undergrowth characterized by palms and *Pandanus,* largely of species ranging to Lake Daviumbu, Sturt Island and even Gaima. Filmy ferns make their first appearance as epiphytes. *Agapetes* 7393 with orange-red flowers and white-flowering *Vaccinium* 7404 are interesting occurrences as canopy lianes.

From a comparison of the forests, and our experience of the climate during seven months spent on the river, it would seem that Oroville occupies a critical position at or about the junction of two very different types of rain-forest, viz. forests of a medium to low rainfall region reaching to the coast (perhaps skirting the eastern hill system), and forests of a high rainfall region extending to the mountains. The change is influenced not so much by increased total rainfall as more even distribution of the rains throughout the year. The first region experiences long dry spells in the southeast tradewind season, during which the second region

benefits from an ample and consistent rainfall. Rainfall periodicity in the southeast season is the standard by which the Papuan (S. E. New Guinea) climate is determined. Even the driest savannah districts receive abundant rains throughout the northwest monsoons. Annual rainfall at Oroville is said by the miners to be about 100 inches.

The expedition camps near the Fly-Palmer Junction (80 m. alt.) and on the Palmer two miles below the junction of the Black River (100 m. alt. and the farthest collecting camp for plants) were in hilly country rising to about 250 m. above sea level and carrying similar types of forest. Occupation of these camps extended over a period of 82 days, from 13th May to 4th August (S. E. season). During that time the longest interval between rains was two days, rain fell on 70 days, and four high floods were experienced. Generally, early morning fogs were followed by mist and drizzling rain until two or three hours after sunrise, and low clouds would close in again and rain begin to fall by mid-afternoon. The heaviest rains fell between late afternoon and midnight. These would often be accompanied by thunder and sometimes strong winds. There was no evidence of high flooding during the N. W. monsoon recently ended before our arrival. It is probable that in this very wet region the seasons are reversed, and that the S. E. trades bring actually more rain than the N. W. monsoons.

The forests of the hill region are seen from the air to be unbroken save for lanes cut by rivers and occasional round or oblong pits representing native garden clearings. One is struck by the uneven surface of the forest, the varied shades of green and brown exhibited in the foliage, and the abundance of tall palms (*Gulubia* 7245 and *Cyrtostachys* 7162) protruding above the forest roof.

In the areas more closely examined, *Vatica papuana,* species of *Myristica, Microcos, Gordonia, Dillenia, Sloanea, Canarium, Terminalia, Elaeocarpus, Sterculia, Calophyllum, Quercus,* and several sapotaceous and annonaceous trees figure prominently in the canopy layer. Few figs were found, and *Eugenia* is but poorly represented by one or two species with reddish flaky bark. A great wealth in mesophytic palms (about 30 spp. collected) and Pandanaceae (*Pandanus* 10 spp., and *Freycinetia* about 15 spp. collected) at once attracts attention. Ferns are in extraordinary abundance and variety of form, and the same applies to orchids. The lower tree layers are seldom clearly defined. Immature canopy trees supply most of the second and substage layers. Undergrowth trees and near-trees of 2–4 m. include *Pittosporum, Kibara, Semecarpus, Lasianthus* and other Rubiaceae, Myristicaceae, *Drimys* 7191 and *Cycas* 6752. In gullies and similar lighted places are luxuriant societies

of mixed broad-leaved woody and herbaceous plants, e.g. *Cyrtandra, Saurauia, Pisonia, Begonia, Elatostema, Ophiorrhiza, Curculigo, Mapania,* Zingiberaceae, Marantaceae and Araceae. Gregarious *Selaginella* 6899 is the characteristic floor plant in heavy shade above flood level. Mosses and filmy ferns are plentiful on the undergrowth and lower tree trunks, and fleshy *Cyrtandra* spp., *Hydnophytum* spp., Araliaceae, and bright flowering Melastomaceae and Zingiberaceae lend variety to a rich epiphytic flora of pteridophytes and orchids at higher levels. Attractive shade climbers (*Freycinetia, Aeschynanthus, Trichomanes, Asplenium*) are a feature of these forests, but light-demanding canopy lianes are by contrast with the drier forests down river poorly represented. These include *Dioclea, Mussaenda, Faradaya, Parsonsia, Agapetes* 6682 with red flowers, *Vaccinium* 7044 with pink flowers and several *Calamus* species.

Riverbanks and low flood-plains carry dense growth of *Pandanus Copelandii, Calamus* 7326 and *C.* 6811. *Pisonia* 6789, a small tree gregarious in muddy backwater gullies, produces viviparous seeds, and vegetative reproduction by bulbils (ferns, *Selaginella, Elatostema*) is a common adaptation facilitating dispersal by floods. In July, individual trees along the riverbanks are ablaze with the scarlet blooms of *Mucuna* 6950. This splendid climber, one of several species known as D'Albertis-creeper, also spreads over low seral forest on sandy islands and flowers profusely under the thin peripheral leafage, the hanging racemes more orange than scarlet, and seeming to light the forest with a warm, suffused glow.

Excepting those of the flood-plains and lower ridges the forests are not truly lowland in character. At 100 m. elevation or less many species occur that seem out of place on lowlands and in parts the general facies is that of mountain rain-forest of at least the 1000 m. contour. In these parts the trees root shallowly in a grey sandy soil overlying brownish clay or grey cemented wash containing quantities of white quartz pebbles. Drainage is by brown-water streams with gravel bottoms. An unidentified tree, called simbiri by the Orokaiva police of our escort (n. 7168), is sufficiently abundant to characterize the forest. Like some other ridge trees, this has rough fibrous bark, a dense crown of upright branches and small, stiff, emarginate leaves. Surface roots, criss-crossing over the ground, are covered with mosses and hepatics, which ascend the trees as far as deep shading is afforded by the substage saplings. The treetops, especially those which project above the general level and are exposed to sun and wind, are cluttered with brown hepatics, lichens, green and grey cushion-mosses and others sheathing the branches, with which are asso-

ciated numerous small ferns and orchids of the mountain mist belt. In places, though this is not a general thing, the ground is springy with a deep covering of interwoven roots and rootlets carpeted with moss, after the manner of the temperate mossy-forests at 1500–3000 m. altitude. In such places *Nepenthes* spp. sprawl over the moss and climb the smaller trees, and a curious pinnate fern (n. 6808) tufted and later climbing to 3–4 m., is plentiful.

The presence in the upper river forests of the genera *Quercus* (2 spp.), *Drimys* (1 sp.), *Vaccinium* and *Agapetes* (5 spp. between them), not to mention orchids, ferns and bryophytes of the treetops, is interesting as an example of the descent of mountain plants to tropical lowlands. All four genera occur in tall closed forest and are integral parts of the forest. They are here found 40 to 80 km., and in the case of the Oroville Ericaceae over 100 km. from the nearest mountains. *Quercus* and other Fagaceae constitute in the mountains practically pure forests following the rain-forests in altitudinal sequence, situated generally from about 800 to 2200 m. elevation and seldom dipping below 500 m. in Papua. *Drimys* spp. are common undergrowth in the mossy-forests, above the oak forests, while *Vaccinium* and *Agapetes* occur commonly as climbers in both formations. Van Steenis[1] has concluded that the establishment of mountain plants in the lowlands of Malaysia is mainly dependent upon an open vegetation and unfertile, mostly acid-reacting soil. The soils of the Upper Fly everywhere support tall forest, but probably the third condition might apply. Mountain forest climatic conditions, characterized by constant moisture, short daily periods of sunshine and regular reduction of light by permeating mists and fogs, are, however, closely approximated in this lowland region, and it is difficult to believe that the pronounced downward movement of mountain plants is not connected with the circumstance. The fact of their presence proves the plasticity of the plants as regards temperature requirements.

The Wassi Kussa and Lake Daviumbu collections, taken with those made on the Oriomo River by the Archbold Expedition of 1933–34, will give a good view of the savannah flora of Western Papua. Most of the component species seem to range throughout the formation, in contrast to the high degree of interrupted distribution and apparent species localization found in rain-forest. The limited range and localized distribution of *Eucalyptus*, the great genus of Australian savannah-forest trees, represented here by the species *clavigera*, *terminalis*, *umbellata* and *papuana*, is exceptional. The allied genera *Melaleuca* and *Tristania* provide most of the tree stocking. The chief grasses are *Ophiurus*

[1] Bull. Jard. Bot. Buitenzorg, Ser. 3, **13**: 54 (1933).

exaltatus, *Ischaemum* sp., *Imperata cylindrica* var. *Koenigii* and *Themeda triandra*.

The Wassi Kussa country consists of a slightly ridgy low plain becoming gradually more elevated as one proceeds inland. The coastal parts are cut by a network of salt creeks and consist of raw clay and grey sand supporting a scrubby savannah vegetation and depauperate brushes of mixed savannah and rain-forest species. At Tarara, about 55 km. (35 miles) from the river mouth, the country is sufficiently improved to support small communities of semi-nomadic agricultural people, who cultivate on the savannahs taito and yams (*Dioscorea* spp.) of excellent quality, and surround their villages with gardens of manioca, pineapples and bananas.

Except for narrow strips of rain-forest lining the river and tributary creeks and odd outlying patches on ridges, and belts of ericoid shrubs, savannah-forests of evergreen trees clothe the whole area inland. The predominant color of the foliage is grey rather than green, and most species have fibrous or soft laminated bark. The white trunks of *Melaleuca Leucadendron* stand out in strong contrast to the blackened ground surface of areas burned in the dry season. Tall termite mounds are a characteristic feature. It is monotonous country, poorly watered in the dry season, and generally too flat for efficient drainage during the rains.

The vegetation cover varies according to soil and especially soil drainage. Only occasional patches of deep, friable, dark-colored soil, indicated by a pure cover of *Imperata*, are considered suitable for the cultivation of crops. These occur on the ridges, where *Tristania suaveolens*, *Melaleuca Leucadendron* var., *Acacia Mangium* and *A. aulacocarpa*, trees which enter freely any adjoining rain-forest, constitute tall thick stands up to 30 m. high. Rather lower, more open stands characterized by *Eucalyptus clavigera* and/or *E. terminalis*, over a mixed grass cover dominated by *Ophiurus exaltatus*, *Imperata*, and *Sorghum nitidum*, occur on less fertile though well drained grey or reddish loam. A third type. found on rather wet flat ridges, consists of almost pure low stands of *Banksia dentata* rising to 5 m. above a viscid grass cover of *Germainia capitata*. Extensive flats of sour, grey, sandy soil, hard packed in the dry season and an inch to ankle deep in water during the wet, carry distinctive communities of slender stunted-looking *Melaleuca Leucadendron* vars. *sanguinea* and *Cunninghamii* (4–6 m. high), the willowy, orange-flowered form of *Melaleuca symphyocarpa* (8–10 m. high), or both in admixture with *Banksia dentata*. Ground cover in such places is of sedges, especially *Rhynchospora rubra* and wiry *Schoenus* spp., with

which appear, in the wet season, numbers of perennial herbs with tuberous roots and bright flowers, such as *Velleia spathulata, Drosera* spp., *Thysanotus tuberosus, Trichoryne* sp., *Haemodorum coccineum* and several orchids. Common grass associates on the ridges include *Euphorbia serrulata, Phyllanthus* sp., *Blumea* sp., *Buchnera* sp., *Eriosema chinense, Centranthera hispida* and *Knoxia corymbosa.* Pitcher-plants (*Nepenthes*) occur almost everywhere as small shrubs.

The shrub communities referred to previously are formed by *Agonis?* 8382, erect in very dense stands generally 1.5 to 2 m. high. *Banksia dentata* is always present at intervals as a low tree projecting a little above the general level, and *Schoenus* 8534, of straggling habit, forms a thin undergrowth. The giant sedge *Gahnia* 8477 is conspicuous in clumps 3–4 m. high. These peculiar scrubs are sharply demarcated from the surrounding savannah-forests as communities, notwithstanding the fact that only a few minor constituents, e.g. *Melaleuca* 8480 and *Gompholobium* 8432, seem to be strictly confined within their limits. They occur in long strips or lanes on sour, grey, often hummocky sandy soil, at least as well drained as the savannah flats. In composition and appearance they bear close resemblance to the "wallum" or peat scrubs of parts of the eastern coast of Australia, from which no doubt the component species are derived.

EXPLANATION OF PLATES

PLATE 221

Papua, Western Division, Fly River. Two miles below junction of Black and Palmer Rivers. ABOVE: Flood-plain forest. BELOW: View up river from tree ladder.

PLATE 222

Papua, Western Division, Fly River, Gaima. ABOVE: Aspect of savannah forest. BELOW: Savannah forest half-mile inland from Kauiapu Village. Large trees, *Tristania suaveolens* var. *glabrescens;* smaller trees, *Wormia alata.*

PLATE 223

Papua, Western Division, Fly River. ABOVE: Two miles below junction of Black and Palmer Rivers showing swamp forest of flat ridge crests. BELOW: East bank opposite Sturt Island showing tea-tree swamp forest (*Melaleuca Leucadendron* var. 8147 with *Stenochlaena* n. 8148 climbing on trunk of trees).





VEGETATION OF THE FLY AND WASSI KUSSA RIVERS,
BRITISH NEW GUINEA

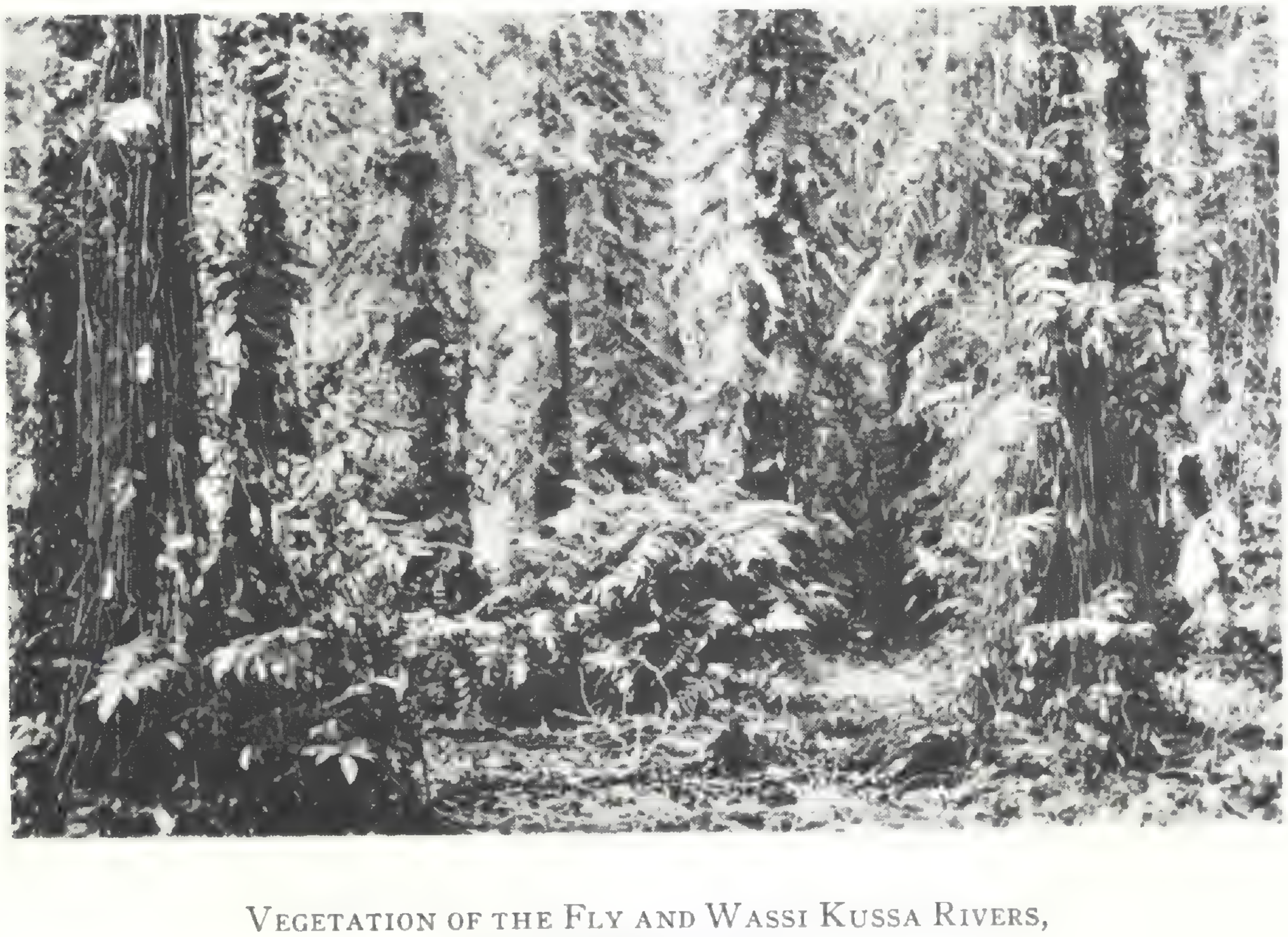
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VEGETATION OF THE FLY AND WASSI KUSSA RIVERS, BRITISH NEW GUINEA

FULL-TONE — MERIDEN





VEGETATION OF THE FLY AND WASSI KUSSA RIVERS, BRITISH NEW GUINEA

FULL-TONE — MERIDEN

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THE MYRTACEAE OF CHINA

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SINCE a critical examination of the Chinese species of *Eugenia* Linn. *sensu latiore* has resulted in the recognition not only of *Eugenia* proper, but also of *Syzygium* Gaertner, *Acmena* de Candolle and *Cleistocalyx* Blume, it has seemed desirable to broaden the scope of the work to include all the known Myrtaceae of this geographic unit. The remaining genera are as yet represented by few species either native or cultivated. These are recorded in some part in the various enumerations and reports of floral additions which have appeared from time to time. Very little has been published on the introduced species of *Eucalyptus* and the genus is scarcely represented from China in our herbarium. The same is true for *Myrtus*, *Melaleuca* and *Eugenia*. *Psidium* is much more widely cultivated and is doubtless naturalized in some places. The other seven genera, *Baeckea*, *Rhodamnia*, *Rhodomyrtus*, *Decaspermum*, *Acmena*, *Syzygium* and *Cleistocalyx* are native. *Syzygium* is by far the largest genus and includes several species difficult to limit, yet for its size *Decaspermum* is perhaps the more puzzling unit.

During this study we have had access to the combined oriental collections of the Arnold Arboretum, the Gray Herbarium, the New York Botanical Garden and selected specimens from the United States National Herbarium. In addition to these we are indebted to Sir W. W. Smith, Director, Royal Botanic Garden, Edinburgh, Scotland, for his courtesy in loaning us important collections from Yunnan, and to Professor W. Y. Chun, Sun Yatsen University, for a loan of unicates and duplicates from his undistributed collections.

We are under obligations to the authorities of Harvard University for a grant from the Milton fund that made this study, and the large forthcoming one on the Bornean species, possible.

KEY TO THE GENERA OF THE CHINESE MYRTACEAE

A. Fruit capsular, dehiscent.
  B. The upper part of the flower-bud circumscissile and falling as a lid or an operculum at anthesis .....1. *Eucalyptus*
  B. Calyx-lobes and petals separate at anthesis.
    C. Flowers sessile, in heads or spikes (at first terminal, later below the leafy shoot grown from the axis); stamens numerous, united in bundles at the base .....2. *Melaleuca*
    C. Flowers pedicelled, few in a cluster or solitary, axillary; stamens 10 or fewer, free .....3. *Baeckea*

A. Fruit baccate, indehiscent.
  B. Embryo hippocrepiform, curved or sometimes coiled, cotyledons not concealing the hypocotyl; testa hard.
    C. Ovary with one locule, the two placentas parietal with many ovules; leaves triple-nerved and veiny .....4. *Rhodamnia*
    C. Ovary with 2 to 5 locules; leaves most often pinnately veined (3-ribbed in *Rhodomyrtus*).
      D. Locules with false partitions.
        E. Ovary with (1–)3 locules, each locule with 2 rows of ovules separated by longitudinal and transverse septa; leaves 3-nerved .....5. *Rhodomyrtus*
        E. Ovary with 2 to 5 locules (with or without longitudinal partitions) with one to several ovules in each compartment; leaves pinnately veined .....8. *Decaspermum*
      D. Locules without false partitions.
        E. Limb of the calyx closed or open at the apex of the bud and tearing ± regularly into lobes at flowering. 6. *Psidium*
        E. Calyx with definite lobes.
          F. Flowers solitary and axillary; ovary with 2 locules and numerous ovules in each locule .....7. *Myrtus*
          F. Inflorescence paniculate with few to many flowers, axillary and sometimes terminal; ovary with 3 to 5 locules (sometimes with false partitions) and one to several ovules in each locule ....8. *Decaspermum*
  B. Embryo not hippocrepiform nor coiled, usually ± globose or ellipsoid, cotyledons practically concealing the hypocotyl; testa membranous, cartilaginous, or of a crumbly texture.
    C. Embryo apparently undivided or pseudomonocotyledonous.
      D. Seed-coat smooth and free from the pericarp; embryo apparently of the same texture throughout; anther-sacs parallel, opening longitudinally .....9. *Eugenia*
      D. Seed-coat loosely or closely adhering to the pericarp; embryo much lobed within, the lobes of somewhat different texture

from the outer portion; anther-sacs divaricate, opening by a terminal slit or pore .....10. *Acmena*

C. Embryo divided, i. e. with distinct cotyledons; seed-coat roughish, loosely or closely adhering to the pericarp; anther-sacs parallel, opening longitudinally.

D. Calyx not calyptrate, lobes distinct both in the bud and in the flower .....11. *Syzygium*

D. Calyx calyptrate, i. e. not at all lobed, the entire upper part circumscissile and falling as a more or less indurated lid or calyptra .....12. *Cleistocalyx*

1. **Eucalyptus** L'Héritier

An examination of the available Chinese botanical literature revealed only the following specific references to the Australian genus *Eucalyptus*: Lingnaam Agric. Rev. **2:** 66. 1924; Chung, Mem. Sci. Soc. China **1**(1)**:** 184. 1924; Walker, Lingnan Sci. Jour. **6:** 29, 137–145. 1928.

The first reference is an unsigned note (probably editorial) commenting on the successful introduction of the eucalyptus tree on the Lingnan University campus and mentioning in particular the fine specimens of *E. robusta* Smith which have been established long enough to produce a considerable quantity of seeds. Chung in a "Catalogue of Trees and Shrubs of China" lists *Eucalyptus tereticornis* Smith from Kwangtung. Walker, writing a popular article on "Fifty-one Common Ornamental Trees of the Lingnan University Campus," mentions the following species in "a complete genetic list of all the identified trees growing on the campus in the summer of 1926": *E. amygdalina* Labill., *E. citriodora* Hook., *E. corynocalyx* F. Muell., *E. ficifolia* F. Muell., *E. leucoxylon* F. Muell., *E. populifolia* Desf., *E. resinifera* Smith, *E. rudis* Endl., and *E. viminalis* Labill. In addition he gives descriptions of three others, *E. globulus* Labill. (p. 139), *E. robusta* Smith (p. 141), and *E. tereticornis* Smith (p. 143), accompanied by plates drawn from living material.

2. **Melaleuca** Linnaeus

Melaleuca Leucadendron Linn. Mant. **1:** 105. 1767 (as *Leucadendra*); Benth. Fl. Austral. **3:** 142. 1866; Woodville, Med. Bot. ed. 3, **3:** 544, *t. 195*. 1832; Kurz, For. Fl. Brit. Burma **1:** 472. 1877; Duthie in Hook. f. Fl. Brit. Ind. **2:** 465. 1878; Koord. & Val. Meded. Lands Plant. **40:** 180. 1900 (Bijdr. Boomsoort. Java **6:** 180); King, Jour. As. Soc. Bengal **70**(*2*)**:** 70. 1901 (Mater. Fl. Malay. Penin. **3:** 500); Guill. Not. Syst. **2:** 101. 1911; Merr. Interpret. Herb. Amboin. 402. 1917, Philip. Jour. Sci. **19:** 368. 1921,

Lingnan Sci. Jour. **9**: 41. 1930, Trans. Amer. Philos. Soc. **24**(*2*): 286. 1935.

Myrtus Leucadendra Linn. in Stickman Herb. Amb. 9. 1754, Amoen. Acad. **4**: 120. 1759, Syst. ed. 10: 1056. 1759, Sp. Pl. ed. *2*: 676. 1762.

HONGKONG, *Tsang 187, 3311*, introduced: HAINAN, Heungkong, *Chu Vong May 156*, July, 1928, whether planted or native not indicated. Burma and Indo-China through Malaysia to Australia.

The above cited specimens belong to the glabrous form (var. *Leucadendron* Duthie) of this cultivated and widely distributed species.

3. **Baeckea** Linnaeus

Baeckea frutescens Linn. Sp. Pl. 358. 1753; Osbeck, Dagbok Ostind. Resa 231, *t. 1*. 1757, Reise Ostind. China 301, *t. 1*. 1765, Voy. China East Ind. **1**: 373, *t. 1*. 1771; Smith, Trans. Linn. Soc. **3**: 260. 1797; Willd. Sp. Pl. **2**: 434. 1799; Poir. Encycl. **7**: 689. 1806; Hooker, Bot. Mag. **55**: *t. 2802*. 1828; DC. Prodr. **2**: 229. 1828; Blume, Mus. Bot. Lugd.-Bat. **1**: 69. 1849; Benth. Jour. Bot. Kew Gard. Misc. **4**: 118. 1852; Miq. Fl. Ind. Bat. **1**(1): 406. 1855, Suppl. 308. 1861; Benth. Fl. Hongk. 118. 1861; Duthie in Hook. f. Fl. Brit. Ind. **2**: 463. 1878; Forbes & Hemsl. Jour. Linn. Soc. Bot. **23**: 295. 1887; King, Jour. As. Soc. Bengal **70**(2): 68. 1901 (Mater. Fl. Malay. Penin. **3**: 498); Valeton, Bull. Dép. Agric. Ind. Néerl. **10**: 39. 1907; Gibbs, Jour. Linn. Soc. Bot. **42**: 75. 1914; Merr. Philip. Jour. Sci. Bot. **10**: 191. 1915 (noting that the genus has no representative in the Philippines); Gagnep. in Lecomte, Fl. Gén. Indo-Chine **2**: 789, *f. 84*. 1920; Merr. Enum. Born. Pl. 436. 1921; Ridley, Fl. Malay Penin. **1**: 712. 1922; Merr. Lingnan Sci. Jour. **5**: 137. 1927; Groff, Lingnan Univ. Sci. Bull. **2**: 77. 1930; Craib, Fl. Siam. Enum. **1**: 624. 1931; McClure, Lingnan Univ. Sci. Bull. **3**: 30. 1931; van Steenis, Bull. Jard. Bot. Buitenzorg III, **12**: 181, *f. 7*. 1932; Merr. Trans. Amer. Philos. Soc. **24**(*2*): 287. 1935.

Baeckea chinensis Gaertn. Fruct. **1**: 157, *t. 31, f. 7*. 1788.
Cedrela rosmarinus Lour. Fl. Cochinch. 160. 1790, ed. Willd. 199. 1793.
Itea rosmarinus Schult. in Roem. & Schult. Syst. **5**: 408. 1819.
Baeckea Cumingeana Schauer in Walp. Rep. **2**: 920. 1843.
Drosodendron rosmarinus M. Roem. Syn. **1**: 138, 140. 1846.
Baeckea cochinchinensis Blume, Mus. Bot. Lugd.-Bat. **1**: 69. 1849.
Baeckea sumatrana Blume, l. c.

KWANGTUNG (locality written only in Chinese), *McClure 279 (C. C. C. 6645)*; Peiyunshan, *Tsiang 2187;* Kochow, *Tsiang 893;* Tai-O,

Chun 3111; near Long Tien, *Chun 6102;* Sui Kai, Shing Muk, *Sui Iu Nin 114 (L. U. 18416)*; Teng Woo Mountain, *Levine & Groff 96, Levine 799;* Yunfou District, *Wang 536;* Yung-yun city and vicinity, Wung-yuen District, *Lau 697;* Wong Chuk I and vicinity, *Lau 2188;* Tingushan (Ting Woo Shan), *Liou 861, Lau 20147, Chun 6347;* Canton and vicinity, *Levine 450, Williams s. n.;* Danes Island, *Baird s. n.* 1829: MACAO, *Callery s. n.*, 1844: HONGKONG, *Wright s. n., O. Kuntze 3383, Brigham s. n., Ford s. n.*; Victoria Peak, *Robinson 1579, Pease 20219;* Bok Fu Lum, *Chun 5112;* Wu Kau Tin, *Tsiang 99;* Shatin, Ma Au Shan, *Tsiang 214*; Lantau Island, Taai Ue Shaan, *Tsang 16494*: KWANGSI, banks of the Si Kiang, *Beauvais 189;* between Suan-tze and Nanning, *Ching 7755;* Shap Man Taai Shan, *Tsang 22172, 22460;* Po Yam Shan (along Kwangtung border), *Tsang 22924;* Tong Shan, Waitsap District, *Tsang 22756*: HAINAN, without definite locality, *Henry 8461, Wang 35160;* Pak Shik Ling and vicinity, Ching Mai District, *Lei 958*.

India, southern China, Indo-China, the Malay Peninsula, Anambas and Natoena Islands, Sumatra, Bangka, Borneo and New Guinea (fide Valeton).

4. **Rhodamnia** Jack

Rhodamnia dumetorum (Poir.) comb. nov.

Myrtus dumetorum Poir. Encycl. Suppl. **4**: 52. 1816.
Myrtus trinervia Lour. Fl. Cochinch. 312. 1790 (sphalm. *triinervia*), ed. Willd. 381. 1793.
Nelitris trinervia Spreng. Syst. **2**: 488. 1825.
Eugenia ? dumetorum DC. Prodr. **3**: 284. 1828.
Rhodamnia siamensis Craib, Kew Bull. **1926**: 167. 1926, Fl. Siam. Enum. 629. 1931.
Rhodamnia trinervia sensu Gagnep. in Lecomte, Fl. Gén. Indo-Chine **2**: 844. 1921, pro parte (fide Craib); Merr. Trans. Amer. Philos. Soc. **24**(2): 283. 1935, non Blume.

INDO-CHINA, Tourane and vicinity, *Clemens 3689;* Phu-quoc, *Pierre;* Me-kong expedition, *Thorel*. Siam.

Although *Rhodamnia trinervia* Blume has been interpreted as an aggregate species, after a careful examination of the readily available material, we have concluded that C. T. White, Blumea, Suppl. **1**: 215. 1937, was right in limiting its distribution to Australia. He pointed out that the Malaysian material differed in mode of inflorescence ("the flowers are pedicellate but amassed in clusters or fascicles, not in pedunculate cymes as in the Australian *R. trinervia* Blume") as well as geographically, but called attention to the fact that *Clemens 3689* (Annam, Indo-China) has the inflorescence-character of the Australian plant and more closely approaches it than any of the other collections

examined. We find the following significant differences: in the Australian specimens, the calyx-lobes are deciduous, the obtusely angled staminate disk is rather prominent in the young fruit, the pubescence on the lower leaf-surface and the calyx-tube is of loose, short, crisp, not closely appressed hairs, and the corolla is practically glabrous; in the Malaysian collections, on the other hand, the calyx-lobes are persistent in fruit, consequently the staminate disk does not appear to be prominent, and the pubescence is appressed both on the lower leaf-surface and on the entire flower-bud; in fact the indument on the lower surface of the leaves is so closely appressed as to be somewhat hoary.

The above cited Indo-Chinese specimens seem to compare favorably with Craib's description of *R. siamensis;* also, there can be no doubt that this is the entity described as *Myrtus trinervia* by Loureiro. Unfortunately his specific name is pre-empted in *Rhodamnia* and it is necessary to adopt the next specific epithet applicable to this species. *Myrtus dumetorum, Nelitris trinervia* and *Eugenia ? dumetorum* were all based on *Myrtus trinervia* Lour.

Rhodamnia dumetorum, var. **hainanensis** var. nov.

Rhodamnia trinervia sensu Merr. & Chun, Sunyat. **2:** 292. 1935, non Blume.

A forma typica differt foliis brevioribus (usque ad 6.5 cm. longis, 3.5 cm. latis) et ± abrupte acutis, vix acuminatis.

HAINAN, without definite locality, *Wang 33310, 33329, 34031;* Yaichow, *Liang 62235, How 71052* (type in Herb. Arnold Arb.).

Variety *hainanensis* differs from the typical Indo-Chinese material in that the leaves are abruptly acute and shorter in proportion to their width; the inflorescence too may be slightly more compact, varying from a little longer than the petiole to twice its length. Further, it should be noted that *on the same branch* the inflorescences may be in fascicles or clusters of pedicelled flowers on very short shoots (as is predominant in the Malaysian material), or in pedunculate cymes (as in the Australian species).

5. **Rhodomyrtus** (DC.) Reichenbach

Rhodomyrtus tomentosa (Ait.) Hassk. Flora 1842, Beibl. **2:** 35. 1842; Benth. Jour. Bot. **2:** 220. 1843; Wight, Spicil. Neilgher. **1:** 60, *t. 71.* 1845; Miq. Anal. Bot. Ind. **1:** 16. 1850; A. Gray, Bot. Wilkes U. S. Expl. Exped. **1:** 546. 1854; Miq. Fl. Ind. Bat. **1**(1)**:** 477. 1855; Benth. Fl. Hongk. 121. 1861; Miq. Choix Pl. Jard. Buitenz. *t. 3.* 1863; Beddome, Fl. Sylv. Anal. Gen. cvi. *t. 14, f. 3.* 1872; Duthie in Hook. f. Fl. Brit. Ind. **2:** 469. 1878; Vidal, Phan. Cuming.

Philip. 112. 1885, Rev. Pl. Vasc. Filip. 129. 1886; Forbes & Hemsl. Jour. Linn. Soc. Bot. **23:** 295. 1887 (Ind. Fl. Sin. **1:** 295); Niedenzu in Engler & Prantl, Nat. Pflanzenfam. **3**(7): 70, *f. 37*. 1893; Henry, Trans. As. Soc. Japan **24**(Suppl.): 43. 1896 (List Pl. Formos. 43); Matsum. Tokyo Bot. Mag. **12:** 68. 1898; Ito & Matsum. Jour. Col. Sci. Imp. Univ. Tokyo **12:** 479. 1899 (Tent. Fl. Lutch. 479); Koord. & Val. Meded. Lands Plant. **40:** 41. 1900 (Bijdr. Boomsoort. Java **6:** 41); King, Jour. As. Soc. Bengal **70**(2): 75. 1901 (Mater. Fl. Malay. Penin. **3:** 505); Matsum. & Hayata, Enum. Pl. Formos. 142. 1906; Holtermann, Einfl. Klimas, *t. 9, f. 46*. 1907; Merr. Philip. Jour. Sci. Bot. **3:** 423. 1908; C. B. Rob. op. cit. **4:** 337. 1909; Hayata, Ic. Pl. Formos. **2:** 18. 1912; Gibbs, Jour. Linn. Soc. Bot. **42:** 76. 1914; Fyson, Fl. Nilgiri & Pulney Hill-tops **1:** 150. 1915, **2:** *t. 108*. 1915; Kanehira, Formos. Trees 258. 1917; Crevost & Lemarié, Cat. Prod. Indochine **1:** 251. 1917; Gagnep. in Lecomte, Fl. Gén. Indo-Chine **2:** 794, *f. 85*. 1920; Merr. Enum. Born. Pl. 425. 1921; Ridl. Fl. Malay Penin. **1:** 717. 1922; Merr. Enum. Philip. Pl. **3:** 156. 1923; Chung, Mem. Sci. Soc. China **1**(1): 183. 1924; Merr. Lingnan Sci. Jour. **5:** 136. 1927; Groff, Lingnan Univ. Sci. Bull. **2:** 76. 1930; Craib, Fl. Siam. Enum. **1:** 628. 1931; McClure, Lingnan Univ. Sci. Bull. **3:** 29. 1931; van Steenis, Bull. Jard. Bot. Buitenz. III, **12:** 167. 1932; Merr. Trans. Amer. Philos. Soc. **24**(2): 283. 1935.

Myrtus tomentosa Ait. Hort. Kew, ed. 1, **2:** 159. 1789, ed. 2, **3:** 189. 1811; Vahl, Symb. Bot. **2:** 56. 1791, **3:** 65. 1794; Curtis, Bot. Mag. **7:** *t. 250*. 1794; Blume, Bijdr. 1081. 1826; DC. Prodr. **3:** 240. 1828; Roxb. Fl. Ind. ed. 2, **2:** 498. 1832; Hook. & Arn. Bot. Beechey's Voy. 187. 1833; Wight & Arn. Prodr. **1:** 328. 1834; Wight, Ill. **2:** 12, *t. 97*, f. 3*. 1841, Ic. **2:** *t. 522*. 1843; Korth. Nederl. Kruidk. Arch. **1:** 197. 1847.

Myrtus canescens Lour. Fl. Cochinch. 311. 1790, ed. Willd. 381. 1793.

FUKIEN, Foochow, *Chung 7393, Carles s. n.*, 1897; Nantai, *Lin Yu Tai 11978;* Kushan Monastery, *Tang 5833;* Minhow Hsien, *Chung 2313;* Amoy Island, Nanputo Hill, *Chung 1691;* Inghok, Fang-Quang-Yen, *Chun 7722*: KIANGSI, Hsin-Feng Hsien, *Hu 985*: KWANGTUNG, Shaan Nim, *McClure 156* (*C. C. C. 7132*); Tai Mo Shan, Tapu District, *Tsang 21288;* Lok Chong, *Tso 20993;* Tsing Wan Shan, Wong Chuk I and vicinity, Wung Yuen District, *Lau 2212;* Yang Shan and vicinity, south of Linchow, Yang Shan District, *Tsui 541, 612;* Kochow, Sintong, Tai-tseh-wei, *Tsiang 2099;* (Teng Woo Mountain) Ting Woo Shan, Kwai Leng, Kao-Yao District, *Lau 20295, Levine 732;* Canton, *Levine 784, 1151, 3017, Tsiang 5, 391*: MACAO and adjacent Islands, *Vachell s. n.*: HONGKONG, *Chun 6570, Ford s. n., Liou 7393, Sargent s. n.*,

Wright s. n.; Tai-O, *Chun 4878*; Lantau Island, Taai Ue Shaan, *Tsiang 16668*: KWANGSI, Mekon, Seh-feng, Dar Shan, south of Nanning, *Ching 8451*; North I-Shan, *Ching 5217*; Tou Ngok Shan, Waitsap District, *Tsang 23187*; Po Yam Shan, Sun-to District, *Tsang 23079*; Shap Man Taai Shan, southeast of Shang-sze, Shang-sze District, *Tsang 22246*: HAINAN, without definite locality, *Henry 8020, 8491, Liang 64124, 65288, 66277, Wang 32849, 36615*; Mi ting, *McClure 7745*; Seven Finger Mountain, *Liang 61654*; Yaichow, *Chun & Tso 44624, Liang 61948, 63066*; Dung Ka, *Chun & Tso 43596*; Fo De, *Gressitt 724*; Tai Tin Shan, Ch'ang-kiang District, *Lau 1261*; Lin Fa Shan, Lam Ko District, *Tsang 13* (*L. U. 16762*), *271* (*L. U. 15770*); Pak Shik Ling and vicinity, Ching Mai District, *Lei 531, 747*. Type from China. India southward through Malaysia to Australia.

Rhodomyrtus parviflora Alston is the only segregate we have found which might raise some question concerning the synonymy as given above. Alston merely indicates, "Species *R. tomentosae* Wight affinis, sed floribus parvis, breviter pedicellatis differt. — Typus: *Thwaites* C. P. 1591." We have not seen the type, but in our Ceylon collections (of which we have only four), although the pedicels are somewhat shorter, the flower-buds are fully as large as in some of the other material represented. Further when specimens show only immature buds or flowers it is very difficult to estimate the value of the characters above designated.

6. **Psidium** Linnaeus

A. Young branchlets quadrangular; leaves oblong to elliptic, with rounded or obtuse base, finely pubescent beneath .....1. *P. Guajava*

A. Young branchlets cylindric or compressed; leaves obovate-elliptic, cuneate at the base, glabrous .....2. *P. littorale*

1. **Psidium Guajava** Linn. Sp. Pl. 470. 1753; Miq. Fl. Ind. Bat. **1**(1): 469. 1855; Benth. Fl. Hongk. 120. 1861; Kurz, For. Fl. Brit. Burma **1**: 476. 1877; Duthie in Hook. f. Fl. Brit. Ind. **2**: 468. 1878; Koord. & Val. Meded. Lands Plant. **40**: 35. 1900 (Bijdr. Boomsoort. Java **6**: 35); Léveillé, Fl. Kouy-Tchéou 289. 1914; Merr. Interpret. Herb. Amboin. 391. 1917; Gagnep. in Lecomte, Fl. Gén. Indo-Chine **2**: 848. 1921; Chung, Mem. Sci. Soc. China **1**(1): 183. 1924; Merr. Lingnan Sci. Jour. **5**: 135. 1927; Walker, Lingnan Sci. Jour. **6**: 29. 1928; Merr. Univ. Calif. Publ. Bot. **15**: 215. 1929; McClure, Lingnan Univ. Sci. Bull. **3**: 29. 1931; Handel-Mazzetti, Symbol. Sin. **3**(7): 596. 1933; Merr. Trans. Amer. Philos. Soc. **24**(2): 283. 1935.

Psidium pomiferum Linn. Sp. Pl. ed. *2*: 672. 1762; Lour. Fl. Cochinch. 310. 1790, ed. Willd. 379. 1793; DC. Prodr. **3**: 234. 1828; Hook. & Arn. Bot. Beechey's Voy. 188. 1833.

Psidium pyriferum Linn. Sp. Pl. ed. *2*: 672. 1762; Lour. Fl. Cochinch. 309. 1790, ed. Willd. 378. 1793; DC. Prodr. **3**: 233. 1828.

Specimens seen from Szechuan, Fukien, Kwangtung, Kwangsi, Yunnan and Hainan. The common guava: a plant of American origin widely cultivated and naturalized in the Old World tropics.

2. **Psidium littorale** Raddi, Opusc. Sci. **4**: 254, *t. 7, f. 2*. 1820.

Psidium Cattleianum Sabine, Trans. Hort. Soc. London **4**: 317, *t. 11*. 1821; Lindl. Coll. Bot. *t. 16*. 1821, Bot. Reg. **8**: *t. 622*. 1822; Sims, Bot. Mag. **51**: *t. 2501*. 1824; DC. Prodr. **3**: 236. 1828; Popenoe, Man. Trop. Subtrop. Fruits 279, *f. 36*. 1920; Fawc. & Rendle, Fl. Jamaica **5**(3): 318. 1926.

Psidium variabile Berg, Mart. Fl. Bras. **14**(1): 400. 1857.

KWANGTUNG, Heungshan, *Chun 99*: HAINAN, Nodoa, *McClure 2547* (*C. C. C. 8992*).

When *Psidium Cattleianum* was originally named the species was thought to be native to China, but Lindley, Bot. Reg. **10**: 1824, in "Notes" at the end of the volume indicated that this was an error adding "Reason now exists for supposing it to be a native of some part of South America." It is now known to be a native of Brazil. According to Popenoe it was carried to China at an early period, presumably by the Portuguese, and from China it was carried to Europe. It is cultivated in various subtropical regions.

In checking the synonymy of *Psidium Cattleianum* Sabine, the name by which this species is best known, we found that *Psidium littorale* Raddi is apparently the earlier specific epithet. The fascicle in which the description and plate of the latter appears was published separately in 1820, although the date of publication usually is cited as 1823. This is the date of the title-page of volume 4 complete, but when fascicle-covers are in the volume, these are to be regarded as indicating the actual date of publication rather than the title-page. We have not been so fortunate as to find any record of the publication of Sabine's name before the year 1821.

7. **Myrtus** Linnaeus

Myrtus communis Linn. Sp. Pl. **1**: 471. 1753; Gaertner, Fruct. **1**: 184, *t. 38*. 1788; Le Maout & Decaisne, Traité Gén. Bot. 293. 1868; Baillon, Hist. Pl. **6**: 305, 306. 1877; Niedenzu in Engler & Prantl, Nat. Pflanzenfam. **3**(7): 67, *f. 35*. 1893; Gard. Chron. III, **45**: 18. 1909; Bailey, Stand. Cycl. Hort. 2096. 1916, Man. Cult. Pl. 535. 1924.

FUKIEN, Kulangsu Island, Amoy (cultivated), *Chung 1629*.

A native of the Mediterranean region and western Asia, widely cultivated in favorable climates for ornamental purposes.

8. **Decaspermum** J. R. & G. Forster

A cursory examination of the genus *Decaspermum* J. R. & G. Forst. shows the species to be highly variable and, perhaps on account of the polygamous flowers, somewhat more difficult than representatives of the other genera here considered. Possibly not more than five species are represented in our collections from China; yet, apart from the very distinct *D. hainanense* and *D. albociliatum*, the species are not easily defined. The following key and summary give the species as we understand them at present.

A. Calyx-lobes ovate, obtuse to acute or slightly acuminate.
  B. Inflorescence terminal and in the uppermost leaf-axils only; the young branchlets and leaves as well as the inflorescence tomentose. 1. *D. hainanense*
  B. Inflorescence axillary and terminal; the young branchlets, the young leaves and the inflorescence appressed-pubescent or glabrous.
    C. Plant glabrous; calyx and corolla mostly 4-merous. 2. *D. cambodianum*
    C. Branchlets, young leaves and inflorescence ± appressed-pubescent; calyx and corolla 3-merous or 5-merous.
      D. Calyx and corolla 5-merous ..... 3. *D. fruticosum*
      D. Calyx and corolla 3-merous ..... 4. *D. gracilentum*

A. Calyx-lobes linear to linear-lanceolate, elongate-acuminate. 5. *D. albociliatum*

1. **Decaspermum hainanense** (Merr.) Merr. Lingnan Sci. Jour. **14**: 42. 1935.

Eugenia hainanensis Merr. Philip. Jour. Sci. **23**: 255. 1923, Lingnan Sci. Jour. **5**: 136. 1927.

HAINAN, without definite locality, *Wang 33701, 34183, 34210, 34679;* Yik Tsok Mau, *McClure 9734;* Yaichow, *Chun & Tso 44739, Liang 62442, How 70687, How 71123;* on the way to Seven Finger Mountain, *Liang 61624;* Po-ting, Lingshui, *How 73499; Ko 52207;* Po T'eng Shi (BoDeng), Ling Shui (Ling-tui) District, *McClure 20044;* Yeung Ling Shan, Ngai District, *Lau 194*.

This species differs from all the other species of *Decaspermum* in China in the larger flowers, the predominantly terminal inflorescence, and the crisp or short tomentose pubescence of the younger parts.

2. **Decaspermum cambodianum** Gagnep. Bull. Mus. Hist. Nat. Paris **26:** 73. 1920 et in Lecomte, Fl. Gén. Indo-Chine **2:** 846, *f. 91.* 1921; Craib, Fl. Siam. Enum. **1:** 630. 1931; Merr. & Chun, Sunyat. **2:** 291. 1935.

Eugenia multipunctata Merr. Jour. Arnold Arb. **6:** 138. 1925, Lingnan Sci. Jour. **5:** 136. 1927.

Eugenia ciliaris Ridley, Kew Bull. **1928:** 74. 1928 (fide Craib).

HAINAN, without definite locality, *Liang 63765, 64946, Wang 35948;* between Dung Ka and Wen Fa Shi, *Chun & Tso 43770;* Dung Ka, *Chun & Tso 43872, 43911;* Mo San Leng, *Chun & Tso 44287;* Chim Fung Ling, Kan-en District, *Lau 3720, 3792;* Five Finger Mountains, *Chun 1567, 2034.* Indo-China and the Malay Peninsula.

In most of the collections of this species the leaves tend to be broader above the middle, with a short obtuse acumen and a more or less attenuate-acute base. *Chun 2034,* the type of *Eugenia multipunctata* Merr. is wholly in agreement with this and apparently the name already has been correctly reduced to the synonymy of *D. cambodianum.* It should be noted, however, that the flowers are mostly 3-merous. *Chun 1567* is aberrant in having the leaves distinctly acuminate with a short obtuse base; the flowers also are 3-merous; in fact except for the lack of pubescence this collection more nearly resembles *D. gracilentum* (Hance).

3. **Decaspermum fruticosum** J. R. & G. Forster, Char. Gen. 74. *t. 37.* 1776, Beschreib. Gattung. Pflanz. Reise Ins. Süd-See 77, *t. 8, f. 37.* 1779; Rehder, Jour. Arnold Arb. **15:** 109. 1934.

Eugenia Esquirolii Léveillé, in Fedde, Rep. Spec. Nov. **9:** 459. 1911, Fl. Kouy-Tchéou 289. 1914.

Pirus Bodinieri Léveillé, Fl. Kouy-Tchéou 350. 1915.

KWEICHOW, heights of Lao-ten, *Esquirol 82;* road between Lo-hou and Tong-tcheou, *Esquirol 3611:* KWANGTUNG, Yang Shan and vicinity, south of Linchow, *Tsui 581:* KWANGSI, Loh Hoh Tsuen, Ling Yün Hsien, *Steward & Cheo 530;* Seh-Feng, Dar Shan, S. Nanning, *Ching 7853, 8098;* Tang Giar Poo, southeast of Luchen, *Ching 5225, 5246:* YUNNAN, Szemao, *Henry 11753, 11753A, 11753B, 11753C;* between Szemao and Puerhfu, *Rock 2832;* between Muang Hing and Szemao and the Szemao hills proper, *Rock 2789;* without definite locality (Plants of E. Tibet and S. W. China), *Forrest 27408.* India to Yunnan, Kweichow and Kwangtung south through Malaysia to Polynesia. A variable and difficult species, possibly an aggregate, frequently called *D. paniculatum* Lindl. which may or may not be specifically distinct.

4. **Decaspermum gracilentum** (Hance) comb. nov.

Eugenia gracilenta Hance, Jour. Bot. **23**: 7. 1885; Forbes & Hemsl. Jour. Linn. Soc. Bot. **23**: 296. 1887.

Syzygium gracilentum Hu, Jour. Arnold Arb. **5**: 232. 1924.

Decaspermum fruticosum sensu Merr. Lingnan Sci. Jour. **5**: 137. 1927; Merr. & Chun, Sunyat. **1**: 74. 1930; Chun, Sunyat. **1**: 289. 1934, non J. R. & G. Forst.

KWANGTUNG, Tai-tseh-wei, Sintong, Kochow, *Tsiang 2087;* Peiyunshan, Kochow, *Tsiang 2186;* near Kying-tung, Sunyi, *Tsiang 2654*: HAINAN, without definite locality, *Wang 32843, 34370, 35415;* Ngai Chau and vicinity, Ngai District, *Lau 5;* Tung Koo Shan and vicinity, Wen Ch'ang District, *Fung 20349*; I Kap Shan and vicinity, Tan District, *Lau 1174;* Hung Mo Shan and vicinity, Lai (Loi) area, *Tsang, Tang & Fung 59* (*L. U. 17590*); Pak Shik Ling and vicinity, Ching Mai District, *Lei 255, 558*; Ka Chik Shan and vicinity, Ch'ang-Kiang District, *Lau 1388;* Ue Lung Shan, *Lau 3177*; Chim Fung Ling, Kan-en District, *Lau 3548;* Lin Fa Shan, Lam Ko District, *Tsang 2* (*L. U. 16751*), *273* (*L. U. 15772*); near Po-ting, Lingshui, *Liang 61564;* Po-ting, *How 71605, 71638;* between Po-ting and Seven Finger Mountain, Lingshui, *Liang 61527*; Seven Finger Mountain, *Liang 61651;* Chim Shan, Fan Maan Ts'uen and vicinity, *Fung 20141*; Five Finger Mountain, *McClure 8628*; Tungkap, Tingan, *Ko 52288*; Tai Pin, *Gressitt 1110;* Fan Yah, *Chun & Tso 44089;* Yaichow, *Liang 62087, 63023, How 70464, 70465*; enroute Ta Hon to Nga Wan, *McClure 9247;* Nar-Fai-Lee, *Ford 433.* Formosa.

In the southeastern part of China, most of the collections recently referred to *D. fruticosum* J. R. & G. Forst. are characterized by 3-merous flowers a little smaller than in Forster's species and by the capsules with fewer (3–5) seeds. The specimens correspond in all details to the description of *Eugenia gracilenta* Hance although in Hance's description the number of parts of the outer floral circles is not mentioned. Dr. W. R. Philipson at the British Museum has very kindly examined Hance's type for us and has assured us the calyx and the corolla are 3-parted. The fairly well marked geographical range and the constancy of the trimerous flowers has led us to believe that these collections are to be regarded as representing a definite entity; hence, we separate them from *D. fruticosum* J. R. & G. Forst. and reestablish Hance's species in the genus *Decaspermum*.

5. **Decaspermum albociliatum** sp. nov.

Frutex circiter 4 m. altus, ramis teretibus, gracilibus, glabratis, ramulis perspicue molliter ac longe albido-ciliatis, ultimis gracillimis, vix 0.5 mm.

diametro; foliis lanceolatis vel oblongo-lanceolatis, 3–6 cm. longis, 1–2.5 cm. latis, chartaceis vel subcoriaceis, graciliter subcaudato-acuminatis, basi late obtusis vel subrotundatis, utrinque minute puncticulatis, junioribus utrinque perspicue longe albido-ciliatis, pilis plus minusve persistentibus, venis primariis utrinque 8–10, obscuris, interdum obsoletis vel subobsoletis; petiolo 1–2 mm. longo, piloso; floribus axillaribus, solitariis, pedicellis calycibusque perspicue longe ac molliter albido-ciliatis, pedicellis sub anthesi 3–4 mm. longis, sub fructu paullo longioribus, bracteolis linearibus, albido-ciliatis, 5–7 mm. longis, sepalis linearibus vel lineari-lanceolatis, elongato-acuminatis, albido-pilosis, 4–5 mm. longis; fructibus subglobosis, circiter 5 mm diametro, albido-ciliatis, circiter 6-locularibus.

HAINAN, Po-ting, *F. C. How 73044* (type in herb. Arnold Arb.), *73736,* July 1 and September 26, 1935, in forests, altitude 250–360 m.

This form with conspicuous long, soft, white indumentum on the branchlets, leaves, pedicels and flowers and its slenderly acuminate leaves manifestly belongs in the group with *Decaspermum fruticosum* Forst. In both specimens cited the flowers are axillary and strictly solitary. Striking differential characters, as compared with *D. fruticosum* Forst., are its slender, elongated, linear bracteoles and the elongated, linear or linear-lanceolate, pilose sepals.

In addition to the above we have one collection from Hainan, Yeung Ling Shan, Ngai District, *Lau 206,* with only staminate flowers. The specimens have short axillary and terminal inflorescences and leaves similar to *D. cambodianum* Gagnep., but the younger parts and the flowers are pubescent. Although we cannot match the specimens, we think it unwise to propose a new species in this critical group without additional material.

9. **Eugenia** Linnaeus

We have, for reasons indicated elsewhere,[1] accepted *Syzygium* Gaertner (including *Jambosa* de Candolle) as the proper generic name for most of the Old World species that have been placed in *Eugenia,* restricting *Eugenia* to that large group characteristic of tropical America but with some representatives in the Old World tropics. *Eugenia,* as thus restricted, has no representatives in China except for a single introduced one of Brazilian origin; and this species is the type- or standard-species of the genus.

Eugenia uniflora Linn. Sp. Pl. **1**: 470. 1753; Miq. Fl. Ind. Bat. **1**(1):

[1]Jour. Arnold Arb. 19: 99. 1938.

440. 1855; Duthie in Hook. f. Fl. Brit. Ind. **2**: 505. 1879; Urb. Bot. Jahrb. **19**: 620. 1895; Turrill, Bot. Mag. **141**: *t. 8599*. 1915; Craib, Fl. Siam. Enum. **1**: 665. 1931; Alston in Trimen, Handb. Fl. Ceyl. **6**(Suppl.): 119. 1931.

Myrtus brasiliana Linn. Sp. Pl. **1**: 471. 1753.
Plinia rubra Linn. Mant. **2**: 243. 1771; Vellozo, Fl. Flum. **5**: *t. 46*. 1827.
Plinia pedunculata Linn. f. Suppl. 253. 1781; Curtis, Bot. Mag. **14**: *t. 473*. 1800.
Eugenia Michelii Lam. Encycl. **3**: 203. 1789; DC. Prodr. **3**: 263. 1828; Trimen, Handb. Fl. Ceyl. **2**: 188. 1894; Koord. & Val. Meded. Lands Plant. **40**: 160. 1900 (Bijdr. Boomsoort. Java **6**: 160).
Stenocalyx Michelii Berg in Mart. Fl. Bras. **14**(1): 337, 628. 1857.

KWANGTUNG, cultivated, *Chun* (*S. Y. U. 4066*).

A native of South America of early introduction into the orient. It is now widely planted for ornamental purposes and for its edible fruits, and in some regions is naturalized or semi-naturalized.

10. **Acmena** de Candolle[1]

Acmena, as first limited by de Candolle (1828) comprised one Australian species. Wight (1841), lacking authentic material for comparison, misinterpreted the genus indicating several Asiatic species as part of *Acmena* which he placed in a subgenus of *Eugenia*. This concept of *Acmena* apparently replaced the original one, and in 1861 a Chinese species, *Acmena Championii* Benth. Fl. Hongk. 119, was described. This is really a *Syzygium*. Only two other species have been attributed to China, *Acmena? chinensis* Planch. Hort. Donat. 84. 1854–58 and *A. acuminatissima* (Blume) Merr. & Perry. As regards the first, the description was based on specimens cultivated in Europe and there is no direct evidence that this cultivated plant came from China. We have been unable to discover its identity, cf. Jour. Arnold Arb. **19**: 19. 1938. The singular structure of the fruits of *A. acuminatissima* prompted us to consider the generic status of this genus. Although, as in *Syzygium,* the naked embryo falls out of the opened pericarp, its structure differs greatly. Here the cotyledons are not at all easily separated, in fact appearing as one, and within is a much lobed organ of different texture (for fuller discussion cf. Jour. Arnold Arb. **19**: 6). A close scrutiny of the anthers shows the sacs divaricate and opening by a terminal slit or pore. In the other genera of this closely related complex the anther-sacs are parallel and open longitudinally.

[1] **Merrill, E. D.** and **L. M. Perry.** A synopsis of Acmena DC., a valid genus of the Myrtaceae, Jour. Arnold Arb. 19: 1-20. 1938. A genus of eleven known species chiefly of Malaysia and Australia but with one species widely ranging from Burma and southern China through Malaysia to Australia and the Solomon Islands.

Acmena acuminatissima (Blume) Merr. & Perry, Jour. Arnold Arb. **19**: 12. 1938.

Myrtus acuminatissima Blume, Bijdr. 1088. 1826.
Syzygium acuminatissimum DC. Prodr. **3**: 261. 1828.
Jambosa acuminatissima Hassk. Cat. Hort. Bogor. Alt. 262. 1844; Miq. Fl. Ind. Bat. **1**(1): 438. 1855.
Syzygium subdecurrens Miq. Fl. Ind. Bat. **1**(1): 449. 1855.
Eugenia acuminatissima Kurz, Rep. Pegu, App. A. lxiii. 1875; For. Fl. Brit. Burma **1**: 487. 1877; Duthie in Hook. f. Fl. Brit. Ind. **2**: 483. 1878; Forbes & Hemsl. Jour. Linn. Soc. Bot. **23**: 296. 1887; Koord. & Val. Meded. Lands Plant. **40**: 155. 1900 (Bijdr. Boomsoort. Java **6**: 155); King, Jour. As. Soc. Bengal **70**(2): 126. 1901 (Mater. Fl. Malay. Penin. **3**: 556); Dunn & Tutcher, Kew Bull. Add. Ser. **10**: 105. 1912; Koord. & Val. Atlas Baumart. Java **3**: *f. 506*. 1915; Ridley, Fl. Malay Penin. **1**: 747. 1922; Chung, Mem. Sci. Soc. China **1**(1): 184. 1924; non Miquel (1847), nec Berg (1857–59).
Eugenia Cumingiana Vidal, Phan. Cuming. Philip. 173. 1885; Craib, Fl. Siam. Enum. **1**: 636. 1931.
Eugenia saligna sensu C. B. Rob. Philip. Jour. Sci. Bot. **4**: 392. 1909; Merr. Lingnan Sci. Jour. **5**: 137. 1927; non *Jambosa saligna* Miq.
Eugenia subdecurrens Merr. & Chun, Sunyat. **2**: 289. 1935.

KWANGTUNG, Shi-wan-da-shan, *Tso 23424*; Ting Wu Shan, *Tsiang 1530, 1565, Chun 6379, Liang 60316*; Sunyi District, *Wang 31838*: HONGKONG, *Ford 21* (Herb. Kew, phot.): KWANGSI, Seh-feng, Dar Shan, South Nanning, *Ching 8266*: HAINAN, without definite locality, *Liang 63367, 63371, 63438, 63692, 64736, 65256, 65331, Wang 33232, 34486;* Yaichow, *Liang 62212, 63277, How 70354;* Po-ting, *How 73046, 73405*; Five Finger Mountain, *McClure 2141* (*C. C. C. 8682*); Ka Chik Shan and vicinity, Ch'ang-kiang District, *Lau 2910*; Ue Lung Shan, *Lau 3165;* Lin Fa Shan, Lam Ko District, *Tsang 381* (*L. U. 15880*). Burma and Siam southward and eastward to the Philippines and the Solomon Islands.

11. **Syzygium** Gaertner

A study of the Chinese species of *Eugenia* was undertaken as a preliminary to the larger, more complex and more difficult task of revising the Bornean species of the same group.

Eugenia is a Linnean genus; nevertheless, it was a vague entity until the time of de Candolle. This distinguished scientist, previous to the publication of the Myrtaceae in the Prodromus, wrote an informal summary of the family, Dict. Class. Hist. Nat. **11**: 399–407. 1827 (preprint, 1826). In this he made a distinct effort to associate closely related genera and to untangle the confusion caused by certain generic concepts. *Eugenia* in particular was set forth with its salient characters. Less

than a quarter of a century later, Wight (1841), unable to maintain de Candolle's concept, re-defined the genus on a much broader basis including therein *Acmena* de Candolle, *Syzygium* Gaertner, *Jambosa* de Candolle and *Caryophyllus* Linnaeus. Thus there were established two contrasting generic ideas, *Eugenia* Linn. *sensu stricto* and *Eugenia* Linn. *sensu latiore*, neither of which has wholly dominated the other. In view of this situation, any study of the genus necessarily involves a consideration of its extent. *Eugenia* in the strict sense stands primarily as limited by de Candolle, although it must be noted that the significant generic characters stressed by him have fallen into disuse and obscurity. *Eugenia* in its broader sense is a heterogeneous assemblage of material. As already indicated in our article on the Indo-Chinese species of *Syzygium* Gaertner, Jour. Arnold Arb. **19**: 99. 1938, we have departed from the broader interpretation of *Eugenia*, not on account of the growing tendency of present-day botanists to use *Syzygium*, but rather owing to the conclusions reached through study of the structure of the fruits. In practically all the fruits of *Syzygium* which we opened, the naked embryo (consisting of two distinct cotyledons with the hypocotyl mostly concealed within) fell out and the seed-coat remained more or less loosely attached to the inside of the pericarp. In contrast, the opened fruits of *Eugenia* proper disclosed not the naked embryo but the seed with a usually lustrous and membranous or possibly cartilaginous seed-coat. Furthermore the embryo is pseudomonocotyledonous. These differences in the fruits we regard as the basic distinctions between the two genera. There are some differences in the inflorescences. Those of *Syzygium* are chiefly cymose-paniculate, whereas, in *Eugenia* they are largely of clustered one-flowered pedicels (or peduncles). The calyx limb is very short in the latter and the stamens are much less incurving in the bud. A more detailed discussion of the history and characters of these two genera is given in our forthcoming paper on the Bornean species of *Eugenia*.

In taking account of all the species of China which have hitherto been accepted as *Eugenia* Linn. *sensu latiore*, it is necessary to call attention to two other genera, *Acmena* de Candolle and *Cleistocalyx* Blume. Summaries of both of these have been published in the Journal of the Arnold Arboretum, **18**: 322–343, *t. 25*. 1937 and **19**: 1–20. 1938, and of course the Chinese species appear again in this paper.

To summarize briefly, the Chinese species of *Eugenia* Linn. *sensu latiore* are here treated as belonging to *Eugenia* Linn., *Syzygium* Gaertner, *Acmena* de Candolle and *Cleistocalyx* Blume. *Eugenia* is limited to one introduced species of American origin. *Acmena* is represented by

a single indigenous species and *Cleistocalyx* by two. All other known Chinese species of the group, whether native or introduced, fall into the genus *Syzygium* which, as we interpret it, also includes *Jambosa* de Candolle.

Of the forty-five species of *Syzygium* as we recognize its occurrence in China, twenty-six are known as yet only from that country, the others are either introduced and cultivated or are already reported from Indo-China and India (Burma). Twenty have been found in Hainan alone and nine of these are not yet recorded from elsewhere in China.

The literature is rather scant and fairly well scattered, and, as already indicated, since Bentham's Flora Hongkongensis was issued in 1861, all treatments appear under *Eugenia* Linn. The only summary of the genus for all China is that of Forbes & Hemsley, Jour. Linn. Soc. **23:** 296–298. 1887. Here fourteen species are listed with synonymy and citations of collections. Since then regional plant lists, such as Groff, Ding and Groff, Lingnaam Agric. Review **2**(2)**:** 119, 120. 1924 and Merr. Lingnan Sci. Jour. **5:** 136, 137. 1927, have been helpful in bringing the summary of species, often described singly, up to date. The only key to the species of the genus in China is that of Dunn & Tutcher, Kew Bull. Add. Ser. **10:** 104, 105. 1912 (Flora of Kwangtung and Hongkong), in which nine species are contrasted. This, perhaps adequate for its purpose at the time, is now of little value when one attempts to identify material in this group since in this paper we record no less than nineteen species from Kwangtung, more than twice the number Dunn & Tutcher knew to occur in that Province.

Our treatment of the group is not in any way intended as final but rather aims to furnish a synopsis of all the species hitherto reported and to provide, we hope, a usable key for identifying assembled collections and currently collected material. Unfortunately, apart from a small group or two, we have been unable to find sectional differences for the great majority of species, hence, we are obliged to use gross and vegetative characters for our key. Gagnepain, Bull. Soc. Bot. France 64: 94–103. 1917, discussed the characters of "*Eugenia*" in great detail as foundation for his treatment of the genus in Lecomte, Fl. Gén. Indo-Chine **2:** 796–844. 1920, 1921. As a whole this is helpful, although not entirely in keeping with our experience as regards either the petals or the orientation of the embryo.

Our study of the embryo has been somewhat handicapped by the complication of polyembryony and the irregularity of the cotyledons resulting from this, the immaturity of many of the fruits at hand, the paucity in the number of fruits and their entire lack in some species.

However, it may be helpful briefly to summarize what we have observed. Five species, *S. Jambos* (L.) Alston, *S. buxifolium* Hook. & Arn., *S. latilimbum* (Merr.), *S. Forrestii* Merr. & Perry and *S. Hancei* Merr. & Perry, are ordinarily polyembryonic. The cotyledons vary in size, the hypocotyls being short. In eight species, *S. zeylanicum* DC., *S. tetragonum* Walp., *S. tephrodes* (Hance), *S. Tsoongii* (Merr.), *S. rysopodum*, *S. stenocladum* and *S. Chunianum* (the last three herein described as new) the inner faces of the cotyledons are interlocking and the hypocotyl is long. *Syzygium Championii* (Benth.) and *S. claviflorum* Wall. have cotyledons adhering more closely than in the other species but clearly separable with the inner faces distinct. The remaining species represented by fruits in the collections available to us have cotyledons with flat or concave inner faces. In *S. Levinei* (Merr.), *S. myrsinifolium* (Hance), *S. balsameum* Walp., *S. euonymifolium* (Metc.), *S. fluviatile* (Hemsl.), *S. Bullockii* (Hance), *S. kwangtungense* (Merr.) and *S. Grijsii* (Hance), the hypocotyl is very short but visible at the side of the embryo, appearing as a circular piece holding the cotyledons together. In *S. Cumini* (L.) Skeels, *S. szemaoense* Merr. & Perry, *S. salwinense*, *S. brachythyrsum* and *S. brachyantherum* (the last three herein described as new) the point of attachment and the hypocotyl are concealed between the two cotyledons.

All the material examined is cited in this article. In 1930 the senior author critically examined Hance's types also those of Hooker and Arnott, and Bentham, and made carbon imprints of the leaves which have been most helpful in showing both the actual size and the plan of the venation.

KEY TO THE CHINESE SPECIES OF SYZYGIUM

A. Flowers large, apex of the bud at anthesis at least 8 mm. in diameter; calyx-lobes persistent, conspicuous, 3 mm. or more high.

B. Inflorescence lateral, i. e., on the branches below the leaves.

1. *S. malaccense*

B. Inflorescence axillary and terminal.

C. Leaves lance-oblong to elliptic, rounded or slightly cordate at the base.

D. Flower-buds 2.5–3.5 cm. high; apex of the calyx-tube about 1.5 cm. in diameter, tube not obviously glandular.

2. *S. latilimbum*

D. Flower-buds 1.5–2 cm. high; apex of the calyx-tube 0.8–0.9 cm. in diameter, the tube copiously dotted with minute glands .....3. *S. samarangense*

C. Leaves elliptic to narrowly lanceolate, tapering at the base (slightly cordate or rounded in *S. Jambos* var. *sylvaticum*).

D. Petioles 5–8 mm. long; leaves gradually acuminate at the apex; anthers elliptic, 1–1.5 mm. long.

E. Leaves narrowly lanceolate, 6–13 cm. long, 1.5–2 cm. broad; fruit with 3–4 seeds .....4. *S. polypetaloideum*

E. Leaves lanceolate, 10–25 cm. long, 2.5–5 cm. broad; fruit with 1(–3) seed(s) .....5. *S. Jambos*

D. Petioles 8–16 mm. long; leaves obtusish or somewhat abruptly acuminate at the apex; anthers elliptic, 0.6–1 mm. long.

E. Inflorescence open, ultimate branchlets ± 1 cm. long; leaves ± obscurely pellucid-punctate, submarginal vein manifest, secondary one ± obscure.
6. *S. brachyantherum*

E. Inflorescence somewhat crowded, ultimate branchlets about 4 mm. long; leaves obviously pellucid-punctate, submarginal veins conspicuous, secondary one manifest.
7. S. imitans

A. Flowers small or slender, apex of the bud at anthesis not exceeding 5 mm. in diameter; calyx, if lobed, with caducous lobes (sometimes only tardily so in fruit) inconspicuous, not more than 2 mm. high.

B. Flower-buds slenderly clavate, not glaucous, at least 9 mm. long; calyx-tube gradually attenuate to the base or narrowed into a very short pseudostipe.

C. Branchlets tetragonous.

D. Leaves oblong-ovate, subcordate at the base; inflorescence chiefly terminal; rachis scarcely 1 cm. long.
8. *S. Boisianum*

D. Leaves elliptic to elliptic-lanceolate, tapering at the base; inflorescence terminal and axillary, rachis up to 2 cm. long.
9. *S. Championii*

C. Branchlets subcompressed, sometimes obscurely tetragonous.

D. Cymes few-flowered, axillary and terminal; calyx-tube narrowed into a short pseudostipe, longitudinally wrinkled or slightly sulcate.

E. Calyx slightly sulcate and copiously glandular; primary veins strongly ascending (from midrib at angle of about 45°); bark of the branchlets grayish-white.
10. *S. stenocladum*

E. Wrinkles of the calyx somewhat obscuring the minute glands; veins spreading-ascending (at approximately 60°); bark of the branchlets fuscous. 11. *S. rysopodum*

D. Cymes usually in dense fascicles, axillary and terminal or in the axils of fallen leaves: calyx-tube gradually attenuate to the base, not obviously wrinkled or sulcate.

E. Leaves large, 10–20 cm. long, 4–9 cm. broad, thick-coriaceous; upper surface minutely punctate; submarginal vein 2 mm. or more from the margin; secondary veins inconspicuous .....12. *S. claviflorum*

E. Leaves smaller, 4–13 cm. long, 2–4.5 cm. broad, coriaceous; both surfaces abundantly but minutely punctate; submarginal vein usually less than 1.5 mm. from the margin; secondary veins tending to be almost as prominent as the primary ones, giving the impression of closer venation than in *S. claviflorum* Wall.
13. *S. leptanthum*

B. Flower-buds various, usually not slenderly clavate (or if clavate, also glaucous) and rarely more than 9 mm. long.

C. Calyx longitudinally wrinkled and more or less glaucous or pruinose when dry; fruit, where known, white or whitish.

D. Branchlets tetragonous, the angles strongly margined or slightly winged.

E. Petioles 7–10 mm. long; leaves elliptic; ultimate branches of the inflorescence very short (2–1 mm. or less), usually bearing several (5 or more) flowers at the apex.
14. *S. Rockii*

E. Petioles 1–3 mm. long; leaves not elliptic; ultimate branches of the inflorescence short, usually bearing 3 (1–5) flowers at the apex.

F. Leaves ovate to ovate-lanceolate, subcordate at the base .....15. *S. tephrodes*

F. Leaves narrowly oblong, acute at the base.
16. *S. Tsoongii*

D. Branchlets slightly compressed or terete.

E. Acumen not more than half as long as the remainder of the blade; branchlets slender.

F. Leaves ovate, scarcely punctate above, only occasionally glandular-punctate beneath; primary veins spreading; secondary venation mostly obscure; calyx chiefly verrucose .....17. *S. zeylanicum*

F. Leaves lanceolate to lance-ovate, minutely punctate above, glandular-punctate beneath; primary veins ascending-spreading; secondary venation almost as prominent as the primary; calyx not verrucose.
18. *S. odoratum*

E. Acumen very slender and about as long as the remainder of the blade; branchlets very slender, thread-like.
19. *S. araiocladum*

C. Calyx not longitudinally wrinkled nor glaucous; fruit variously colored, not white.

D. Rachis and branches of the inflorescence minutely papillate.

E. Leaves slenderly oblong with narrow obtuse apices.
20. *S. myrsinifolium*

E. Leaves elliptic to ovate-elliptic with the acumen ± 1 cm. long .....21. *S. Levinei*

D. Rachis and branches of the inflorescence glabrous.
E. Inflorescence usually lateral in the axils of old or fallen leaves (sometimes appearing terminal), below the new leafy shoots.
F. Leaves large, up to 23 cm. long; primary veins ± 10 mm. apart.
G. Inflorescence apparently terminal or subterminal (on last year's shoots); flower-bud 2–2.5 mm. high, obconical .....22. *S. yunnanense*
G. Inflorescence lateral (occasionally terminal); flower-bud 4–6 mm. high, globose or depressed-globose at the apex, abruptly narrowed into a stalk-like base.
H. Leaves coriaceous; flower-bud with a thick pseudostipe; branchlets brownish.
I. Branchlets definitely winged; leaves drying olive-green .....23. *S. Nienkui*
I. Branchlets obscurely 4-angled or only slightly compressed; leaves drying red-dish-brown .....24. *S. tetragonum*
H. Leaves chartaceous; flower-bud with a slender clavate pseudostipe; branchlets olive-green becoming whitish .....25. *S. balsameum*
F. Leaves, if large, closely veined; primary veins ± 5 mm. apart; secondary veins almost as prominent.
G. Inflorescence open and elongated, 3–7(–12) cm. long; flowers sessile.
H. Flower-bud obovoid or subglobose at apex, tapering to a pseudostipe; leaves mostly elliptic to oblong-elliptic.
I. Inflorescence lateral; calyx obscurely lobed. 26. *S. Cumini*
I. Inflorescence axillary and terminal; calyx-lobes definite, about 2 mm. high. 27. *S. Augustinii*
H. Flower-bud obconical; leaves lanceolate to slenderly elliptic .....28. *S. fruticosum*
G. Inflorescence mostly compact and short, scarcely more than 2 cm. high; flowers pedicelled. 42. *S. euonymifolium*
E. Inflorescence axillary and terminal.
F. Branchlets tetragonous.
G. Angles of the branchlets definitely winged; inflorescence chiefly lateral; flower-bud globose at apex and abruptly contracted into pseudostipe toward base; primary veins 6–12 mm. apart. 23. *S. Nienkui*

G. Angles of the branchlets often strongly margined; inflorescence axillary and terminal; flower-bud gradually tapering to the base, or if abruptly contracted, with calyx-lobes 2 mm. high; primary veins of the leaves 1–5 mm. apart (6–12 mm. in *S. cathayense*).

H. Flower-buds with obvious calyx-lobes, abruptly contracted into a stalk-like base; submarginal vein(s) (usually two) 2–4 mm. within the margin .....29. *S. cathayense*

H. Flower-buds with inconspicuous calyx-lobes, gradually tapering to the base; submarginal vein scarcely 1 mm. within the margin.

I. Leaves lanceolate, 4.5–10 cm. long; primary veins strongly ascending.

30. *S. sterrophyllum*

I. Leaves not lanceolate, or if so, not more than 5 cm. long; primary veins spreading-ascending.

J. Flowers pedicelled; branches of the inflorescence usually ascending.

K. Leaves rounded to acutish at the apex, 1–5 cm. long; primary veins 10–21 on each side of the midrib, 1.5–3 mm. apart.

L. Leaves subcoriaceous with relatively large pellucid pustulations; submarginal vein obvious; primary veins 16–21, obvious .....31. *S. Handelii*

L. Leaves subcoriaceous to coriaceous with minute or obsolete pustulations; primary veins 10–14, more or less obscure.

M. Leaves often verticillate, occasionally opposite and alternate, 1–3 cm. long, about 1/3 as broad ....32. *S. Grijsii*

M. Leaves chiefly opposite, if as short as in *S. Grijsii*, usually somewhat rounded.

33. *S. buxifolium*

K. Leaves acuminate at the apex, 4–7 cm. long; primary veins 16–23 on either side of midrib, 2–3 mm. apart.

S. buxifolium var. *austrosinense*

J. Flowers sessile; branches of the inflorescence often strongly divaricate.

K. Flowers and leaves appearing together (inflorescence apparently leafy); upper surface of leaves with midrib, primary and submarginal veins impressed, punctate. 34. *S. salwinense*

K. Flowers appearing after leaves; upper surface of leaves with only the midrib impressed, obscurely punctate .....35. *S. szemaoense*

F. Branchlets terete or slightly compressed to sulcate, occasionally obscurely tetragonous.

G. Leaves large, with very open venation, primary veins ± 10 mm. apart.

H. Inflorescence chiefly terminal; flower-bud obconical, 2–2.5 mm. high; branchlets whitish. *22. S. yunnanense*

H. Inflorescence occasionally terminal; flower-bud turbinate with thickish pseudostipe, 3–4 mm. high; branchlets brownish. 24. *S. tetragonum*

G. Leaves smaller with primary veins rarely more than 5 mm. apart.

H. Leaves with rounded subcordate base, practically sessile .....36. *S. Bullockii*

H. Leaves tapering to petiolar base or petiole.

I. Secondary venation almost as prominent as the primary (leaves closely veined).

J. Inflorescence 3–10 cm. high, flowers usually clustered at the tips of the branches.

K. Flower-buds 5–6 mm. high, subglobose at the apex or obovoid and narrowed into a pseudostipe.

L. Petiole 7–10 mm. long; calyx-lobes about 2 mm. high. *27. S. Augustinii*

L. Petiole 15–20 mm. long; calyx-lobes about 0.5 mm. high. *37. S. Forrestii*

K. Flower-buds 2.5–3 mm. high, obconical, without pseudostipe. *28. S. fruticosum*

J. Inflorescence 1–4 cm. high, flowers usually single at tips of the branches, or,

if apparently in triads, one sessile and two pedicellate.

K. Inflorescence scarcely more than 1 cm. high with branches 1–1.5 mm. long; flower-bud 5 mm. long, 3.5–4 mm. in diameter at apex; calyx-lobes about 1 mm. long.
38. *S. brachythyrsum*

K. Inflorescence 2–4 cm. high, usually with secondary branches; flowers 3 mm. long, apex 2 mm. in diameter; calyx-lobes scarcely 0.5 mm. long .....39. *S. Chunianum*

I. Secondary venation not at all prominent.

J. Leaves linear-oblong, rounded at the apex; flowers pedicellate.
40. *S. fluviatile*

J. Leaves not linear-oblong; flowers pedicellate or sessile.

K. Flowers obviously pedicellate.

L. Bark brownish; venation of the leaves ± obscure; inflorescence chiefly terminal or in the upper axils; flower-buds about 5 mm. long ....41. *S. kwangtungense*

L. Bark greyish-white; venation of the leaves evident; inflorescence chiefly axillary or lateral in the axils of fallen leaves; flower-buds about 3 mm. long.
42. *S. euonymifolium*

K. Flowers very short-pedicellate or sessile.

L. Inflorescence 2–4 cm. high, fairly open; secondary venation of the leaves often obvious.
39. *S. Chunianum*

L. Inflorescence usually not more than 2 cm. high, fairly compact.

M. Primary veins parallel, somewhat transverse; calyx-lobes at least 1 mm. long.
38. *S. brachythyrsum*

M. Primary veins oblique; calyx-lobes 0.5 mm. or less long.

N. Flower-bud scarcely more

than 2 mm. high, usually angled; stamens very short (± 1 mm. long). 43. *S. Hancei*

N. Flower-bud 2.5–4 mm. long, scarcely, if at all, angled; stamens 2–3 mm. long.

O. Leaves roundish-elliptic, abruptly contracted into a short (3–5 mm. long) obtuse acumen; inflorescence terminal; branchlets sulcate ....44. *S. Howii*

O. Leaves elliptic, usually not so abruptly acuminate (acumen ± 10 mm. long); inflorescence axillary and terminal; branchlets compressed. 45. *S. Rehderianum*

1. **Syzygium malaccense** (Linn.) comb. nov.

Eugenia malaccensis Linn. Sp. Pl. 470. 1753; Kurz, For. Fl. Brit. Burma **1**: 493. 1877; Duthie in Hook. f. Fl. Brit. Ind. **2**: 471. 1878; Forbes & Hemsl. Jour. Linn. Soc. Bot. **23**: 297. 1887; Hemsl. Jour. Linn. Soc. Bot. **30**: 177. 1894; Koord. & Val. Meded. Lands Plant. **40**: 55. 1900 (Bijdr. Boomsoort. Java **6**: 55); King, Jour. As. Soc. Bengal **70**(2): 82. 1901 (Mater. Fl. Malay. Penin. **3**: 512); Merr. Philip. Jour. Sci. Bot. **9**: 121. 1914; Koord. & Val. Atlas Baumart. Java **3**: *f. 445*. 1914; Merr. Herb. Amboin. 398. 1917; Gagnep. in Lecomte, Fl. Gén. Indo-Chine **2**: 839. 1921; Ridl. Fl. Malay Penin. **1**: 724. 1922; Craib, Fl. Siam. Enum. **1**: 651. 1931; Kanehira, Bot. Mag. Tokyo **45**: 334. 1931, Jour. Dept. Agric. Kyushu Univ. **4**: 380. 1935.

Eugenia macrophylla Lam. Encycl. **3**: 196. 1789.

Jambosa malaccensis DC. Prodr. **3**: 286. 1828; Hook. & Arn. Bot. Beechey's Voy. 188. 1833; Wight & Arn. Prodr. **1**: 332. 1834; Hook. Bot. Mag. **74**: *t. 4408*. 1848; Wight, Ill. **2**: *t. 98*. 1841; Diels, Bot. Jahrb. **56**: 532. 1921.

Jambosa purpurascens DC. Prodr. **3**: 286. 1828, quoad syn. Roxb.

Eugenia purpurea Roxb. Fl. Ind. ed. 2, **2**: 483. 1832; Wight, Ic. **2**: *t. 549*. 1843.

Eugenia malaccensis Linn. var. *purpurea* Duthie in Hook. f. Fl. Brit. Ind. **2**: 472. 1878.

Jambosa domestica Blume, Mus. Bot. Lugd.-Bat. **1**: 91. 1849.

Caryophyllus malaccensis W. F. Wight ex Safford, Contr. U. S. Nat. Herb. **9**: 217. 1905.

Reported from southern China by Hooker and Arnott and also by Forbes and Hemsley, on the basis of specimens collected during Beechey's Voyage; these would have been from an introduced and cultivated tree, probably at Macao. Native of some part of the Indo-Malaysian region, now more or less pantropic in cultivation; we have seen no Chinese material that is referable to this strongly characterized species.

2. **Syzygium latilimbum** (Merr.) comb. nov.

Eugenia latilimba Merr. Lingnan Sci. Jour. **13**: 64. 1934.

HAINAN, *Wang 33965;* Yaichow, *How 70575, 71075,* April 23, July 21, 1933, in woods by stream; Po-ting, Ling Shui, *Ko 52169;* Chim Shan, Fan Maan Ts'uen, *McClure 20098* (type in Herb. New York Bot. Gard.), May 4–20, 1932.

Syzygium latilimbum is readily separated from the other Chinese species of this group by the oblong-elliptic leaves which are rounded or slightly cordate at the base, and by its very large flowers.

In addition to the above cited material we have a collection from Yunnan, Szemao, *Henry 11945,* which appears to be a close relative. Its leaves are scarcely more than half as wide, gradually acuminate and more obviously glandular-punctate. Although this collection does not match any species represented in the material at hand, it is too fragmentary to characterize as a distinct species without supplementary specimens.

3. **Syzygium samarangense** (Blume) Merr. & Perry, Jour. Arnold Arb. **19:** 115. 1938.

Myrtus samarangensis Blume, Bijdr. 1084. 1826.

Jambosa samarangensis DC. Prodr. **3**: 286. 1828.

Eugenia javanica Lam. Encycl. **3**: 200. 1789; Kurz, Jour. As. Soc. Bengal **46**(2): 69. 1877, For. Fl. Brit. Burma **1**: 494. 1877; Duthie in Hook. f. Fl. Brit. Ind. **2**: 474. 1878; King, Jour. As. Soc. Bengal **70**(2): 81. 1901 (Mater. Fl. Malay. Penin. **3**: 511); Merr. Philip. Jour. Sci. Bot. **9**: 120. 1914, Interpret. Rumph. Herb. Amboin. 395: 1917; Gagnep. in Lecomte, Fl. Gén. Indo-Chine **2**: 837. 1921; Ridley, Fl. Malay Penin. **1**: 726. 1922; Guillaumin, Jour. Arnold Arb. **12**: 255. 1931; Kanehira, Bot. Mag. Tokyo **45**: 334. 1931; Craib, Fl. Siam. Enum. **1**: 647. 1931; Merr. Lingnan Sci. Jour. **13**: 41. 1934; non *Syzygium javanicum* Miq.

KWANGTUNG, *Tong 98* (*S. Y. U. 6209*); Honam Island, *Lau 4* (*L. U. 18405*); Heungshan, *Chun 98*. An introduced and planted species here. Native of Malaysia, widely distributed in the Old World tropics.

Unfortunately the currently used specific name *javanica* is preoccupied

in *Syzygium*, *S. javanicum* Miq. (1855) being a totally different species based on a Javan specimen collected by Horsfield.

4. **Syzygium polypetaloideum** sp. nov.

Arbor parva, 3–5 m. alta; ramulis novellis paulum subcompressis, ferrugineis; foliis lineari-lanceolatis, 6–13 cm. longis, 1.5–2 cm. latis, utrinque angustatis, subcoriaceis, pellucido-punctatis, venis primariis utrinque 10–19, supra obscuris, subtus prominulis, secus marginem in venam submarginalem confluentibus, venulis laxe reticulatis; petiolo 5–7 mm. longo; inflorescentiis terminalibus, 6–8 cm. longis, paucifloris, ramis paucis, ± 2 cm. longis; floribus magnis, alabastris obovoideis, circiter 15 mm. longis, apice 10–12 mm. latis; calycis lobis 4, circiter 5 mm. longis, semi-orbicularibus, petalis 4, liberis, staminibus elongatis, antheris elliptico-oblongis, 1 mm. longis; fructibus subglobosis, circiter 1.7 cm. latis, seminibus 3–4.

KWANGSI, Bako Shan, W. Poseh, *Ching 7637*, September 24, 1928, by open stream side, 600 m. alt.: YUNNAN, Red River bank, *Beauvais 826*, Maupan, *Henry 10716, 10716A* (type in Herb. Arnold Arb.).

This species superficially resembles *Eugenia polypetala* Wight. It differs in having opposite leaves with primary veins less remote and more divergent, terminal inflorescence and corolla of only four petals.

5. **Syzygium Jambos** (L.) Alston in Trimen, Fl. Ceyl. **6**(Suppl.): 115. 1931; Merr. & Perry, Jour. Arnold Arb. **19**: 114. 1938.

Eugenia Jambos L. Sp. Pl. 470. 1753; Lour. Fl. Cochinch. 307. 1790, ed. Willd. 375. 1793; Willd. Sp. Pl. **2**: 959. 1800; Roxb. Fl. Ind. ed. 2, **2**: 494. 1832; Wight, Ill. **2**: 14. 1841; Kurz, Jour. As. Soc. Bengal **46**(2): 69. 1877, For. Fl. Brit. Burma **1**: 495. 1877; Duthie in Hook. f. Fl. Brit. Ind. **2**: 474. 1878; Forbes & Hemsl. Jour. Linn. Soc. Bot. **23**: 297. 1887; King, Jour. As. Soc. Bengal **70**(2): 82. 1901 (Mater. Fl. Malay. Penin. **3**: 512); Dunn & Tutcher, Kew Bull. Add. Ser. **10**: 104. 1912; Merr. Herb. Amboin. 397. 1917; Gagnep. in Lecomte, Fl. Gén. Indo-Chine **2**: 834. 1921; Ridley, Fl. Malay Penin. **1**: 724. 1922; Merr. Lingnan Sci. Jour. **5**: 136. 1927; Walker, Lingnan Sci. Jour. **6**: 133. 1928; Craib, Fl. Siam. Enum. **1**: 647. 1931; Merr. Trans. Amer. Philos. Soc. **24**(2): 285. 1935.

E. malaccensis sensu Lour. Fl. Cochinch. 306. 1790, ed. Willd. 374. 1793, non Linn.

Myrtus Jambos HBK. Nov. Gen. Sp. Pl. **6**: 144. 1823.

Jambosa vulgaris DC. Prodr. **3**: 286. 1828; Hook. & Arn. Bot. Beechey's Voy. 188. 1833; Wight & Arn. Prodr. **1**: 332. 1834; Hook. Bot. Mag. **61**: *t. 3356*. 1834; Wight, Ic. **2**: *t. 435*. 1843; Benth. Fl. Hongk. 120. 1861.

Jambosa Jambos Millsp. Field Columb. Mus. Bot. **2**: 80. 1900.

FUKIEN, Changchow, White Cloud Hill, *Chung 1148*; Foochow City,

Chung 2381, 2697: KWANGTUNG, without locality, *Chun 6132, 9785, 40188, Hu* (*S. Y. U. 20794*), *Lau 223, Liang 61872, Ng 101, Tso 20088, Wang 30496*; Ying-Tak, *Liang 60549*; Yeung-kong, *Wang 38818*; Honam Island, *Levine 357, 427;* Lofoushan, *Chun 40510;* Canton, White Cloud Hill, *Tso 20007;* vicinity of Canton, *Levine 627, 3217*: HONG-KONG, *Wright s. n., Bodinier s. n., Chun 5610, 5144, Wang 32392, Gibbs* (*Hb. Hongkong 7440*), *Tsiang 356*: YUNNAN, *Tsiang 12647* (*S. Y. U. 73450*): HAINAN, *Wang 36437, Liang 64518;* south of Fan Ta, *McClure 9156;* Pak Shik Ling and vicinity, Ching Mai District, *Lei 308;* Hung Mo Shan and vicinity, Lai, *Tsang & Fung 414* (*L. U. 17948*); Na Lin Shan, Taam Chau District, *Tsang 152* (*L. U. 16901*); Sha Po Shan, *Tsang 431* (*L. U. 17180*); Chim Shan, Fan Maan Ts'uen, Ling Shui District, *McClure 20129*.

Many of the Hainan collections are reported as from trees growing near streams.

Syzygium Jambos var. **sylvaticum** (Gagnep.) Merr. & Perry, Jour. Arnold Arb. **19:** 114. 1938.

Eugenia Jambos L., var. *sylvatica* Gagnep. in Lecomte, Fl. Gén. Indo-Chine **2:** 835. 1921.

KWANGTUNG, *Ng 101,* in part (*S. Y. U. 27508, 67794*).

Unfortunately, since the label is written in Chinese characters, we do not know in what locality the specimens were collected. Gagnepain reports the variety from Hongkong. It differs from the species in the rounded leaf-base and the compact inflorescence. It is well to add, however, that there is a specimen in the Royal Botanic Garden, Edinburgh, collected by Bodinier in Happy Valley, Hongkong, March, 1894, which has rather broad leaves with rounded base but the inflorescence is open.

Native of the Indo-Malaysian region, now pantropic in cultivation.

6. **Syzygium brachyantherum** sp. nov.

Arbor 3–12 m. alta; ramulis teretibus vel subcompressiusculis; foliis anguste ellipticis, 8–14 cm. longis, 2.5–5 cm. latis, basi obtusis, apice obtuse vel abrupte acuminatis, acumine 1–1.5 cm. longo, subcoriaceis glanduloso-punctatis, siccis subtus pallido-brunneis, venis primariis 12–19 utrinque prominulis secus marginem arcuatim confluentibus, venulis laxe reticulatis, petiolo 8–14 mm. longo; inflorescentiis terminalibus 5–10 cm. longis latisque, ramis gracilibus, divaricatis, 2–5 cm. longis, ultimis ± 1 cm. longis; floribus magnis, alabastris obovoideis 12–14 mm. longis, apice 10–11 mm. latis; calycis lobis 4 semiorbicularibus circiter 5 mm. longis, 6 mm. latis, petalis liberis, staminibus elongatis, antheris late ellipticis 0.6–1 mm. longis; fructibus obovoideo-globosis 2 cm. diametro.

YUNNAN, Szemao, *Henry 12651, 12091, 12091A, 12091B;* Ping-pien-Hsien, *Tsai 61322,* July 28, 1934, in ravine 360 m. alt.: HAINAN, Fan Yah, *Chun & Tso 44077,* October 19, 1932, 730 m. alt.; Ngo Ko Shan, Ch'ang-kiang District, *Lau 1894* (type in Herb. Arnold Arb.), June 8, 1933; Yaichow, *Liang 62614, 63154,* August 15 and September 26, 1933; Five Finger Mountain, *McClure 8425,* December 9, 1921.

This species is closely allied to *S. Jambos* (L.) Alston, but it is clearly distinct in its long-petioled and slenderly elliptic leaves and its open and often widely branching inflorescence; the flowers are smaller with shorter pseudostipes and somewhat shorter anthers than in the latter species.

7. **Syzygium imitans** Merr. & Perry, Jour. Arnold Arb. **19:** 113. 1938.

KWANGSI, Shap Man Taai Shan, *Tsang 24111, 24327.* Indo-China.

This species is very much like *S. brachyantherum* Merr. & Perry in general appearance. The inflorescence, however, is rather crowded and has much shorter ultimate branchlets with slightly smaller flowers. The leaves are more glandular and practically all show a secondary submarginal vein, the main one being very distinct. The average length of the petiole is as long as that of the longer ones in *S. brachyantherum.*

8. **Syzygium Boisianum** (Gagnep.) Merr. & Perry, Jour. Arnold Arb. **19:** 115. 1938.

Eugenia Boisiana Gagnep. Not. Syst. **3:** 318. 1917 et in Lecomte, Fl. Gén. Indo-Chine **2:** 840, *f. 87.* 1921.

HAINAN, Po-ting, *How 72784,* June 8, 1935, in forest at 360 m. alt.

This species is reported for the first time from China. The collection appears to differ from the Indo-Chinese material only in its somewhat larger leaves. *Eugenia Boisiana* is characterized by Gagnepain as having 10 petals; we suggest that the number is variable, and if used as a key-character, it needs further consideration and support.

9. **Syzygium Championii** (Benth.) comb. nov.

Acmena Championii Benth. Jour. Bot. Kew Gard. Miscel. **4:** 118. 1852; Walp. Ann. **4:** 840. 1857; Benth. Fl. Hongk. 119. 1861.

Eugenia Henryi Hance, Jour. Bot. **23:** 7. 1885.

Eugenia Championii Hemsl. Jour. Linn. Soc. Bot. **23:** 296. 1887; Dunn & Tutcher, Kew Bull. Add. Ser. **10:** 105. 1912; Merr. Lingnan Sci. Jour. **13:** 41. 1934.

Eugenia Maclurei Merr. Philip. Jour. Sci. **21:** 350. 1922, Lingnan Sci. Jour. **5:** 136. 1927.

KWANGTUNG, without locality, *Sun Yatsen University 5416, Chun 40107;* Yeungchun, *Wang 38740;* Shi-wan-da-shan, *Tso 23531;* Ying-Tak, Wentongshan, *Liang 61042;* Lokcheong, *Ko 51123;* Sunyi, *Wang 37725;* Fan Shiu Au and vicinity, Wung Yuen District, *Lau 2751;*

Yoongyuen, *Lau 25023;* Loufoushan, *Chun 40430, 40457, Tsiang 1697, Ko 52447, 52459, 53520;* Toishan, *Tso 22390*: HONGKONG, *Sargent s. n.;* below Bowen Road, *Ford s. n.*, October 16, 1893; Happy Valley, *Bodinier 670*: KWANGSI, Pingnan, *Wang 39980;* Seh-feng, Dar Shan, S. Nanning, *Ching 8094*; Shap Man Taai Shan, southeast of Shang-sze, *Tsang 24132, 24555, 24693*: HAINAN, Po-ting, *How 73417, 73597, 73859*; Tai Un, *McClure 7678*, October 26, 1921 (type of *E. Maclurei*); Dung Ka to Wen Fa Shi, *Chun & Tso 43858;* Dung Ka, *Chun & Tso 43917*.

In the material at hand we have not found any tangible differences by which *Eugenia Henryi* Hance and *E. Maclurei* Merr. can be maintained as separate species.

A full discussion of the identity of Bentham's species may be found in Lingnan Sci. Jour. **13:** 41. 1934. Briefly, the original description included two distinct species; one with smaller pale leaves, narrowly clavate calyces and 4-angled branchlets; the other with slightly larger dark brown leaves, ellipsoid fruits and terete branchlets. The first Merrill designated as true *E. Championii* (Benth.) Hemsl., as it is that part of the material with *Acmena* characters on which the original description was based, as *Acmena* was interpreted by Bentham, i. e., that group of species characterized by elongated rather slender calyx tubes that gradually taper to the base.

10. **Syzygium stenocladum** sp. nov.

Arbor ± 12 m. alta; ramulis cinereis subcompressis vel teretibus; foliis anguste ellipticis 4–7 cm. longis, 1.5–3 cm. latis, coriaceis, basi acuminatis, apice obtuse acuminatis recurvatisque, glandulis minutis impressis conspersis, utrinque subconcoloribus, costa supra impressa, venis primariis gracilibus inconspicuis, valde ascendentibus, 2–4 mm. remotis, venulis laxe reticulatis, petiolo 5–7 mm. longo; inflorescentiis terminalibus axillaribusque paucifloris, rachi 5–10 mm. longo; calycis tubo clavato, basi stipitato, 12–13 mm. longo, crebre glanduloso, lobis 0.4 mm. altis.

HAINAN, Ue Lung Ling, Ch'ang-kiang District, *Lau 1454,* (type in Herb. Arnold Arb.), April 4, 1933.

This species is characterized by its slender grayish-white branchlets, the leaves with a recurving apex and strongly ascending primary veins. The calyx is copiously glandular and inclined to be sulcate when dry. The corolla and most of the stamens have already fallen.

Two nearly mature fruiting collections, Hainan, Yaichow, *How 70640,* May 1, 1933; Ka Chik Shan and vicinity, Ch'ang-kiang District, *Lau 1638,* April 26, 1933, are very closely allied, having grayish-white

branchlets and very short and sparsely flowered inflorescences. *How 70640* apparently differs only in having the primary veins of the leaves spreading-ascending. *Lau 1638* has larger thicker leaves more profusely punctate above as well as spreading-ascending primary veins. Possibly both collections are but forms of *S. stenocladum*.

11. **Syzygium rysopodum** sp. nov.

Arbor 14–20 m. alta; ramulis fuscis, subcompressis; foliis ellipticis, 4.5–9 cm. longis, 1.7–3.6 cm. latis, utrinque angustatis, basi obtusis, apice abrupte acuminatis, acumine 5–10 mm. longo, firmis nitidis, coriaceis, olivaceis, subtus pallidis, glandulis minutis impressis conspersis, costa supra impressa, venis primariis ± conspicuis 2–4 mm. remotis in venam unicam secus marginem confluentibus; petiolo 9–14 mm. longo, transversim corrugato; cymis terminalibus et in axillis superioribus usque ad 6 cm. longis, alabastris ignotis; calycis lobis 5, 0.5–0.8 mm. longis vix 1 mm. latis, obtusiusculis, tubo 12 mm. longo, 4 mm. lato, longitudinaliter rugoso, late clavato, breviter stipitato, staminibus numerosis, antheris suborbicularibus, vix 0.4 mm. longis, stylo 4.5–5 mm. longo; fructibus pyriformibus vel ellipsoideis, circiter 1 cm. longis.

HAINAN, *Liang 65063*, February 21, 1933, shaded forest, midway up the mountain; Po-ting, *How 73669* (type in Herb. Arnold Arb.), September 14, 1935, ravine in forest at about 480 m. alt.; Yaichow, *How & Chun 70137*; Mo San Leng, *Chun & Tso 44316*.

A rather distinct species with the longitudinally wrinkled calyx as its obvious character. The flowers of the type-specimen have already passed anthesis. The fruit is red with one or two seeds and the embryo is similar to that found in the seeds of the other clavate-flowered species of *Syzygium*.

12. **Syzygium claviflorum** (Roxb.) Wall. List no. 3575. 1931, *nomen nudum;* Cowan & Cowan, Trees North. Bengal 67. 1929.

Eugenia claviflora Roxb. Hort. Bengal. 37. 1814, *nomen nudum*, Fl. Ind. ed. 2, **2**: 488. 1832; Wight, Ic. **2**: *t. 606*. 1843; Kurz, Jour. As. Soc. Bengal **46**(*2*): 65. 1877, For. Fl. Brit. Burma **1**: 480. 1877; Duthie in Hook. f. Fl. Brit. Ind. **2**: 484. 1878; King, Jour. As. Soc. Bengal **70**(*2*): 107. 1901 (Mater. Fl. Malay. Penin. **3**: 537); Craib, Fl. Siam. Enum. **1**: 635. 1931; Merr. & Chun, Sunyat. **2**: 43. 1934.

HAINAN, *Liang 65221, 65372, Wang 36691;* Po T'eng Shi (BoDeng) and vicinity, Ling Shui District, *Fung 20020;* Chim Shan, Fan Maan Ts'uen, *McClure 20128;* near Po-ting, *Liang 61602;* Tun Shan Lin, Manyun, *Ko 52125;* Chung Ngo Shan, Ch'ang-kiang District, *Lau 3355;* I Kap Shan and vicinity, Tan District, *Lau 1189;* Chim Fung Ling, Kan-en District, *Lau 3424;* Yaichow, *How & Chun 70206, How 70665*.

This material is reasonably constant in floral characters, texture and venation of leaves, and color of bark. Although the leaves show a strong tendency to be elliptic rather than lanceolate as in the original description, the collections compare favorably with specimens available to us from Chittagong, the type-locality of this species. Burma, Siam, Indo-China, and the Malay Peninsula.

13. **Syzygium leptanthum** (Wight) Niedenzu in Engler & Prantl, Nat. Pflanzenfam. **3**(7): 85. 1893.

Eugenia leptantha Wight, Ill. **2**: 15. 1841, Ic. **2**: *t.* 528. 1843; Kurz, Jour. As. Soc. Bengal **46**(*2*): 65. 1877, For. Fl. Brit. Burma **1**: 480. 1877; Duthie in Hook. f. Fl. Brit. Ind. **2**: 484. 1878; Gagnep. in Lecomte, Fl. Gén. Indo-Chine **2**: 833. 1921; non Benth. (1840).

Eugenia claviflora var. *leptantha* King, Jour. As. Soc. Bengal **70**(*2*): 108. 1901 (Mater. Fl. Malay. Penin. **3**: 538).

Eugenia leptalea Craib, Fl. Siam. Enum. **1**: 649. 1931.

YUNNAN, Szemao, *Henry 12860, 12921, 12921A*.

Most of the flowers on these specimens have already opened, but, of the remaining buds, two dissected had eight petals each. Among the species of *Syzygium* with clavate flowers and small calyx-lobes (± 1 mm. high), as far as we know, only *S. Boisianum* (Gagnep.) Merr. & Perry and *S. Wightianum* Wight have been reported as having more than the usual number (4–5) of petals. The first is readily excluded on foliar characters; likewise the second, if the material of that species in our herbarium (Pen. Ind. Or., *Hb. Wight 1036*, distr. Royal Gardens, Kew 1866–7, and Malabar, Concan, *Stocks, Law*) may be regarded as authentic.

On the other hand, our specimens are fairly comparable to *Griffith* (*Herb. East India Co. 2367*, distr. Royal Gardens, Kew, 1861–2) cited by King, l. c., as *E. claviflora* var. *leptantha* King (in the Griffith collection there was at least one flower with eight petals), i. e., *S. leptanthum* (Wight) Ndz. and, provisionally we are placing our collections in this species.

We are not greatly assured as to its true identity nor as to that of *S. claviflorum* Wall. Our nearest approach to the original of each is found in the descriptions and in Wight, Ic. *t. 528* and *t. 606*. The first illustration shows a flowering branch natural size; *t. 606* is a copy of Roxburgh's original drawing without reference to size. Doubt as to the identity of the two must have existed in Wight's mind since *t. 528* is labeled *Eugenia* (*A*) *claviflora* ? Roxb. although his legend is *Eugenia* (*A*) *leptantha* (R. W.). We note that *S. leptanthum* (Wight) Ndz., as meagerly represented in our herbarium by six sheets, tends to have

slightly smaller leaves and often smaller flowers than those shown in Wight's plate.

14. **Syzygium Rockii** sp. nov.

Arbor ± 12 m. alta; ramulis tetragonis subfuliginosis; foliis ellipticis, coriaceis, nitidis, olivaceis, supra pallidis, 8–10 cm. longis, 2.5–3.5 cm. latis, basi obtusiusculis, apice obtuse acuminatis, acumine ± 1 cm. longo, subtus glandulis minutis conspersis; costa subtus prominente, venis primariis utrinque vix elevatis, 2–3 mm. remotis, ad marginem in venam unicam confluentibus, venulis laxe reticulatis; petiolo ± 1 cm. longo; paniculis terminalibus et in axillis superioribus, 5–10 cm. altis, ramulis ultimis brevibus; floribus glomerulatis, alabastris 8–9 mm. longis, apice 2.5 mm. diametro; calycis tubo glaucescente, lobis 1–1.5 mm. longis, obtuse triangularibus, antheris late orbiculatis; stylo ± 3 mm. longo.

YUNNAN, Muang Hing plain, between Muang Hing and Szemao and the Szemao hills proper, *Rock 2742* (type in Herb. Arnold Arb.), March 2, 1922.

A very distinct species belonging to the Leptomyrtus group, and characterized by long slender caducous bracts, glaucous calyces and 4-angled branchlets. The inflorescence is widely branching with the tips of the branches subdividing, very slightly elongating and bearing flowers in glomerules or fascicles.

15. **Syzygium tephrodes** (Hance) comb. nov.

Eugenia tephrodes Hance, Jour. Bot. **23**: 7. 1885; Forbes & Hemsl. Jour. Linn. Soc. Bot. **23**: 298. 1887; Merr. Lingnan Sci. Jour. **5**: 137. 1927.

HAINAN, *Henry 8258, Moninger 51, Liang 63738, 64932, Wang 33411;* near Ka-chik, *Henry 162* (type in Herb. Brit. Mus.; phot. and carbon imprint); Yaichow, *Liang 61953, 63098;* Tai Un, *McClure 7828;* Poting, *How 72816, 73350;* Mo San Leng, *Chun & Tso 44394;* Tung Koo Shan and vicinity, Wen-ch'ang District, *Fung 20351;* Mei Maan and vicinity, *Lei 10;* Pak Shik Ling and vicinity, Ching Mai District, *Lei 696.*

In the characters of the branchlets, inflorescence and fruit, *S. tephrodes* and *S. Tsoongii* are very much alike. The branchlets of the former may more nearly approach a winged condition at or just below the nodes and the flowers of the latter may have a little longer pseudostipe, but these differences are only in degree or scarcely worth mentioning. The foliar characters, however, are definitely those of distinct species; the leaves of *S. tephrodes* (Hance) are ovate or elongate-ovate with a rounded, emarginate, or subcordate base; whereas, those of *S. Tsoongii* are narrowly oblong with an acute base.

16. **Syzygium Tsoongii** (Merr.) Merr. & Perry, Jour. Arnold Arb. **19:** 112. 1938.

Eugenia leucocarpa Gagnep. Not. Syst. **3:** 327. 1918 et in Fl. Gén. Indo-Chine **2:** 828. 1921, non Merr. 1916.

Eugenia Tsoongii Merr. Philip. Jour. Sci. **21:** 504. 1922.

KWANGTUNG, Yamchow, *Tsoong 1867* (*C. C. C. 3748*) (type of *E. Tsoongii* in Herb. Manila): HAINAN, *Liang 64157, Wang 33342, 36838;* Dung Ka to Wen Fa Shi, *Chun & Tso 43676, 43688,* in thicket by stream at about 500 m. alt.; Po-ting, *How 72810, 73714;* Yaichow, *How 70528, Liang 62020;* Lokwui, *How 72270;* Chung Kon, *Gressitt 1034.* Indo-China.

How 72270 varies a little from the other specimens cited in having broader leaves somewhat tapering at the apex.

Eugenia leucocarpa Gagnep. and *E. Tsoongii* Merr., described independently, are apparently the same species. Although Gagnepain's is the earlier name, owing to the fact that it is a later homonym of *E. leucocarpa* Merr. Philip. Jour. Sci. Bot. **11:** 23. 1916, it must be rejected.

17. **Syzygium zeylanicum** (L.) DC. Prodr. **3:** 260. 1828; Merr. & Perry, Jour. Arnold Arb. **19:** 101. 1938.

Myrtus zeylanica Linn. Sp. Pl. 472. 1753.

Eugenia spicata Lam. Encycl. **3:** 201. 1789; Koord. & Val. Meded. Lands Plant. **40:** 122. 1900 (Bijdr. Boomsoort. Java **6:** 122).

Eugenia zeylanica Wight, Ill. **2:** 15. 1841; Duthie in Hook. f. Fl. Brit. Ind. **2:** 485. 1878; King, Jour. As. Soc. Bengal **70**(2): 108. 1901 (Mater. Fl. Malay. Penin. **3:** 538); Gagnep. in Lecomte, Fl. Gén. Indo-Chine 2: 804. 1920; Merr. Enum. Born. Pl. 434. 1921; Ridl. Fl. Malay Penin. **2:** 738. 1922; non Willd.

Syzygium bracteatum Korth. Nederl. Kruidk. Arch. **1:** 205. 1847.

Eugenia varians Miq. Anal. Bot. Ind. **1:** 21. 1850.

Syzygium coarctatum Blume ex Miq. l. c., in syn., excl. syn. *S. rugosum* Korth.

Eugenia myrtifolia sensu Miq. Anal. Bot. Ind. **1:** 20. 1850, non Roxb.

Myrtus lepidocarpa Korth. ex Miq. l. c., in syn.

Syzygium myrtifolium Miq. Fl. Ind. Bat. **1**(1): 456. 1855.

Jambosa bracteata Miq. op. cit. 437.

Eugenia antiseptica sensu Ridl. Jour. Bot. **68:** 17. 1930, non O. Ktze.

KWANGTUNG, *Chun 51635,* July 18, 1931; Sunyi District, *Wang 32075;* Yeungchun, *Wang 38666.* India and Ceylon to Burma and Indo-China, southward to Sumatra, Java, and Borneo.

Syzygium zeylanicum DC. and *S. odoratum* DC. are very closely related species. In the former, however, the leaves are usually more rounded-cuneate at base and the primary veins are more spreading-ascending; the flowers are usually a little larger with slightly longer calyx-lobes and there is a tendency for the calyx-tube to be verruculose.

18. **Syzygium odoratum** (Lour.) DC. Prodr. **3:** 260. 1828; Hook. & Arn. Bot. Beechey's Voy. 187. 1833; Benth. Fl. Hongk. 119. 1861; Merr. & Perry, Jour. Arnold Arb. **19:** 102. 1938.

Opa odorata Lour. Fl. Cochinch. 309. 1790; Moore, Jour. Bot. **63:** 283. 1925; non *Eugenia odorata* Berg.

Eugenia Millettiana Hemsl. Jour. Linn. Soc. Bot. **23:** 297. 1887; Merr. Trans. Amer. Philos. Soc. **24**(2): 285. 1935, Lingnan Sci. Jour. **14:** 41. 1935.

Eugenia Deckeri Gagnep. Not. Syst. **3:** 323. 1918 et in Lecomte, Fl. Gén. Indo-Chine **2:** 807. 1920.

CHINA, without locality, ex herb. *Lindley*: KWANGTUNG, Canton, *Arnott s. n.;* Pon-tan, Hoi Kong District, Luichow, *Tsiang 2549, 2566;* Kouang-tcheou, *Decker 15* (type of *E. Deckeri* Gagnep.); Lappa Island, near Macao, *Hance 1314*: HONGKONG, Sha-tin, New Territory, *Chun 4944, 5114*: HAINAN, Po-ting, *How 73460;* Wong Kam Shan, Ngai District, *Lau 564*. COCHIN-CHINA, photograph of the type of *Opa odorata* Lour., original in the herbarium of the British Museum.

A complete discussion of this species under the name *Eugenia Millettiana* Hemsl. may be found in Merrill, Trans. Amer. Philos. Soc. **24**(2): 285. 1935, Loureiro's specific name *odorata* being invalid in *Eugenia*. Confusion in the concept of the species arose owing to the fact that the collections cited by Hemsley (and therefore accepted as correct) represent this and a very different species which has since been described as *Eugenia Levinei* Merr. Nomenclaturally, when no original description is given, the name must be interpreted from the synonymy rather than from erroneously named specimens. Hooker & Arnott suggested the possibility of *S. lucidum* Gaertn. as a synonym and Seemann accepted it as such, but Britten (Jour. Bot. **58:** 151. 1920) points out that *S. lucidum* Gaertn. is an Australian species and not identical with the one in question. Loureiro's specific name is valid in *Syzygium* but is invalid in *Eugenia*.

Doctor F. Gagnepain very kindly sent us a leaf and a flower of the type of *Eugenia Deckeri* Gagnep. As we had already suspected, true *Syzygium odoratum* DC. is the species represented. Further, it is to be noted that Kouang-tcheou, where Gagnepain's type was collected, is the small French possession just northeast of Luichow Peninsula in Kwangtung Province, China, and is hence geographically a part of China not of Indo-China. *Eugenia Millettiana* sensu Gagnep. in Lecomte, Fl. Gén. Indo-Chine **2:** 823. 1920, is *S. Levinei* (Merr.) Merr. & Perry.

19. **Syzygium araiocladum** sp. nov.

Arbuscula ± 1 m. alta; ramulis teretibus vel subcompressis, gracillimis

ferrugineis; foliis coriaceis, 3–5 cm. longis, 0.6–1.5 cm. latis, lanceolatis, basi acutis vel obtusiusculis, apice longissime obtuseque acuminatis, acumine 1.5–2 cm. longo, subtus glandulis minutis impressis conspersis ad marginem crebris, costa supra impressa, venis primariis vix perspicuis, ± 2 mm. remotis, petiolo 2–3 mm. longo; inflorescentiis terminalibus et in axillis superioribus, ± 2.5 cm. longis, paucifloris; alabastris clavatis 7–8 mm. longis, apice 2–2.5 mm. latis, basi longe stipitatis; calycis tubo glaucescente, lobis vix 0.5 mm. longis, deltoideis, antheris orbiculatis, stylo ± 4 mm. longo; fructibus ignotis.

KWANGSI, Shap Man Taai Shan, near Hoh Lung Village, southeast of Shang-sze, Kwangtung Border, Shang-sze District, *Tsang 22482, 22559* (type in Herb. Arnold Arb.), June, 1933.

This species is apparently related to *Syzygium odoratum* DC. It is, however, a smaller shrub with very slender almost thread-like branchlets and strikingly different leaves. The tip of the leaf is practically linear and almost as long as the rest of the blade; the lower surface is sparsely dotted with minute glands which become very abundant close to the margin, and more or less form a marginal row. Then, too, the pseudostipe of the flower is longer and more slender than that of any other Chinese species of the Leptomyrtus group.

20. **Syzygium myrsinifolium** (Hance) comb. nov.

Eugenia myrsinifolia Hance, Jour. Bot. **23**: 8. 1885; Forbes & Hemsley, Jour. Linn. Soc. Bot. **23**: 297. 1887; Merr. Lingnan Sci. Jour. **5**: 137. 1927.

HAINAN, *Henry* (type in Herb. Brit. Mus.; carbon imprint), *Liang 64578*, January 13, 1934, margin of stream, *Wang 33343, 34274, 35429;* Dung Ka, *Chun & Tso 43520*, along stream, about 500 m. alt.; Tungkap, Tingan, *Ko 52286*, January 5, 1932; Hung Mo Shan, *Tsang & Fung 420* (*L. U. 17954*), *669* (*L. U. 18203*), *Tsang, Tang & Fung 176* (*L. U. 17707*), May 15, 1929; Nga Wan, *McClure 8347*, December 6, 1921; Five Finger Mountain, *McClure 8525*, December 18, 1921; near Shui Mun, *McClure 3085* (*C. C. C. 9637*), May 15, 1922, shady ravine, edge of mountain stream, 600–650 m. alt.; Seven Finger Mountains, *Liang 61756*, May 5, 1932; Yaichow, *Liang 62529*, August 11, 1933; between T'ang K'iu (Din-kio) and Po T'eng Shi (BoDeng), Ngai District, *McClure 20039*, April-May, 1932; Sama Kong and vicinity, *McClure 20039*, April-May, 1932; Po-ting, *How 72173, 73716.*

Syzygium myrsinifolium (Hance) Merr. & Perry and *S. Levinei* (Merr.) Merr. & Perry are the only two described Chinese species of *Syzygium* which do not have glabrous inflorescences. They are quite unlike as to flowers and foliage. The first has slenderly obovoid flower-

buds about 6 mm. long and oblong leaves; the second has turbinate flower-buds near 4 mm. long and elliptic to ovate-elliptic leaves.

21. **Syzygium Levinei** (Merr.) Merr. & Perry, Jour. Arnold Arb. **19:** 110. 1938.

Eugenia Levinei Merr. Lingnan Sci. Jour. **13:** 39. 1934.
Eugenia Millettiana sensu Dunn & Tutcher, Kew Bull. Add. Ser. **10:** 105. 1912; Gagnep. in Lecomte Fl. Gén. Indo-Chine **2:** 823. 1920; McClure, Lingnan Univ. Sci. Bull. **3:** 30. 1931; non Hemsl.

KWANGTUNG, without locality, *Chun 5145, 9849, 40126;* vicinity of Canton, *Kwok 80453, Wang 30559;* Lantau Island, *McClure 13107, Tsang 16638;* Lofoushan, *Chun 40502, 40963, Ko 52422, Ford s. n., Merrill 10713* (type in Herb. Manila), August 28, 1917; Toishan, *Tso 22540;* Ting Woo Shan, Kao-Yao District, *Lau 20245;* Poon Ue, Paak Shan, *Kwok 6803;* Poon Yue District, *Levine 3251;* Kong Moon, *McClure & Fung 00455* (*L. U. 19636*); Kochow, *Tsiang 871, 945:* HONGKONG, *Chun 5110, 40306, 41744, Tsiang 359, Wright s. n., Wang 30316;* Aberdeen Road, *Gibbs* (*Herb. Hongkong 7492*); Ta-wei, New Territory, *Chun 5135;* Sha-tin, *Chun 5107;* August, 1927; Ma Au Shan, *Tsiang 201,* April 17, 1928; Wu Kau Tin, *Chun 6231, Tsiang 2976, 2989;* Causeway Road, *Ford s. n.* in part, August 17, 1893; Little Hongkong, *Chun 4987;* Wong Nei Chong, *Tsiang 2997,* August 14, 1929; Bowen Road, *Tsiang 2997, Bodinier 1295;* Peak, *Wang 3023:* KWANGSI, Seh-Feng, Dar Shan, S. Nanning, *Ching 7858,* October 15, 1928, in woods at about 360 m. alt.: HAINAN, *Fenzel* (*S. Y. U. 17736*), *Liang 63305, 64947, 65142, Wang 33433, 34317;* Namdmu, *Chun 5918;* Tung Koo Shan and vicinity, Wen-ch'ang District, *Fung 20434;* Yaichow, *How 71076;* Fung Leng, Ngai District, *Lau 486;* Tai Tin Shan, Ch'angkiang District, *Lau 1279;* Ka Chik Shan and vicinity, *Lau 1466;* Chim Fung Ling, Kan-en District, *Lau 3543,* forest; Mei Maan and vicinity, Ching Mai District, *Lei 21;* Sha Po Shan and vicinity, Taam-chau District, *Tsang 631* (*L. U. 16130*).

Syzygium Levinei (Merr.) Merr. & Perry is the correct name for the species which, until very lately, has been confused with *Syzygium odoratum* DC. (*E. Millettiana* Hemsl.). They are much alike as to foliage but the inflorescences are very different, at least when dry. In the former, the axes and branches are minutely papillate and the flowers dry a dark brown; in the latter the axes of the inflorescences are smooth and the flowers are glaucous or pruinose on drying.

22. **Syzygium yunnanense** sp. nov.

Arbor ± 9 m. alta; ramulis subcompressis albis vel cinereis; foliis late

lanceolatis, utrinque angustatis, basi acutis, apice obtuse acuminatis, 9–17 cm. longis, 2.5–5 cm. latis, coriaceis, siccis brunneis, subtus pallidis et minute glanduloso-punctatis, venis primariis perspicuis, ± 1 cm. remotis, intra marginem arcuatim anastomosantibus, venulis inconspicuis; petiolo 1.5–2 cm. longo; paniculis pluribus terminalibus et in axillis superioribus aggregatis, 2.5–4.5 cm. longis, ramulis obscure tetragonis, minute pustulatis, 3–5-floris; alabastris obovoideis, 2–2.5 mm. longis, apice circiter 1.5 mm. latis, calycibus obsolete 4-dentatis vel undulatis, staminibus vix 2 mm. longis, antheris ovatis, connectivo in glandulam producto.

YUNNAN, Szemao, *Henry 12938* (type in Herb. Arnold Arb.).

This species is undoubtedly very closely related to *S. cinereum* Wall., in which the branches of the inflorescence are brachiate, the primary veins of the leaves anastomose 3–5 mm. from the margin and a second submarginal vein may be faintly present; glandular punctations too are sparse or lacking. In *S. yunnanense* Merr. & Perry, on the other hand, the branches of the inflorescence are ascending, the flowers perhaps a little larger, the primary veins anastomose about 2 mm. from the margin and the leaves are much more puncticulate.

23. **Syzygium Nienkui** sp. nov.

Arbuscula vel arbor parva, glabra, 3–12 m. alta; ramis teretibus, cinereis, ramulis 2–4 mm. crassis, tetragonis, anguste alatis, olivaceis vel brunneis; foliis coriaceis, olivaceis, ellipticis vel oblongo-obovatis, 10–20 cm. longis, 4.5–8 cm. latis, basi cuneatis vel obtusiusculis, apice abrupte obtuseque acuminatis, acumine ± 1 cm. longo, supra minute pellucido-punctatis, subtus pallidioribus, venis primariis 15–18, 7–12 mm. remotis prominulis, venulis vix conspicuis laxe reticulatis, vena intramarginali a margine 2–3 mm. distante, costa supra impressa; petiolo 1–1.5 cm. longo; paniculis axillaribus terminalibusque vel ex axillis defoliatis, 1.5–4.5 (plerumque 3) cm. longis, ramis brachiatis ad 2 cm. longis, tetragonis vel subalatis, 1–3-floris; alabastris obovoideis, 4.5–5.5 mm. longis, apice 4 mm. diametro; calycis parte limboidea valde depresso-cupulari, post anthesin fere plana, lobis vix 0.4 mm. longis, 1 mm. latis, petalis calyptratim deciduis.

HAINAN, *Liang 64187*, in light woods on slope of hill, *Wang 34300, 34705, 35056, 35350, 36369;* Dai Land, Dung Ka, *Chun & Tso 43905* (type in Herb. Arnold Arb.), September 23, 1932, in forested ravine, about 700 m. alt.; Po-ting, *How 73070*, July 4, 1935, in forest at about 360 m. alt.

This species is closely allied to *S. tetragonum* Wall. It differs in the

very definitely winged branchlets, the coarser and narrowly winged rachis and the larger flowers. In addition to these apparently constant characters the leaves of this species dry an olive-green; whereas, in *S. tetragonum* they are reddish-brown when dry. The specific name is derived from the given names of one of the collectors, Nien Ku Chun. This was indicated by Prof. W. Y. Chun as a new species under *Eugenia*. It is named in honor of N. K. Chun.

24. **Syzygium tetragonum** Wall. List no. 3550. 1831, *nomen nudum;* Wight, Ill. **2:** 16. 1841, in syn.; Walp. Repert. **2:** 179. 1843; Cowan & Cowan, Trees North. Bengal 67. 1929.

Eugenia tetragona Wight, Ill. **2:** 16. 1841; Kurz, Jour. As. Soc. Bengal **46**(*2*): 66. 1877, For. Fl. Brit. Burma **1:** 484. 1877; Duthie in Hook. f. Fl. Brit. Ind. **2:** 497. 1879.

Syzygium rameum Wall. List no. 3595. 1831 (fide Duthie), *nomen nudum.*

YUNNAN, without locality, *Forrest 29973;* Salwin-Irrawadi Divide, near La-To-Wa-Di, *Forrest 954,* banks of streams, side valleys of the Salwin; Shweli valley, *Forrest 8296, 9572, 11810;* Shweli-Salwin Divide, *Forrest 24424, 24425, 26149;* hills 3 days south of Tengyueh, *Forrest 26667;* watershed of Black River or Papienho, between Mohei and Maokai, *Rock 2925;* Lung-ling Hsien, *Tsai 55031, 56673, 56686;* Mongka, *Tsai 56338, 56767;* Szemao, *Henry 12650, 12650A, 12650C;* Kintung, near Jiutsun, *Tsiang 12409;* Tsukai, *Tsiang 12230.*

In the collection *Henry 12650C,* the primary veins are not so far apart as in the other collections cited. On the whole our material is a good match for various collections of *E. tetragona* Wight from Assam and Burma. Unfortunately we have no representation from the type-locality. Wight describes the stems (branchlets) as 4-sided with winged angles. Some specimens of the Indian material have the branchlets sharply quadrangular though not definitely winged, others show merely compressed or obtusely quadrangular branchlets; the latter compare well with the Chinese collections.

Craib, Fl. Siam. Enum. **1:** 664. 1931, suggests, in his discussion of *E. subviridis* Craib, that the material passing as *E. tetragona* Wight contains two species, the true *E. tetragona* Wight and *E. ramosa* Wall., the latter being the more common. At present we have not located the second binomial; is it possible that *S. rameum* Wall. is the one intended? Duthie included *S. rameum* Wall. under *E. tetragona* Wight and noted that the branchlets were not so acutely 4-gonous.

25. **Syzygium balsameum** Wall. List no. 3592. 1831, *nomen nudum;* Wight, Ill. **2:** 16. 1841 in syn.; Walp. Repert. **2:** 179. 1843; Cowan

& Cowan, Trees North. Bengal 68. 1929; Merr. & Perry, Jour. Arnold Arb. **19:** 108. 1938.

Eugenia balsamea Wight, Ill. **2:** 16. 1841; Kurz, Jour. As. Soc. Bengal **46**(*2*)**:** 66. 1877, For. Fl. Brit. Burma **1:** 485. 1877; Duthie in Hook. f. Fl. Brit. Ind. **2:** 499. 1879; Craib, Aberdeen Univ. Studies **57:** 84. 1912 (Contrib. Fl. Siam, Dicotyl.); Gagnep. in Lecomte, Fl. Gén. Indo-Chine **2:** 819. 1920.

Memecylon floribundum Wall. List no. 4113. 1831 (fide Duthie), *nomen nudum.*

YUNNAN, Szemao, *Henry 12682, 12798;* between Muang Hai and Keng Hung, *Rock 2479,* February 15–17, 1922, grassy shaded bank of the Nam Ha.

In addition to the above specimens we have examined the following collections, Sikkim, *Hooker f.;* Silhet, *Hooker f. & Thomson;* Assam, *Dr. King's Collector, Mann;* Indo-China, province of Tuyen-Quang (no collector given). All appear to make a consistent series giving the species a geographical range from the Himalayan region in India to Burma, Indo-China and the southwestern part of China. Craib, Fl. Siam. Enum. **1:** 633. 1931, points out that there is no record of its occurrence in the Malay Peninsula. Although *S. balsameum* seems not to have been noted in the various reports on the flora of China, both Duthie and Craib record it as occurring in Yunnan.

26. **Syzygium Cumini** (L.) Skeels, U. S. Dept. Agric. Bur. Pl. Ind. Bull. **248:** 25. 1912; Alston, Handb. Fl. Ceyl. **6**(Suppl.)**:** 116. 1931; Merr. & Perry, Jour. Arnold Arb. **19:** 108. 1938.

Myrtus Cumini Linn. Sp. Pl. 471. 1753.

Eugenia Jambolana Lam. Encycl. **3:** 198. 1789; Wight, Ill. **2:** 16. 1841, Ic. **2:** *t. 535.* 1843; Kurz, Jour. As. Soc. Bengal **46**(*2*)**:** 67. 1877, For. Fl. Brit. Burma **1:** 485. 1877; Duthie in Hook. f. Fl. Brit. Ind. **2:** 499. 1879; King, Jour. As. Soc. Bengal **70**(*2*)**:** 131. 1901 (Mater. Fl. Malay. Penin. **3:** 561); Gagnep. in Lecomte, Fl. Gén. Indo-Chine **2:** 818. 1920; Ridley, Fl. Malay Penin. **1:** 754. 1922; Wilder, Bishop Mus. Bull. **86:** 81. 1931; F. Brown, Bishop Mus. Bull. **130:** 202. 1935.

Jambolifera pedunculata sensu Lour. Fl. Cochinch. 230. 1790, ed. Willd. 283. 1793; non Linn.

Jambolifera chinensis Spreng. Syst. **2:** 216. 1825 (based on *J. pedunculata* Lour.).

Syzygium Jambolanum DC. Prodr. **3:** 259. 1828; Wight & Arn. Prodr. **1:** 329. 1834.

Eugenia Cumini Druce, Rept. Bot. Exch. Club Brit. Isles **3:** 418. 1914; Merr. Interpret. Herb. Amb. 394. 1917, Enum. Philip. Fl. Pl. **3:** 164. 1923, Lingnan Sci. Jour. **5:** 136. 1927; Craib, Fl. Siam. Enum. **1:** 637. 1931; Merr. Trans. Amer. Philos. Soc. **24**(*2*)**:** 284. 1935.

Eugenia Tsoi Merr. & Chun, Sunyat. **2:** 291. 1935.

KWANGTUNG, Hongkong, *Wang 32362*: KWANGSI, Lungchow, *Morse 497;* near Sui-luk, southwest of Nanning, Sui-luk District, *Tsang 21931*: YUNNAN, without locality, *Tsai 55828;* Lu-Shuei, *Tsai 54538;* Lu-se, *Tsai 56309;* Szemao, *Henry 11782 A, B, C*: HAINAN, *Wang 32716, 32888, Liang 65014, 66312;* Notia, *McClure 7787;* Nor T-ai See, *Ford 354;* Yaichow, *Liang 61908, 62067, How 70536, 70777, Chun & Tso 44728;* Nam Shan Ling, *Tso 23006* (type of *E. Tsoi*), *23019;* Lin Fa Shan, Lam Ko District, *Tsang 7, 198* (*L. U. 16756, 15697*); Pak Shik Ling and vicinity, Ching Mai District, *Lei 551;* Tai Wong Ling and vicinity, *Lei 767;* Chim Fung Ling, Kan-en District, *Lau 3408;* Lok Mooi Shan and vicinity, Ch'ang-kiang District, *Lau 1215;* Ue Lung Shan, *Lau 3184;* Ngai Chau and vicinity, Ngai District, *Lau 8;* Paai Poon Ts'uen and vicinity, *Fung 20075;* Tung Koo Shan and vicinity, Wen-ch'ang District, *Fung 20352.*

Widely distributed in the Indo-Malaysian region, extending from India and Ceylon to Malaysia, introduced in other tropical regions.

27. **Syzygium Augustinii** sp. nov.

Arbor? ± 6 m. alta; ramulis compressis vel ± sulcatis cinereis decorticatis rufis; foliis ellipticis, utrinque angustatis, basi acutis, apice obtuse acuminatis, 9–12 cm. longis, 3.5–6 cm. latis, coriaceis, pellucido-punctatis, supra viridibus, subtus pallidioribus, costa supra impressa, venis perspicuis, gracilibus, conferte penninerviis, venulis reticulatis, vena submarginali a margine ± 1 mm. distante, petiolo 7–10 mm. longo, gracili; paniculis axillaribus terminalibusque 3–9 cm. longis; floribus sessilibus, calycis tubo late obconico, basi abrupte longiuscule stipitato, usque ad 5 mm. longo, apice circiter 5 mm. lato, lobis 1.5–2 mm. longis, 2 mm. latis, rotundatis, petalis calyptratim coalitis, deciduis, staminibus numerosis, longis, antheris ellipticis, 0.8 mm. longis, stylo circiter 10 mm. longo.

YUNNAN, Szemao, *Henry 11782* (type in Herb. Arnold Arb.).

The leaves of this species very closely resemble those of *S. Cumini* (L.) Skeels but the inflorescence is both axillary and terminal and the flowers are slightly larger with very obvious calyx-lobes; on the other hand, in *S. Cumini* (L.) Skeels the inflorescence is seldom terminal and the calyx is undulate or obscurely lobed.

28. **Syzygium fruticosum** DC. Prodr. **3:** 260. 1828, Mém. Myrt. *t. 19.* 1842; MERR. & Perry, Jour. Arnold Arb. **19:** 109. 1938.

Eugenia fruticosa Roxb. Fl. Ind. ed. *2*, **2**: 487. 1832; Wight, Ic. **2**: *t. 624.* 1843; Kurz, Jour. As. Soc. Bengal **46**(*2*): 66. 1877, For. Fl. Brit. Burma **1**: 485. 1877; Duthie in Hook. f. Fl. Brit. Ind. **2**: 499. 1879;

Gagnep. in Lecomte, Fl. Gén. Indo-Chine **2**: 843. 1921; Craib, Fl. Siam. Enum. **1**: 642. 1931.

YUNNAN, Red River, *Henry 9644;* near Maupan, Red River valley, *Henry 10666;* vicinity of Szemao City, *Tsiang 12702* (*S. Y. U. 73027*), November 27, 1933.

Our collections seem to compare favorably with those of the above species from Bengal, Upper Burma and Indo-China. The leaves may be slightly narrower but the venation is very similar and the flowers are much like those of the Indian specimens.

29. **Syzygium cathayense** sp. nov.

Glabra; ramulis tetragonis, pallide brunneis; foliis coriaceis, anguste ellipticis, basi acutiusculis vel obtusis, apice acuminatis supra atro-brunneis, subtus pallidioribus, margine subrevolutis, costa supra impressa, venis primariis prominulis, utrinque 8–12, 5–7 mm. remotis, secus marginem in venas duas arcuatim confluentibus, venulis gracilioribus, laxe reticulatis; petiolo ruguloso 7–10 mm. longo; paniculis terminalibus et in axillis superioribus, ± 4 cm. longis, ramis ad 2.5 cm. longis, flores sessiles plerumque tres gerentibus; alabastris stipitato-globosis; calycis tubo 6–6.5 mm. longo, apice 4–4.5 mm. lato, lobis 4 circiter 2 mm. longis latisque, rotundatis, petalis liberis, staminibus longis, numerosis, antheris ellipticis, 0.5 mm. longis, stylo circiter 13 mm. longo gracili.

KWANGTUNG, Fang Cheng, *Wu 104* (*S. Y. U. 67797*) (type in Herb. Sun Yatsen Univ.).

The open venation of the leaves, with the primary veins anastomosing well within the margin forming a very definite submarginal vein outside of which is a secondary and less obvious one, suggests an alliance with the larger-flowered species (*S. Jambos* [L.] Alston and others), which is perhaps emphasized by the relatively large calyx-lobes. In addition to the characters already mentioned, the small flowers and the 4-angled brownish white branchlets render this a very distinct species.

30. **Syzygium sterrophyllum** Merr. & Perry, Jour. Arnold Arb. **19**: 103. 1938.

Eugenia fluviatilis sensu Gagnep. in Lecomte, Fl. Gén. Indo-Chine **2**: 810. 1920, non Hemsl.

KWANGTUNG, Shi-wan-da-shan, *Tso 23377* (type in Herb. Arnold Arb.), July, 1933, shrub in shaded ravine: KWANGSI, Seh-feng, Dar Shan, S. Nanning, *Ching 7857, 7890, 8089, 8230,* October, 1928; Shap Man Taai Shan, southeast of Shang-sze, *Tsang 23807, 24411, 24720.* Indo-China.

This species is most like *S. fluviatile* (Hemsl.) in habit. It differs in

the tetragonous branchlets, the obtusely acuminate leaves, and the sessile or subsessile flowers.

31. **Syzygium Handelii** sp. nov.

Eugenia acuminatissima sensu Léveillé, Fl. Kouy-Tchéou, 289. 1914, non Kurz.

Eugenia Millettiana sensu Handel-Mazzetti, Symbol. Sin. **7**: 596. 1933, non Hemsl.

Frutex flexuosus; ramulis tetragonis, ferrugineis, gracilibus; foliis linearibus oblongisve, 2–5.5 cm. longis, 0.6–1.3 (–1.9) cm. latis, basi in petiolum 2–4 mm. longum attenuatis, apice obtusis, subcoriaceis crebre et pellucide glanduloso-pustulatis siccis brunneis, subtus pallidioribus, venis primariis gracilibus sed prominulis, oblique patulis, utrinque 14–20, in venam submarginalem a margine 1.5–3 mm. distantem confluentibus; paniculis terminalibus et axillaribus, foliis brevioribus, ramulis erecto-patulis, alabastris 3.5–4 mm. longis, pyriformibus, pedicellatis; calycis tubo obconico, apice ± 3.5 mm. lato, lobis circiter 0.5 mm. longis, obtusis, petalis singulatim deciduis, staminibus longis, antheris ovatis, apice glanduloso-mucronatis; fructibus subglobosis, ± 6 mm. crassis, calycis margine elevato persistente coronatis; cotyledonibus semiglobosis.

HUPEH, *Wilson 456 (S. Y. U. 35123)*; Ichang and immediate neighborhood, *Henry 2886*: KWEICHOW, on the river below Sandjio, *Handel-Mazzetti 276–10811 (Diar. Nr. 2129, 41)* (type in Herb. Arnold Arb.), July 16, 1918, along streams, often submersed; near Tou-chan, *Cavalerie* in hb. Bodinier *2673;* border of stream, *Esquirol 891*: KWANGTUNG, without locality, *Chun 42758*: KWANGSI, south of Nee Bai, border of Kweichow, *Ching 6289.*

This species, quite remote from *S. odoratum* DC. (*E. Millettiana* Hemsl.) belongs to the buxifolium group. It is distinguished by its thinner and prominently veined leaves and their glandular pustulations. In *S. buxifolium* H. & A. the glandular contents seem to have shrunk in drying so that the glands appear as minute dots and the lower surface of the leaves appear as if about to wrinkle. Handel-Mazzetti notes that the leaves vary from 3.7 × 1.9 cm. to 5 × 1 cm. on the same twig.

32. **Syzygium Grijsii** (Hance) comb. nov.

Eugenia Grijsii Hance, Jour. Bot. **9**: 5. 1871.

Eugenia pyxophylla Hance, l. c. 6.

CHEKIANG, without locality, *Tsoong 569;* Tsing Tien, *Keng 70;* Choochow, *Hu 564;* S. Chekiang, *Ching 2424*: FUKIEN, *De Grijs 391* (phot. of type), *Chung 6943;* Changchow, *Chung 872;* Kuliang Hills, near Foochow, *Norton 1276;* Kushan, Foochow, *Chung 8089;* Ku-Dien,

Chung 8045; Amoy, *Chung 4676;* Hinghwa District, *Chung 985*: KIANGSI, Lingnan District, *Lau 4645*: KWANGTUNG, *Gilchrist 47, 104* (*S. Y. U. 72337, 89692*); Ying-Tak, *Liang 61194;* Tai Mo Shan, Tapu District, *Tsang 21023*: KWANGSI, *Graves* (phot. of type of *E. pyxophylla*).

A species undoubtedly very closely related to *S. buxifolium* Hook. & Arn., but the thinner and narrowly oblong leaves are numerous and often crowded into verticils, the veins are faintly outlined on the lower surface and the minute punctations more or less scattered. The inflorescence is similar to that of *S. buxifolium* Hook. & Arn. Hemsley reduced both of Hance's species to *Eugenia sinensis* Hemsl.

33. **Syzygium buxifolium** Hook. & Arn. Bot. Beechey's Voy. 187. 1833; Walpers Rep. **2:** 180. 1843; Benth. Jour. Bot. Kew Gard. Misc. **4:** 118. 1852, Fl. Hongk. 118. 1861; Merr. & Perry, Jour. Arnold Arb. **19:** 104. 1938.

Eugenia microphylla Abel, Narr. Jour. China 181, 364. 1818; Forbes, Jour. Bot. **22:** 124. 1884; Rehder & Wilson in Sargent, Pl. Wils. **2:** 420. 1915, Jour. Arnold Arb. **8:** 179. 1927; Groff, Lingnan Univ. Sci. Bull. **2:** 76. 1930; McClure, op. cit. **3:** 30. 1931; Handel-Mazzetti, Symb. Sin. **7:** 596. 1933, Beih. Bot. Centralbl. **52B:** 161. 1934; Merr. Jour. Arnold Arb. **18:** 71. 1937; non *Syzygium microphyllum* (Bedd.) Gamble, 1919.

Syllisium buxifolium Meyen & Schauer, Nov. Act. Acad. Leop.-Carol. Nat. Cur. **19:** Suppl. **1:** 334. 1843.

Eugenia sp. Moore, Jour. Bot. **13:** 227. 1875.

Eugenia sinensis Hemsl. Jour. Linn. Soc. Bot. **23:** 298. 1887; Dunn & Tutcher, Kew Bull. Add. Ser. **10:** 105. 1912; Léveillé, Fl. Kouy-Tchéou, 289. 1914.

Syzygium microphyllum sensu Masamune, Mem. Fac. Sci. Agr. Taihoku Univ. **11:** 323. 1934, non Gamble.

CHEKIANG, *Tsoong 569* (*S. Y. U. 43334*); Tientaishan, Kwoh Ching Sze, *Chiao 14189;* vicinity of Ningpo, *McGregor s. n.;* south of Pang Yung, *Ching 1981;* Tai Suan, *Ching 2103;* Tai Chow, *Ching 1314;* Chei-Ki, *Ching 4932;* Chu-Hsien, *Keng 861;* Tai Pai Shan, *Keng 1176;* Taishun Hsien, *Keng 292;* Westlake, *Hu 1443;* Hangchow, *Tang & Hsia 83, Allison 53, Meyer 426, 1476*: ANHWEI, Wu Yuan, *Ching 3311*: FUKIEN, *Chung 6678, 7352, Dunn* (*Herb. Hongkong 2703*); Kuliang, *Norton 1275, Chung 6460, 7257;* Foochow, *Tang Chung Chang & Uong Sing Po 3775, Carles 562, 658, Hicken s. n.;* Kushan, *Chung F335, 3700, 8012;* behind Kushan Monastery, *Uong Sing Po 12222;* Minhow Hsien, *Chung 2083, 2253;* Buong Kang, Yenping, *Chung 3502*: KIANGSI, Lu Shan, *Steward & Chiao 4729;* Fa Yii Hsien, *Hu 974*: KWEICHOW, mills of Tong-Tcheou, *Esquirol 3237, 3767;* Pin Fa Mount, *Cavalerie*

403, 600; Pinfa, Kweiting, *Tsiang 5463;* Miao Wang, Kiangkou Hsien, *Steward, Chiao & Cheo 543;* Ta Ho Yen, Fan Ching Shan, *Steward, Chiao & Cheo 695;* Tuyun, Hwang Chai Shan, *Tsiang 5806*: KWANGTUNG, *Chun 8237, 8524, Loh 8299, Hui 8570* (*S. Y. U. 29002, 34210, 29823, 34250*); Naam Kwan Shan, Tsengshing District, *Tsang 20389;* Tai Mo Shan, Tapu District, *Tsang 21088;* Tung Koo Shan, *Tsang 21648;* Lofoushan, *Chun 41388;* Wong Chuk I and vicinity, Wung Yuen District, *Lau 2174;* Yoongyuen, *Lau 24934, 25167;* Yueyuen, *Ko 53065, 53530, 53567;* Yang-Mei-Lang, *Sin 11890;* Tung Koon, near Cheung Hang Kang, *Lau 00348* (*L. U. 19629*); Tai-O, *Chun 3141;* Tsatmuknggao, near Lienping, *Mell 649;* North River Region, *Wang & Liang 31650;* Pan Ling Tsze, *Chun 5879;* Huang-tung, Yao-Shan, *Sin 9114, 9918;* Canton and vicinity, *Levine 1344;* Lok Chong, *Tso 20992, Ko 51898;* Sam Kok Shan, Tsung-fa-Lungmoon Districts, *Tsang 20537;* Yingtak, *Wang 2898, 30009, Tso 22069, 22175, Liang 61112;* Chung Som Tsuen, *McClure 150;* Sunyi, *Ko 51750, Wang 37914;* Lantau Island, Taai Ue Shan, *Tsang* (*L. U. 16507, 16665*): HONGKONG, *Chun 41774, 41825, Wang 30307, Bodinier 1013, 1149, Sargent s. n., Ford s. n., Wright s. n., Hance 1043, Wilford s. n.;* woods of Little Hongkong, *Bodinier 709;* Tai Ue Mountain, *Fung 00116* (*L. U. 19424*); Sha-tin, *Chun 5311;* Swatow, *Dalziel s. n.* Indo-China, Riu Kiu Islands, and Formosa.

On account of the variation in size and outline of the leaves it has been exceedingly difficult to determine what may be regarded as definite specific lines for *S. buxifolium* H. & A. The above series of collections are reasonably uniform. In addition to these, we have two other groups and a variety which with better representation may prove to be a good species.

The first group cited below is aberrant in having short internodes, crowded and chiefly verticillate leaves usually obviously veined and scattered-punctate; the branches of the inflorescence too are sometimes verticillate but the flowers are like those of *S. buxifolium* H. & A.

ANHWEI, Li Shan, *Ching 3106;* Wu Yuan, *Ching 3306*: HUPEH, *Henry 7758*: KIANGSI, Sai Hang Cheung, Kiennan District, *Lau 3931;* near Ningdu, *Wang 466;* Hong San, near Kit-tan, *Gressitt 1553;* Nanchang, *Hsiung 487;* near Kuling, *Wilson 1576, Chun 4302;* Kan Hsien, *Hu 1159;* between Tsoongjen and Ihwang, *Tsiang 10002;* near Lipeichiao, Tsoongjen, *Tsiang 10182*: HUNAN, Changning Hsien, *Fan & Li 116;* near Tschangscha, *Handel-Mazzetti 284*: KWANGTUNG, without locality, *Ko 50956;* Sunyi District, *Wang 31075, 38168;* open place on bank of Yanfa River, *Mell 83;* Lokchong District, *Chun 42053;* between

Ren Hua and Ben Shi Ling, *Chun 5620;* Lien-Hsien, Yao-Shan, *Tso 22615;* North River Region, *Wang & Liang 31508, Chun 42850;* between Bei Shen and Nan Shung, *Chun 5688;* south of Nam Hsiung, *Chun 5712;* Yam Na Shan (Yit Nga Shan), Mei (Kaying) District, *Tsang 21369, 21513;* Lin District, *Levine 3462;* Tsing Leung Shan, *McClure 268* (*C. C. C. 6742*); Lung T'au Shan, *To & Ts'ang* (*L. U. 12388, 12786*): KWANGSI, Pingnan, *Wang 40366.*

The second group is perhaps intermediate between the typical and var. *austrosinense* Merr. & Perry. The leaves are a little larger and slightly more acuminate.

CHEKIANG, S. Yentang, *Hu 126*: KIANGSI, Oo Chi Shan, Lingnan District, *Lau 4707*: KWANGTUNG, North River Region, *Wang & Liang 31520*: KWANGSI, Tou Ngok Shan, Waitsap District, *Tsang 23118;* Tong Shan, *Tsang 22837;* Shap Man Taai Shan, Shang-sze District, *Tsang 22401;* Mekon Seh-feng, Dar Shan, S. Nanning, *Ching 8226, 8359.*

Syzygium buxifolium var. **austrosinense**, var. nov.

Foliis anguste ellipticis, basi obtusiusculis, apice obtuse acuminatis, 4–7 cm. longis, 1.7–3 cm. latis, copiose glanduloso-punctatis, venis primariis utrinque 16–23, 2–3 mm. remotis.

HUPEH, Enshih Hsien, *Chow 1854*: SZECHUAN, Pa Hsien, *Fang 5612*: KIANGSI, Oo Chi Shan, Lingnan District, *Lau 4477*: KWEICHOW, Miao Wang, Kiangkou Hsien, *Steward, Chiao & Cheo 545* (type in Herb. Arnold Arb.), September 27, 1931, on bushy slope at 600 m. alt.; Tushan, *Tsiang 6653*: KWANGTUNG, Wong Chuk I and vicinity, Wung Yuen District, *Lau 2089;* Fan Shiu Au and vicinity, *Lau 2769;* Lung T'au Shan, Iu, *To & Ts'ang 12653*: KWANGSI, In-tung, Miu Shan, N. Luchen, *Ching 6198,* Kweichow border; Bako Shan, W. Poseh, *Ching 7475.*

These collections are practically all in some fruiting stage and, since we have found descriptions of fruiting specimens rather difficult to interpret, it seems preferable to leave them as a variety of *S. buxifolium* H. & A. with which they have been associated and to which they are evidently related although probably specifically distinct. They are all fairly large shrubs (or trees?) and the foliar characters are strikingly dissimilar. In addition to the differences mentioned in the description, the lower surface of the dried leaves of the variety shows no tendency toward shrinkage. In a majority of the specimens of *S. buxifolium* H. & A. the lower surface of the leaves appears as if there had been a trivial shrinkage; this is probably owing to a difference in the texture of the leaves of the two entities.

This species is the type of the genus *Syllisium* Meyen & Schauer, but its type-species, *Syllisium buxifolium* Meyen & Schauer (1843) was not based on the slightly earlier *Syzygium buxifolium* Hook. & Arn. (1841), although the material from which both were described came from the same general region, the neighborhood of Macao. The species was first described by Abel in 1818 as *Eugenia microphylla* but his specific name is invalidated in *Syzygium* by *S. microphyllum* Gamble which was based on *Eugenia microphylla* Beddome, a species very different from *E. microphylla* Abel.

34. **Syzygium salwinense** sp. nov.

Arbor vel arbuscula, 3–15 m. alta; ramulis 4-angulatis interdum sulcatis, cinereis; foliis anguste ellipticis, 4–8 cm. longis, 1.2–3.5 cm. latis, basi cuneatis, apice obtuse acuminatis, coriaceis, siccis supra badiis vel olivaceis, subtus pallidioribus, utrinque punctatis, costa supra impressa, venis primariis et vena submarginali impressis, costa subtus elevata, venis primariis circiter 25, prominulis, subpatulis, venulis laxe reticulatis, vena intramarginali saepissime circiter 2 mm. a margine distante; petiolo 3–10 mm. longo; paniculis axillaribus terminalibusque, 2–4 cm. longis, saepissime foliatis, ramis adscendentibus, floribus sessilibus saepe ternis in apice ramulorum; alabastris ± 5 mm. longis, apice 2.5–3 mm. diametro; calycis tubo pyriformi, lobis vix 0.5 mm. longis, circiter 1.5 mm. latis, petalis singulatim deciduis, staminibus circiter 5 mm. longis, antheris ellipticis, vix 0.5 mm. longis, glanduloso-mucronatis; fructibus globoso-urceolatis, ± 1 cm. diametro.

YUNNAN, hills to the northeast of Tengyueh, *Forrest 9323*, at about 2100 m. alt.; N'Maikha-Salwin Divide, lat. 26° 30′ N., *Forrest 18163* (type in Herb. Arnold Arb.), July, 1919, open situations in thickets at ± 2400 m. alt.; Shweli-Salwin Divide, lat. 25° 45′ N., long. 98° 40′ E., *Forrest 24439, 26089;* Shweli Valley, lat. 25° 45′ N., long. 98° 58′ E., *Forrest 29688*.

Described in the field-notes as an evergreen shrub (8–20 feet) or tree (30–50 feet) with fragrant creamy-white flowers and dull crimson or purple-red fruits.

This is the only species of *Syzygium* in China which is apparently characterized by a leafy inflorescence; probably the flowers and the leaves appear together on the new growth or, if not, the bracts which ordinarily subtend the branches of the inflorescence are large and leaf-like but later caducous. The pattern on the upper leaf-surface formed by the impressed and loosely anastomosing veins and the punctations is distinctive enough to separate this species from *S. szemaoense* Merr. & Perry which it resembles in general habit and leaf-outline.

35. **Syzygium szemaoense** Merr. & Perry, Jour. Arnold Arb. **19:** 105. 1938.

YUNNAN, Szemao, *Henry 12138* (type in Herb. New York Bot. Gard.), *12895;* Lung-ling Hsien, *Tsai 56689*. Indo-China.

This species may be allied to *E. campylocarpa* Gagnep. In that species, however, the leaves are much thinner and obscurely pellucid-punctate; the fruits are inequilateral and slightly curved. Further material is needed to clarify this species. In our species the leaves are thicker and the fruit is regularly formed.

Two collections closely allied, but perhaps not conspecific with the above, are: Hainan, Po-ting, *How 72922, 73422*.

36. **Syzygium Bullockii** (Hance) Merr. & Perry, Jour. Arnold Arb. **19:** 107. 1938.

Eugenia Bullockii Hance, Jour. Bot. **16:** 227. 1878; Forbes & Hemsl. Jour. Linn. Soc. Bot. **23:** 296. 1887; Merr. Philip. Jour. Sci. **15:** 249. 1919; Gagnep. in Lecomte, Fl. Gén. Indo-Chine **2:** 817. 1920; Merr. Lingnan Sci. Jour. **5:** 136. 1927, Trans. Amer. Philos. Soc. **24**(2): 284. 1935.

Myrtus androsaemoides sensu Lour. Fl. Cochinch. 312. 1790, ed. Willd. 382. 1793, non Linn.

KWANGTUNG, Chung Shan District, Nga Iu Mountain, *Tsang 15* (*L. U. 19254*); Tong Ka Wan, *Fung 2–71* (*L. U. 18677*); Pon-tan, Luichow, *Tsiang 2528;* Canton, *Tsoong 2671*: HAINAN, *Wang 33934, 34008, 36442, 36486;* Hoihow, *Bullock 20289* (type in Herb. Brit. Mus.; carbon imprint of leaf), *Herb. Carles;* Po-ting, *How 72083,* June 24, 1935, grassy slope about 330 m. alt.; Kacheck, Khêng-dong, *Moninger 53;* Pak Shik Ling and vicinity, Ching Mai District, *Lei 827, 1022;* Yaichow, *Liang 62860,* in thickets near the seashore. Indo-China.

Only two other Chinese species of *Syzygium, S. tephrodes* (Hance) and *S. Boisianum* (Gagnep.) Merr. & Perry, have subsessile leaves with rounded bases. These are readily separable on various characters. Both have 4-angled branchlets; *S. tephrodes* usually has glaucous calyces and *S. Boisianum* slenderly clavate flower-buds. On the other hand, *S. Bullockii* is characterized by slightly compressed branchlets and turbinate flower-buds.

37. **Syzygium Forrestii** sp. nov.

Arbor ± 10 m. alta; ramulis compressis vel obscure tetragonis, atro-brunneis, circiter 2 mm. crassis; foliis coriaceis, ellipticis, 6–11 cm. longis, 2.5–4 cm. latis, utrinque angustatis, basi acutis, apice obtuse acuminatis, acumine 1–2.5 cm. longo, supra minute et sparse punctatis venis primariis subtus prominulis, gracilibus, creberrime penninerviis,

reticulatis, in venam submarginalem a margine 0.5–1 mm. distantem confluentibus; petiolo 12–18 mm. longo; paniculis axillaribus terminalibusque, multifloris, 3–8 cm. altis, ramulis 0.5–3 cm. longis, divaricatis; alabastris sessilibus vel subsessilibus, 5 mm. longis, apice globosis, 3.5 mm. diametro, abrupte in stipitem crassiusculum contractis; calycibus obscure lobatis vel truncatis, petalis calyptratim vel singulatim caducis, staminibus numerosis, ad 6 mm. longis, antheris 0.6 mm. longis, ellipticis, apice glanduloso-mucronatis; fructibus ellipsoideis, circiter 8 mm. longis, 6 mm. diametro.

YUNNAN, *Tsiang 3400* (*S. Y. U. 75250*); Mingkwong Valley, *Forrest 9243;* Shweli-Salwin Divide, *Forrest 11750;* Shweli Valley, lat. 25° 20′ N., *Forrest 16086* (type in Herb. Arnold Arb.), in thickets at about 2100 m. alt.; Szemao, *Henry 11764, 11764A, 12764, 12764A.* A tree 20–40 feet high, flowers lemon- or creamy-yellow.

Although our species suggests *S. syzygioides* (Miq.) Merr. & Perry, i. e. *E. cymosa* as interpreted by Duthie, King, Koorders and Valeton and Ridley, but not *E. cymosa* Lamarck, the leaves are longer and more prominently veined and the petioles are about twice as long. The fruit is elongate rather than depressed as in the latter species. *Eugenia cymosa* Lam. was based on a specimen from Mauritius, and our photograph of the type specimen shows it to be totally different from the Indo-Malaysian form currently referred to Lamarck's species by all modern authors.

38. **Syzygium brachythyrsum** sp. nov.

Frutex ± 3 m. altus; ramulis fuscis vel pallide brunneis, teretibus vel leviter compressis, gracilibus; foliis pergamenaceis, ellipticis, 8–10 cm. longis, 3.5–5 cm. latis, basi acutis, apice abrupte obtuseque acuminatis, acumine circiter 1.5 cm. longo, siccis olivaceo-viridibus, subtus pallidioribus vel brunnescentibus, costa supra impressa subtus prominula, venis primariis rectis, numerosis, parallelis, patulis, 2–4 mm. remotis, supra manifestis, subtus perspicuis, venulis laxe reticulatis; petiolo vix 1 cm. longo, tenui, atrobrunneo; inflorescentiis terminalibus, paucifloris (5–8 rachi 1–1.5 cm. longa, ramis circiter 1 mm. longis; alabastris ± 6 mm. longis, apice ± 4.5 mm. diametro, sessilibus vel brevipedicellatis; calycis tubo obconico, lobis 4, 1 mm. longis, 2 mm. latis, obtusis; fructibus oblongo-pyriformibus, ± 1.5 cm. longis, ± 0.7 cm. diametro.

YUNNAN, Ping-pien-hsien, *Tsai 61581* (type in Herb. Arnold Arb), August 22, 1934, in ravine: HAINAN, Tai Tin Shan, *Lau 1324*, March 16, 1933.

Lau 1324 is a specimen with young branches and detached fruits. Although we believe it to represent the same species as the type, we

would point out that this species should be looked for in Hainan in flower and also with fruits attached; in more than one instance the leaves of two species have appeared to be practically identical, yet the inflorescence or the individual flowers of the two were not at all alike. This species is perhaps most nearly related to *S. oblatum* Wall., but the inflorescence is much too small and too few-flowered for that species, the calyx-lobes are somewhat larger; and if *Lau 1324* is this species (as we believe it is), the fruits are not like those of *S. oblatum* Wall.

39. **Syzygium Chunianum** sp. nov.

Arbuscula vel arbor parva, 3–10 m. alta; ramulis teretibus vel leviter compressis vel sulcatis; foliis oblongo-ellipticis vel ellipticis, basi leviter acuminatis, apice in acumen breve vel longiusculum abrupte productis, 4–10 cm. longis, 1.5–4.5 cm. latis, creberrime pellucido-punctatis, venis primariis divaricatis, 1–3 mm. remotis, venis venulisque subaequaliter manifestis, omnibus parallelis, supra siccis atroviridibus, subtus pallidioribus; petiolo 7–12 mm. longo; paniculis 1.5–3 cm. longis, singulis vel fasciculatis terminalibus axillaribusque, ramulis brachiatis, floribus in apice ramulorum singulis vel ternis, flore centrali sessili, reliquis pedicellatis, alabastris 2–3.5 mm. longis, 2–2.5 mm. diametro, gracilibus obovoideis; calycibus undulatis vel truncatis, staminibus brevissimis; fructibus immaturis.

HAINAN, *Liang 64296, 64444, Wang 35278, 35368, 35822, 36154, 36561, Fenzel s. n., 258* (*S. Y. U. 17727, 17737*); Po-ting, *How 72137, 72666, 73353, 73510;* road between Dung Ka and Wen Fa Shi, *Chun & Tso 43446* (type in Herb. Arnold Arb.), August 15, 1932, in forest along stream at about 600 m. alt.; Dung Ka, Ma Seong Ling, *Chun & Tso 43342;* Manning, *How 73193;* Hung Mo Shan and vicinity, Lai (Loi) Area, *Tsang & Fung 686* (*L. U. 18220*).

In mode of branching of inflorescence and in floral arrangement suggesting *Acmena acuminatissima* (Blume) Merr. & Perry, in leaf-outline and close venation resembling *S. syzygioides* (*Eugenia cymosa* of authors, not of Lamarck), and in general habit most like *S. corticosum* (Lour.) Merr. & Perry as represented by *Clemens 3532* which has been critically compared with Loureiro's type at the British Museum; our species, however, is easily separated from all these. The flowers are smaller than those of *S. syzygioides* and different in outline (obovoid, without tapering to pseudostipe), the petioles are a little longer on the average and the leaves dry olive-green rather than a reddish-brown. *Syzygium corticosum* has much more open leaf-venation with the intramarginal vein more remote from the margin.

Although the material cited is apparently referable to a single species, there is considerable variation in leaf-outline, some leaves are short and broad, others narrower and elongate, and the acumen, at times slender, ranges from 0.5–2 cm. in length.

Dedicated to Professor W. Y. Chun of Sun Yatsen University in appreciation of his energetic work in assembling comprehensive collections of herbarium material from the botanically little known parts of southern China.

40. **Syzygium fluviatile** (Hemsl.) comb. nov.

Eugenia fluviatilis Hemsl. Jour. Linn. Soc. Bot. **23**: 296. 1887; Merr. Lingnan Sci. Jour. **5**: 136. 1927.

HAINAN, *Henry 55* (carbon imprint of type), *Liang 63934*, margin of stream, *Wang 33192, 33293;* Lokwui, *How 72272;* Po-ting, *How 73690;* Tsat Cha Ling, Ch'ang-kiang District, *Lei 741;* Pak Shik Ling and vicinity, *Lei 890A;* Tai-too, Seven Finger Mountain, *Liang 61726;* Yaichow, *Liang 62023;* Pat Ka Ling, *McClure 7725;* near Shui Mun, *McClure 9617;* Chiu Sam Tsuen, Ngai District, *Lau 370;* Mei Yeung Tsuen, Taam-chau District, *Tsang 783* (*L. U. 16282*); Chi To Shan, *Tsang 890* (*L. U. 16389*); Ta Hian, *Gressitt 748, 794;* Ta Han, *Gressitt 730.*

This species is characterized by its compressed branchlets, glabrous inflorescences (axillary and terminal), and its linear-oblong leaves which are usually rounded at the apex. What was taken for this species by Gagnepain in Lecomte, Fl. Gén. Indo-Chine **2**: 810. 1920, is *S. sterrophyllum* Merr. & Perry. We have seen no material representing this species from the mainland.

41. **Syzygium kwangtungense** (Merr.) comb. nov.

Eugenia kwangtungensis Merr. Sunyat. **1**: 202. 1934.

KWANGTUNG, Pon-tan, Luichow, *Tsiang 2552* (type in Herb. New York Bot. Gard.); Yeungchun, *Wang 38665;* Heung Shan, Paak Shui Lam, *To 6236*, October 25, 1920: KWANGSI, Shap Man Taai Shan, Shang-sze District, *Tsiang 22664.*

In the light of the more abundant material at hand, it is evident that the description of the fruit in the original diagnosis of this species must be excluded, also the citation *Tsiang 1754.* Although the leaves of this collection are a perfect match for those of the type, *Tsiang 2552*, the mode of inflorescence is different. In the type the panicles are up to 3 cm. long, chiefly terminal (a few shorter ones in the upper axils) and usually much branched. *To 6236* is a fruiting specimen which we believe belongs to this species. The fruit is obovoid or subglobose, crowned by

the upper part of the calyx, 0.7–0.9 cm. long and 0.6–0.7 cm. in diameter; according to the field-label it is yellow; it dries reddish-brown.

42. **Syzygium euonymifolium** (Metcalf) comb. nov.

Eugenia euonymifolia Metcalf, Lingnan Sci. Jour. **11**: 22. 1932; Handel-Mazzetti, Beih. Bot. Centralbl. **52B**: 160. 1934.

KWANGTUNG, *Hui 8546* (*S. Y. U. 34227*), *Fenzel 103* (*S. Y. U. 8772*); Ting Wu Shan, *Tsiang 1549* (type in Herb. Arnold Arb.); North River, *Chun 7333;* North River Region, *Ko 50807;* Yung-yun City and vicinity, Wung-Yuen District, *Lau 772, 829;* Yoongyuen, *Lau 24127, 24599;* Yunfou, *Wang 37597;* Wong Chuk I and vicinity, *Lau 1965, 2383;* Yam Na Shan (Yit Nga Shan), Mei (Kaying) District, *Tsang 21304;* Ying-Tak District, *Liang 60965, 61091, Wang 531, Tsang & Wong 14247;* Wentongshan, *Tso 22111;* Kyingtung, Sunyi, *Tsiang 2615, Wang 31046.*

In this species the inflorescence shows a marked tendency to appear below the new shoots as well as being axillary. Although it seems most like the Hancei group of species, it is distinct by its pale green leaves with fairly long petioles, grayish-white branches and its mode of flowering.

43. **Syzygium Hancei** nom. nov.

Eugenia minutiflora Hance, Jour. Bot. **9**: 5. 1871; Forbes & Hemsl. Jour. Linn. Soc. Bot. **23**: 297. 1887; Dunn & Tutcher, Kew Bull. Add. Ser. **10**: 105. 1912; Merr. Lingnan Sci. Jour. **5**: 136. 1927; Groff, Lingnan Univ. Sci. Bull. **2**: 77. 1930; non *Syzygium minutiflorum* (Bedd.) Gamble (1919).

CHINA, without locality, *Millett s. n.*: KWANGTUNG, *S. Y. U. 6994, 53771, Wong 30, 65* (*S. Y. U. 20456, 20478*); Shui-tung, *Sampson & Hance 13754* (type in Herb. Brit. Mus.; phot.); Loh Kong Tung, Kong Tan Uen, *McClure 1748;* Tengwushan, *Liang 60321, Lion 863;* Toishan, *Tso 22525;* Kochow District, *Tsiang 906;* Canton and vicinity, *Levine 1214, 1905, Chun 40340, Li & Lam 9974;* Bo-on, *Li 9630;* Ying-Tak, Wentongshan, *Liang 60931;* Sunyi District, *Ko 51731;* Yeungkong, *Wang 38816;* Waan Lau To, *McClure 229* (*C. C. C. 7103*); Fuloshun, *Wang 523;* Shuen-Tak, *Chang 166;* Pok Lor, *Fung A-547* (*L. U. 18952*); Lofoushan, *Ko 50045*: HONGKONG, *Wang 30353, Chun 40160*: HAINAN, *Fenzel* (*S. Y. U. 17728*), *Liang 63516, 63583, 63678, 66047;* Yaichow, *Liang 63206;* Ka Chik Shan and vicinity, Ch'ang-kiang District, *Lau 2917;* Manning, *How 73872;* Tung Koo Shan and vicinity, Wen-Ch'ang District, *Fung 20353;* Mei Maan and vicinity, Mai District, *Lei 77.*

Typical *S. Hancei* is comparatively easy to identify by its very small and slightly angular flowers, which in bud are scarcely more than convex at the apex and in full bloom have very short stamens. The calyx is dark brown when dry, the leaves also are brown but not so dark. Most of the Hainan specimens cited above differ slightly in having more acuminate and slightly paler leaves than those from Kwangtung.

In addition to the material above cited, we refer the following specimens to this species, noting that the leaves are more abruptly acuminate and the venation, apart from the midrib, is rather obscure. The few-flowered inflorescences are scarcely more than half as long and slightly, if at all, branched.

HAINAN, Yaichow, *How 70310;* Dung Ka, Ma Seong Ling, *Chun & Tso 43377;* Mo San Leng, *Chun & Tso 44298;* Lingshui, *How 73799.*

44. **Syzygium Howii** sp. nov.

Arbuscula ± 2 m. alta; ramulis sulcatis, cinereis; foliis late ellipticis, 2.5–4.5 cm. longis, 1.4–2.9 cm. latis, basi obtuse acuminatis, apice obtusis vel abrupte in acumen obtusum 2–4 mm. longum contractis, supra creberrime minuteque punctatis, costa impressa, subtus consperse glanduloso-punctatis, venis primariis manifestis, utrinque 9–13, 2–3 mm. remotis, adscendentibus, vix reticulatis, in venam submarginalem confluentibus; petiolo ± 3 mm. longo; paniculis terminalibus, rachi circiter 1 cm. longa, ramulis usque ad 3 mm. longis; alabastris obconicis, sessilibus vel subsessilibus, 2.5–3 mm. longis, apice circiter 2 mm. diametro; calycibus interdum angulatis, undulatis vel truncatis, staminibus numerosis, 2–3 mm. longis, antheris circiter 0.4 mm. longis, apice minutissime glanduloso-mucronatis; fructibus ± 7 mm. longis, 6 mm. diametro, subglobosis, apice contractis et cupula calycis coronatis.

HAINAN, Po-ting, *How 73663* (type in Herb. Arnold Arb.), September 13, 1935, in forest at about 870 m. alt.

This species is closely allied to *S. Hancei* Merr. & Perry. It differs in having terminal inflorescence and larger flowers with longer stamens. It also lacks the reddish-brown color so characteristic of *S. Hancei* Merr. & Perry.

45. **Syzygium Rehderianum** sp. nov.

Arbuscula 3–5 m. alta; ramulis teretibus vel obscure compressis, fulvis; foliis ellipticis, utrinque angustatis, 4–7 cm. longis, 2–3 cm. latis, obtuse acuminatis, acumine usque ad 1 cm. longo, supra sparse punctatis, subtus glanduloso-puncticulatis, costa supra impressa, venis primariis utrinque inconspicuis 2–5 mm. remotis, vena submarginali a margine 1 mm. distante; petiolo 3–5 mm. longo; inflorescentiis axillaribus terminali-

busque, 1.5–2 cm. latis, ramulis 3–5 mm. longis, obscure tetragonis, floribus ternis sessilibus in ramulis ultimis siccis cinnamomeis, alabastris 3.5–4 mm. longis, apice 2 mm. diametro, calycibus obovoideis, truncatis vel undulatis, petalis calyptratim concretis; staminibus circiter 3.5 mm. longis, antheris minutis, stylo circiter 3 mm. longo; fructibus obovoideo-ellipsoideis vel elongato-subglobosis, ad 2 cm. longis, ± 1.5 cm. diametro.

KWANGTUNG, Tai Mo Shan, Tapu District, *Tsang 21234* (type in Herb. Arnold Arb.), July 19, 1932; Tsing Wan Shan, Wung Yuen District, *Lau 2440;* K'ei Lau Tsz, *Lau 894;* Yoongyuen, *Lau 23489;* Sunyi, *Ko 51595, Wang 38166;* Lofoushan, *Chun 41229, 41327, Tsiang 1754;* Lokcheong, *Ko 53140, Wang 31409;* Tsingyuen, *Wang 30265, 30733;* Yeungchun, *Wang 38745;* Ying-Tak, *Tso 21896;* Toishan, *Tso 22389;* Tengwushan, *Liang 60340*: KWANGSI, Pingnan, *Wang 40352;* Tou Ngok Shan (along Kwangtung border), Waitsap District, *Tsang 23188;* Ta Tze Tsuen, Yung Hsien, *Steward & Cheo 759;* Seh-feng, Dar Shan, S. Nanning, *Ching 8137;* Ta Tze Shan, *Steward & Cheo 881;* Shap Man Taai Shan, southeast of Shang-sze, *Tsang 23950;* without locality, *Ching 8396*: SZECHUAN, Lo-shan Hsien and vicinity, *Wang 23534;* without locality, *S. Y. U. 29516.*

This species differs from *E. Hancei* Merr. & Perry in both foliar and floral characters. The leaves are more abruptly acuminate with an acumen about 1 cm. long. The flower-buds are larger (3.5–4 mm. long), hemispherical at the apex and dry a yellowish- rather than a dark-brown; the stamens are longer and more conspicuous and the bracts of the inflorescence tend to be more deciduous.

The following specimens are somewhat aberrant. *Wang 23534* does not differ greatly except in having larger leaves somewhat more obtuse at either end. *Ching 8396* is a fruiting specimen with larger leaves, *Chun 9805* (*S. Y. U. 89695*) and *S. Y. U. 29516* also have larger leaves. *Steward & Cheo 881* has leaves with a shorter and practically obtuse base, the inflorescence is more compact and occasionally the branchlets approach tetragonous. *Tsiang 1754* is placed here with some hesitancy; it is very difficult to match a practically mature fruiting specimen with flowers or young fruit.

EXCLUDED SPECIES

The following species of *Eugenia* and *Syzygium* have been credited to China or described from Chinese material by various authors. None of them belongs in either genus as we understand the limits of these two groups. Five of the binomials appertain to the genus *Decaspermum*. Two species belong in generic segregates, *Cleistocalyx* and *Acmena*, that

we believe to be entirely worthy of recognition. In both cases the several species can always be distinguished from *Eugenia* Linnaeus and from *Syzygium* Gaertner by constant characters.

CALYPTRANTHES MANGIFERIFOLIA Hance ex Walp. Ann. **2:** 629. 1852, type from Macao, thought by Hance to have been from a tree introduced from tropical America by the Portuguese = *Eugenia operculata* Roxb. = *Cleistocalyx operculatus* (Roxb.) Merr. & Perry.

EUGENIA ACUMINATISSIMA Kurz; Hemsl. Jour. Linn. Soc. Bot. **23:** 296. 1887; Dunn & Tutcher, Kew Bull. Add. Ser. **10:** 105. 1912 = *Eugenia subdecurrens* (Miq.) Merr. & Chun = *Acmena acuminatissima* (Blume) Merr. & Perry.

EUGENIA CHINENSIS Regel, Cat. Pl. Hort. Aksakov. 58. 1860, *nomen nudum.*

EUGENIA DIVARICATO-CYMOSA Hayata, Ic. Pl. Formos. **3:** 118. 1913, type from Hainan = *Eugenia operculata* Roxb. = *Cleistocalyx operculatus* (Roxb.) Merr. & Perry.

EUGENIA ESQUIROLII Lévl. Repert. Sp. Nov. **9:** 459. 1911, Fl. Kouy-Tchéou 289. 1914, type from Kweichow Province = *Decaspermum fruticosum* Forst.

EUGENIA GRACILENTA Hance, Jour. Bot. **23:** 7. 1885; Hemsl. Jour. Linn. Soc. Bot. **23:** 296. 1887; Dunn & Tutcher, Kew Bull. Add. Ser. **10:** 105. 1912, type from Kwangtung Province = *Decaspermum gracilentum* (Hance) Merr. & Perry.

EUGENIA HAINANENSIS Merr. Philip. Jour. Sci. **23:** 255. 1923, type from Hainan = *Decaspermum hainanense* Merr.

EUGENIA MULTIPUNCTATA Merr. Jour. Arnold Arb. **6:** 138. 1925, type from Hainan = *Decaspermum cambodianum* Gagnep.

EUGENIA OPERCULATA Roxb.; Hemsl. Jour. Linn. Soc. Bot. **23:** 297. 1887; Dunn & Tutcher, Kew Bull. Add. Ser. **10:** 105. 1912 = *Cleistocalyx operculatus* (Roxb.) Merr. & Perry.

EUGENIA SALIGNA sensu C. B. Rob. Philip. Jour. Sci. Bot. **4:** 392. 1909, non *Syzygium salignum* Miq.; Merr. Lingnan Sci. Jour. **5:** 137. 1927 = *Eugenia subdecurrens* (Miq.) Merr. & Chun = *Eugenia acuminatissima* Kurz = *Acmena acuminatissima* (Blume) Merr. & Perry.

EUGENIA SUBDECURRENS Merr. & Chun, Sunyat. **2:** 289. 1935 = *Eugenia acuminatissima* Kurz = *Acmena acuminatissima* (Blume) Merr. & Perry.

SYZYGIUM GRACILENTUM Hu, Jour. Arnold Arb. **5:** 232. 1924, based on *Eugenia gracilenta* Hance = *Decaspermum gracilentum* (Hance) Merr. & Perry.

SYZYGIUM NERVOSUM DC. Prodr. **3:** 260. 1828, based on *Eugenia operculata* Roxb. = *Cleistocalyx operculatus* (Roxb.) Merr. & Perry.

SYZYGIUM OPERCULATUM Niedenzu in Engl. & Prantl, Nat. Pflanzenfam. **3**(7): 85. 1893 = *Eugenia operculata* Roxb. = *Cleistocalyx operculatus* (Roxb.) Merr. & Perry.

12. **Cleistocalyx** Blume[1]

Cleistocalyx Blume (1849) differs from *Syzygium* Gaertner only in its calyptrate calyces.

A. Leaves with a short and obtuse acumen; the inflorescence axillary and terminal; the inner faces of the cotyledons concave and the hypocotyl short .....1. *C. conspersipunctatus*

A. Leaves acuminate; the inflorescence lateral (rarely axillary and terminal); the inner faces of the cotyledons interlocking and the hypocotyl usually extending from the center (point of attachment) to the outer surface .....2. *C. operculatus*

1. **Cleistocalyx conspersipunctatus** Merr. & Perry, Jour. Arnold Arb. **18:** 335. 1937.

HAINAN, without definite locality, *Wang 33524, 33687, 34214,* in mixed woods, August and September, 1933; Po-ting, *How 73248, 73332* (type); Ah Ping, *Chun & Tso 44145,* October 24, 1932, in forested ravine, about 900 m. alt.; Yaichow, *Liang 62200,* July 19, 1933, in forests. The holotype is preserved in the Arnold Arboretum herbarium.

This species is readily distinguished from *C. operculatus* (Roxb.) Merr. & Perry by the blunt leaves with short and obtuse acumen, and scattered glands sometimes large enough to be seen with the naked eye. The inflorescences are axillary and terminal; the flowers are slightly larger than those of *C. operculatus* and the fruits markedly so.

2. **Cleistocalyx operculatus** (Roxb.) Merr. & Perry, Jour. Arnold Arb. **18:** 337. 1937.

Eugenia operculata Roxb. Hort. Bengal. 37. 1814, *nomen nudum*, Fl. Ind. ed. 2, **2:** 486. 1832; Wight, Ic. **2**(3): 4, *t. 552.* 1843; Hemsl. Jour. Linn. Soc. Bot. **23:** 297. 1887; Dunn & Tutcher, Kew Bull. Add. Ser. **10:** 105. 1912; Koord. & Val. Atlas Baumart. Java **3:** *f. 503.* 1915; Merr. Lingnan Sci. Jour. **5:** 137. 1927.

Syzygium nervosum DC. Prodr. **3:** 260. 1828, Mém. Myrt. **2:** *t. 16.* 1842, excluding interpretation of genus p. 41.

Calyptranthes mangiferifolia Hance ex Walp. Ann. **2:** 629. 1851–52.

[1] **Merrill, E. D.** and **L. M. Perry.** Reinstatement and revision of Cleistocalyx Blume (including Acicalyptus A. Gray) of the Myrtaceae, Jour. Arnold Arb. **18:** 322-343, *pl. 215.* 1937. A genus of twenty-one known species extending from Chittagong, Burma, Indo-China, Hainan and southeastern China southward through Malaysia to northern Australia, Lord Howe Island, New Caledonia and Fiji.

Syzygium nodosum Miq. Fl. Ind. Bat. **1**(1): 447. 1855.
Syzygium angkolanum Miq. op. cit. 448.
Eugenia Holtzei F. v. Muell. Australas. Jour. Pharm. June, 1886, Bot. Centralbl. **28**: 148. 1886.
Syzygium operculatum Niedenzu in Engler & Prantl, Nat. Pflanzenfam. **3**(*7*): 85. 1893; Gamble, Fl. Madras **1**: 481. 1919.
Eugenia clausa C. B. Rob. Philip. Jour. Sci. Bot. **4**: 380. 1909.
Eugenia divaricato-cymosa Hayata, Icon. Pl. Formos. **3**: 118. 1913.

KWANGTUNG, *S. Y. U. 50364, 89693, Wang 9421* (*S. Y. U. 67781*); Canton and vicinity, *Levine 1288, 2126, Tsiang 11047;* Honam Island, *Levine 1050;* White Cloud Mountain, *Levine 3129;* Sunyi District, Weishang, *Tsiang 2721;* Ting Wu Shan, Kao-Yao District, *Tsiang 775, 1496, Liang 60737, Lau 20275;* Ying-Tak, Wentongshan, *Tso 22242;* Shi-wan-da-shan, *Tso 23371*: HONGKONG, *Bodinier 613, Wright s. n.;* North Point, *Ford s. n.*, July 29, 1895; Tai-O, New Territory, *Wang 3189;* Ma Au Shan, Shatin, *Tsiang 215;* Upper Aberdeen Road, *Gibbs* (*Herb. Hongkong 10261*): KWANGSI, Shap Man Taai Shan, *Tsang 23824;* Lungchau, *Morse 625*: HAINAN, without definite locality, *Wang 32834, 34169;* Lam Ko District, Lin Fa Shan, *Tsang 166* (*L. U. 15665*), *343* (*L. U. 17092*); Hung Mo Shan, *Tsang & Fung 458* (*L. U. 17992*); Dung Ka, *Chun & Tso 43430*, along stream at about 500 m. alt.; Yaichow, *How 70840, 71120, Liang 61996;* Yeung Ling Shan, Ngai District, *Lau 78;* Pak Shik Ling and vicinity, Ching Mai District, *Lei 697, 918;* Tai-too, Seven Finger Mountain, *Liang 61722;* Liamui (Leng Mun), *Gressitt 1165*. India and China southward through Malaysia to northern Australia.

ARNOLD ARBORETUM,
HARVARD UNIVERSITY.

NEW OR NOTEWORTHY PLANTS FROM TEMPERATE SOUTH AMERICA

IVAN M. JOHNSTON

Mirabilis campestris (Griseb.), comb. nov.

Oxybaphus campestris Grisebach, Abhandl. K. Ges. Wiss. Göttingen **19**: 87 (1874); Heimerl, Ann. Conserv. Jard. Bot. Genève **17**: *222* (1913). *Oxybaphus ovatus* and *Mirabilis ovata* of authors.

This is the plant that has passed as *Calyxhymenia ovata* R. & P., Fl. Peru. **1**: 45, *t. 75* (1798). This latter is based upon material from west-central Peru and hence from far to the north of the area in northern Chile and western and northwestern Argentina in which *M. campestris* has been collected. The Peruvian plant does not have the leaves strongly reduced up the stem and does not have the dichotomously branched inflorescence with elongate internodes and much reduced bracts which characterize the plant of Chile and Argentina. It most suggests some of the hairy forms of *M. expansa* (R. & P.) Standley.

Anemone cicutifolia, sp. nov.

Herba e rhizomate tuberoso 2–5 cm. longo 3–9 mm. crasso oriens; foliis basalibus biternatis triangularibus; pinnulis secundariis profunde irregulariterque 2–3-lobatis, lobulis elongatis ascendentibus sparse ascendenterque lobulato-dentatis, supra sparse adpresse hispidulis, subtus pallidioribus secus nervos strigosis alibi saepe subglabris, margine minute ciliolatis; sinibus apertis cuneatis; petiolis foliorum inferiorum quam lamina saepe 2–3-plo longioribus; caulibus 1–2-floris 8–30 cm. longis quam foliis inferioribus saepe duplo longioribus; foliis involucri 3 pinnatifidis 2–4 cm. longis, lobis saepe 2-jugatis distantibus linearibus inferioribus non rariter lobulatis ceteris simplicibus; pedicellis 8–15 cm. longis; tepalis 9–15 mm. longis ca. 2 mm. latis oblongo-linearibus saepe 10 nervis longitudinalibus 3–5 notatis, apice rotundis, extus strigosis, intus glabris albis; staminibus 30–40; filamentis usque 3–4 mm. longis glabris; antheris oblongis ca. 0.8 mm. longis; achaeniis dense villosis valde compressis ca. 2 mm. longis et latis sessilibus; stylis obliquis ca. 0.4 mm. longis; receptaculo ca. 1 cm. longo.

ARGENTINA. T u c u m a n : Cerro del Campo, dept. Burroyaco, 2000 m., Dec. 15, 1928, *Venturi 7716* (TYPE, Gray Herb.); Est. Las

Pavas, 2900–3000 m., *Venturi 4586, 4629* (G); Tafi del Valle, 2500 m., *Venturi 2933, 2933½* (G); Cumbre del Siambon, 1700 m., *Venturi 2817* (G). Salta: Alemania, 1300 m., *Venturi 9846* (G).

Bolivia. near Sorata, 2600–2800 m., *Mandon 868* (G); Bolivian Plateau, *Bang 1041, 1923* (G).

A member of the collective species, *A. decapetala* Ard. (cf. Ulbrich, Bot. Jahrb. **37**: 259. 1906), the representative of this group in the mountains of northwestern Argentina and on the Bolivian Plateau. The species has a range detached from the other members of the group and has a characteristic aspect permitting its ready recognition. Its closest relative is probably *A. triternata* Vahl, a vernal species of low altitudes in Uruguay and eastern Argentina. From this eastern plant *A. cicutifolia* may be distinguished by its elongate stems, biternate rather than triternate basal leaves with elongate narrowly oblong rather than ovate ultimate leaf-segments, its essentially pinnate rather than digitately dissected involucral leaves, and its oblong-linear rather than lance-oblong tepals which are rounded rather than acutish at the apex.

Margyricarpus paucijugatus, sp. nov.

Frutex metralis debiliter armatus; ramis elongatis rectis juventate cortice pallido donatis; foliorum rhachibus in ramulorum majorum conspicuis persistentibus 0.5–1 vel rariter usque 2 cm. longis cuneatis vel subulatis, juventate apice 1–3-foliolatis margine villosis, maturitate denudatis compressis graciliter subulatis vel acutis haud vel debiliter spinescentibus fasciculos axillares foliorum saepe suffulcientibus; foliolis 1–3 glaberrimis costatis sed enervatis margine valde revolutis apice apiculatis basi obtusis vel rotundis, terminalibus 4–7 mm. longis 1–2 (–2.6) mm. latis, lateralibus paullo minoribus; sepalis 2.2 mm. longis 1 mm. latis acutis; fructibus 4–6 mm. longis axillaribus solitariis evidenter alatis haud baccatis, alis consimilibus saepe 3 crenatis usque lobulatis 1–1.5 mm. latis stramineis vel parce purpureo-tinctis, valliculis rugulosis vel inconspicue tuberculatis.

Argentina. Tucuman: Est. Las Pavas, dept. Chicligasta, 3300 m., Dec. 7, 1923, *Venturi 4664* (G). Catamarca: Cerro de Yutoyaco, dept. Andalgalá, 3500 m., Feb. 10, 1916, *Joergensen 1143* (type, Gray Herb.).

A bush with long erect branches, few leaflets, and weakly spinescent or innocuous leaf-rachises. These characters, and the lack of secondary wings between the primary ones of the fruit, distinguish *M. paucijugatus* from *M. costatus* Britton, a low shrubby plant which ranges from Catamarca and Tucuman northward to southern Peru.

Margyricarpus inermis, sp. nov.

Frutex prostratus vel caespitosus ramosissimus; ramulis numerosis 1–5 cm. longis glaberrimis 1–2 mm. crassis, internodiis 1–5 mm. longis; foliorum rhachibus ramulorum majorum 5–8 mm. longis infra medium late marginatis et laxe vaginatis, juventate margine villosis 3–5-foliatis, maturitate cuneatis deciduis haud spinescentibus vix conspicuis; foliolis saepe 3 terminalibus rariter imparipinnatis et bijugatis, subtus sparse villosis, margine valde revolutis, apice apiculatis basi obtusis vel cordulatis, terminalibus 3–4 mm. longis, lateralibus minoribus; sepalis 4 ovato-oblongis ca. 1.8 mm. longis et 1 mm. latis; fructibus 4–5 mm. longis axillaribus solitariis alatis haud baccatis, alis 4 integerrimis vel crenato-dentatis ca. 1 mm. latis; valliculis laevis vel non rariter alas secondarias parvas gerentibus.

ARGENTINA. Catamarca: Sierra Anconquija, 4600 m., Feb. 24, 1925, *Venturi 6633* (TYPE, U. S. Nat. Herb.); Sierra Anconquija, 4400 m., *Venturi 6360* (US). Salta: Nevado del Castillo, 4500 m., Jan. 1929, *Venturi 8540* (US).

A well marked species because of its caespitose habit, paucifoliolate leaves, non-spinescent leaf-rachises and its 4–5-winged fruit. It is probably related to *M. paucijugatus* from which it is readily separated by habit or growth, 4-winged fruit and its inconspicuous leaf-rachises.

Margyricarpus alatus Gillies ex Hook. & Arnott, Bot. Miscel. **3:** 305 (March 1833).

Tetraglochin strictum Poeppig, Frag. Syn. Pl. Chile 26 (Oct. 1833).
Tetraglochin alatum (Gillies) Kuntze, Rev. Gen. **3**[2]**:** 81 (1898).

It has been the common practice to use Poeppig's specific name for this, the most common member of its genus in central Chile and west-central Argentina. It should be noted, however, that the name published by Hooker & Arnott has at least six months priority.

Margyricarpus caespitosus (Phil.), comb. nov.

Tetraglochin caespitosum Philippi, Anal. Univ. Chile **23:** 452, 463 (1863); Linnaea **33:** 63 (1864).
Margyricarpus microphyllus sensu Niederlein in Lorentz & Niederlein, Bot. Exped. Rio Negro 215, *t. 6* (1881); not *T. microphyllus* Phil.!
M. Niederleinii Spegazzini, Rev. Agron. La Plata **3:** 513 (1897).
M. Clarazii Ball, Jour. Linn. Soc. Bot. **21:** 217 (1884).

The name given by Philippi to this very well marked species of Patagonia is the oldest and should be accepted.

Lathyrus lomanus, sp. nov.

Herba laxa e radice perenni gracili 3–5 mm. crassa profunda oriens

juventate sparse pilosa mox glabrescens; caulibus 1–2 m. longis 4-costatis usque 3–4 mm. crassis, internodiis 2–7 cm. longis; foliis unijugatis; stipulis conspicuis 1–4 cm. longis 8–24 mm. latis ovato-sagittatis asymmetricis margine paucidentatis apice acutis apiculatis sinibus clausis; petiolo 8–30 mm. longo stipulis subaequilongo vel breviore costato; cirrho quam petiolo 2–3-plo longiore saepe trifido rariter simplice; foliolis lanceolatis vel ellipticis stipulis latioribus 4–6 cm. longis 12–30 mm. latis utrinque acutis vel obtusis sub lente minute inconspicueque albo-punctulatis apice apiculatis, basi 1 mm. longe petiolulatis, subtus (in sicco) plus minusve purpurescentibus saepe villulosis, supra viridioribus saepe glabrescentibus; racemis 3–10-floris 1–2 dm. longis; pedicello florifero 2–5 cm. longo, fructifero 5–8 mm. longo; floribus 2 cm. longis; calyce 1 cm. longo sparse piloso, tubo cupulato 4 mm. profundo, lobo infero ca. 6 mm. longo subulato, lobis superioribus ca. 4 mm. longis cuneatis; corolla purpurea, vexillo glaberrimo 18–20 mm. longo apice rotundo, lamina alarum 12 mm. longa 5–6 mm. lata ca. 5 mm. longe unguiculata, carina alis conspicue breviore; ovario dense adpresseque villoso apicem versus glabro, stylo persistente 5 mm. longo supra medium compresso-clavato stigmatibus 2 distinctis notato; legumine villoso 5 cm. longo 5–6.5 mm. lato intus nitido et semina versus saepe dense villoso alibi glabro; seminibus nigris 3 mm. longis 2 mm. latis 1–1.5 mm. crassis.

CHILE: Aguada del Panul, dept. Taltal, trailing over rocks in the small steep quebrada above the water-hole, fl. purple, Dec. 4, 1925, *Johnston 5430* (TYPE, Gray Herb.).

Probably most closely related to *L. dumetorum* Phil., but very different in its purple flowers, very sparse, pale rather than fulvous indument, more deeply lobed calyx, broader thinner purplish-stained leaflets, etc.

Adesmia Pirionii, sp. nov.

Frutex inermis ramosissimus glanduliferus sordide villulosus; ramulis gracilibus elongatis usque 2.5 mm. crassis, juventate pilis erectis 0.6–1 mm. longis gracilibus saepe abundantibus plus minusve velutinis, cortice glandulis sessilibus minutis donato; foliis villosis et glanduliferis numerosis alternis 3–10 mm. distantibus imparipinnatis; stipulis lanceolatis 1.5–4 mm. longis 0.6–1.4 mm. latis acutis deciduis; rhachi folii 3–8 mm. longa ca. 0.3 mm. crassa supra sulcata; foliolis 3–5-jugatis rhachi longioribus oblanceolatis 8–19 mm. longis 2–4 mm. latis 1–2.5 mm. distantibus supra medium latioribus deinde basim versus gradatim attenuatis crassiusculis in sicco rugulosis perinconspicue costatis vix nervatis utrinque consimilibus glanduliferis et pilosis, basi cuneatis sessilibus, apice acutis vel abrupte breviterque acuminatis, margine revolutis; floribus secus ramulos

e axilla folii normalis orientibus solitariis 1–2 mm. longe pedicellatis; calyce 8–10 mm. longo villoso glandulifero, lobis subulatis quam tubo cupulato 2–2.5 mm. longo et crasso ca. 3-plo longioribus; vexillo corollae 10–12 mm. longo, lamina obovata 7–8 mm. lata extus glandulifera sparse pilosa 1–2 mm. longe unguiculata; carina ca. 10 mm. longa 3–3.5 mm. alta; alis carinae subaequilongis vel (0–1 mm. longe) brevioribus; ovario velutino; stylo breviter villoso; legumine biarticulato in calyce incluso; segmentis leguminis ca. 2 mm. longis 2.5 mm. latis et ca. 1 mm. crassis, latere convexis rugulosis et papillatis minute inconspicueque pubescentibus vix vel haud glanduliferis.

CHILE. Cerro de Lliu-Lliu, 800 m., a dominant shrub on one of the hills, Nov. 1929, *Father Felix Jaffuel 228* (TYPE, Gray Herb.); Lliu-Lliu, Jan. 1920, *Father Felix Jaffuel & Father Anastasio Pirion* (G); Cerro Tres Puntas near Limache, Oct. 26, 1930, *A. Garaventa 1654* (G).

This shrub appears to be an endemic in the coastal mountains, prov. Aconcagua, south of the city of Limache. It is a relative of *A. Loudonia* H. & A. differing from that species in having an indument of spreading sordid hairs, rather than being silky strigose, and in having numerous glands borne on the stems, leaves, calyx and vexillum. Its fruit is smaller than in *A. Loudonia* and, rather than surpassing the calyx-lobes, reaches barely up to their middle.

The species is named in honor of my esteemed friend, Father Anastasio Pirion, to whom I am indebted for very many specimens from various parts of Chile and particularly from the Valle de Marga Marga. This *Adesmia* comes from the slopes at the head of the valley of Marga Marga and it is eminently fitting that it should commemorate the name of Father Pirion and associate it more firmly with the region which he has made so well known to naturalists through his studies and collecting.

Erodium chilense, sp. nov.

Herba annua vel biennis; radice verticali subulata radiculas tenues laterales paucas gerente; caulibus pluribus laxe decumbentibus 5–15 cm. longis pauciramosis foliosis plus minusve stipitato-glandulosis cum pilis albis patentibus mollibus evidenter villosis; laminis foliorum imam ad basim palmate 5-nervatis (nervis pinnate ramosis) sparse stipitato-glandulosis adpresse villosis; petiolis conspicue patenter villosis inconspicue glanduliferis; stipulis membranaceis acutis conspicuis pallidis 5–8 mm. longis 2–3 mm. latis; foliis basalibus mox deciduis quam caulinis minoribus et minus angulatis elongatisve cordato-ovatis plus minusve trilobatis 1.7–2.3 cm. longis 1.5–1.8 cm. latis, apice rotundis, basi cordatis, margine crenato-dentatis; petiolis laminis 1.5–2-plo longiori-

bus; foliis caulinis plus minusve 5-lobatis, basi subcordatis, margine irregulariter inciso-dentatis, supremis sessilibus basi subtruncatis; margine irregulariter inciso-dentatis, supremis sessilibus basi subtruncatis; pedunculo 1–3.5 cm. longo villoso inconspicue stipitato-glandulifero petiolis conspicue longiore 3–5-floro; bracteis involucri ca. 4 late ovatis ca. 1 mm. longis obtusiusculis membranaceis villosis; pedicellis ad anthesin 5–8 mm. longis stipitato-glandulosis villosis, fructiferis paullo longioribus et saepe recurvatis; sepalis oblongis vel lanceolato-oblongis ca. 5 mm. longis 1.5 mm. latis 5-nervatis apice mucronatis extus villosis intus glabris; petalis aequalibus lilaceis sepalos vix superantibus, lamina oblongo-ovata 3 mm. longa 2 mm. lata apice rotunda basi triangulari in unguem 1 mm. longum producta; ovario strigoso; fructu 3–4 cm. longo; rostro achaenii 2.4–3.4 cm. longo villoso.

CHILE: Tocopilla, 1930–32, *Jaffuel 1056, 2540* (G); Valle de Marga Marga, 1916–1930, *Jaffuel 916, Pirion & Jaffuel 3115, 3156* (G); Valparaiso, 1895, *Buchtien* (G, mixed with *E. Botrys*); Tiltil, 1928, *Looser 739* (TYPE, Gray Herb.); Cerro de La Leona, Rancagua, 1828, *Bertero 251* (G).

This is an endemic Chilean species resembling *E. malacoides* (L.) Willd. From that European species it is distinguished by having the apical prolongation of the carpels strigose rather than glabrous, the pedicels and sepals distinctly villous rather than glandular, the leaves lacking resinous granules, and the stems less elongate. In texture, shape and size of leaves, and in the size and shape of floral parts the two species are very similar. The difference in habit of growth and in the indument is clear and well marked. The native Chilean plant can be readily separated from material of *E. malacoides* not only from the Mediterranean but also from Peru, Argentina, Uruguay and Brazil where it has been introduced. From *E. geoides* St. Hil. of Argentina, the other native *Erodium* of South America, the Chilean species can be quickly distinguished by its much smaller flowers and fruit.

Porlieria chilensis, sp. nov.

Frutex 1–3 m. altus; ramulis numerosis rigidis validis divaricatis haud gracilibus; foliis oppositis imparipinnatis 1.2–2 cm. longis; foliolis crassiusculis 5–7(saepe 6)-jugatis 1–2 mm. distantibus oblongis vel elliptico-oblongis, apice obtusis vel rotundis basi oblique rotundis, subtus villosulis mox subglabrescentibus, supra subglabris, utrinque cum nervis 1–2 longitudinalibus plus minusve ramosis prominulis rugulosis; rhachibus 4–10 mm. longis villosulis mox glabrescentibus; stipulis 1.5–3 mm. longis ascendentibus subulatis fragilibus inconspicuis; floribus axillaribus

solitariis in alabastro distincte tomentulosis; pedicello 4–8 mm. longo; sepalis orbiculatis 3–5 mm. latis extus villosulis; petalis 4.5 mm. longis 4 mm. latis 5 apice truncatis vel late obtusis sub apicem latioribus deinde basim versus valde angustatis et subunguiculatis; staminibus 10 glaberrimis; filamentis 5–5.5 mm. longis medium versus appendiculas oblongas obovatas gerentibus; appendiculis 1–1.5 mm. longis ca. 0.8 mm. latis inciso-lobatis, lobis linearibus ca. 0.3–0.5 mm. longis; antheris oblongis; ovario evidenter sed sparse villoso ca. 0.9 mm. longe stipitato ca. 2.5 mm. longe et lato apice stylo ca. 1 mm. longe donato; fructibus marginem versus inconspicue strigoso-villosis vel subglabris 5-lobatis brunneis; lobis 5–8 mm. longis et latis; seminibus lateraliter compressis ca. 8 mm. longis 5 mm. latis et 2.5 mm. crassis.

CHILE: Frai Jorge, prov. Coquimbo, 1925, *Werdermann 919* (TYPE Gray Herb.); Renca near Santiago, 1922, *G. Montero 64* (G); central Chile, *Cuming 274* (G); Chile, *Gay* (G).

This is the plant of central Chile, known as "Guayacan," which has passed as *P. hygrometra* R. & P. Synop. Veg. Fl. Peru. 94 (1798). When Ruiz & Pavon described *P. hygrometra* they mentioned plants from Huanuco, Peru and from Coquimbo, Chile. It is obvious from their discussion, however, that they had a greater familiarity with the Peruvian plants. Furthermore it is the northern one which they illustrated in their plate, no. 343, which was destined for the fourth and unpublished volume of their great flora. The Peruvian plant, accordingly, has properly been accepted as the typical form of *P. hygrometra*. This plant differs from *P. chilensis* in having more elongate, more numerous leaflets that are thinner and smoother and are glabrous except for a ciliolate margin. It has distinctly more slender branches, a completely glabrous ovary, and much less tomentulose buds. I can not distinguish the typical plant of central Peru from the forms of *Porlieria* found in Bolivia and northwestern Argentina and now current under the names, *P. Lorentzii* Engler and *P. arida* Rusby. These latter names I believe are synonyms of *P. hygrometra* R. & P.

Schinus polygamus (Cav.), comb. nov.

Amyris polygama Cav. Icon. **3**: *20, t. 239* (1795).
Schinus dependens Ortega, Decas **8**: 102 (1798).

Since the species described and illustrated by Cavanilles is older than *S. dependens* Ortega and clear in its application there is no good reason why it should not be taken up for the common Chilean shrub of this genus. Otto Kuntze, Rev. Gen. **3**^{2}: 45 (1898), has taken up *Schinus Huigan* Molina, Saggio 169 (1783), as a still older name for this common Chilean plant but such a procedure seems contrary to good botanical

practice. While Molina appears to have had *Schinus polygamus* in mind when he proposed the name *Schinus Huigan*, his knowledge of its characters were so very indefinite and his account of it so thoroughly confused and contradictory that the name had best be discarded. If the name is not discarded there are better reasons taxonomically for placing it in the synonymy of the Peruvian, *Schinus Molle* L., than there is for applying it to the present Chilean shrub.

The Latin diagnosis given by Molina, p. 169 and 355, is as follows, — "Schinus *Huigan* fol. pinnatis: foliolis serratis petiolatis, impari brevissimo." This certainly does not describe the Chilean *S. polygamus* which has simple oblanceolate, usually entire leaves, but does describe the Peruvian, *S. Molle*. In his discussion of the species, p. 169, Molina states that there are two sorts of "Molle" in Chile, the common *Schinus Molle* from the coastal region, and *Schinus Huigan*, the "Huigan" with "foglioline picciuolate" which grows generally in all parts of Chile. He adds that both species provide berries from which a beverage is made. I have quoted, in the original Italian, the only morphological terms used by Molina in his discussion of the species. These have commonly been translated, "folium parvum petiolatum," but they are also capable of translation as "foliolum petiolulatum" which is probably correct, since they would then agree with the Latin diagnosis which reads, "fol. pinnatis, foliolis serratis petiolatis."

In the much revised second edition of the Saggio, p. 154–5 (1810), Molina repeats the original Latin diagnosis of his *Schinus Huigan*. His discussion is completely new. He gives a copy from the description of *Amyris polygama* Cav. which he calls "Huigual," and then adds that this plant should not be confused with the "Huigan" (*Schinus Huigan*), another Chilean tree which is the same species as *Schinus Molle* or only a variety of it, and which also supplies berries used in making a beverage. He concludes with the remark that these two Chilean trees have nearly the same appearance and can be readily confused.

In his commentary on the species of Molina, Philippi, Anal. Univ. Chile **22**: 717 (1863), has suggested that Molina was attempting to distinguish the widely distributed *S. polygamus* from the plant of the coast ranges, *S. latifolius* (Gillies) Engler. This is probably correct. Molina's knowledge of the plants was obviously very vague and probably second-hand. The common name, "Molle," which is applied to all species of *Schinus*, confused him greatly. In the first edition he considered the coastal plant "*Schinus Molle*." In the second edition he considered his *Schinus Huigan* as the same or perhaps only a variety of that Peruvian species. In both editions Molina gave a Latin diagnosis of

S. Huigan which can apply only to the Peruvian, *Schinus Molle*. Molina was not a naturalist but a scholastic who obviously had only a casual acquaintance with plants and was inclined toward searching for information about them in books rather than by a study of them in the fields, hills and mountains. His account of *Schinus Huigan* is evidently a conglomeration of some vague personal acquaintance with *S. polygamus*, mixed with some hearsay and some misunderstood information derived from literary sources. The "Molle" of Peru, *Schinus Molle* L., had been described by many travelers and I believe that Molina, confusing the "Molle" of Chile with the plant of Peru (in his time cultivated rarely if at all in Chile), derived his description of *S. Huigan* from some illustration or account of the Peruvian plant. If the name *S. Huigan* is not to be rejected as hopelessly confused, it must be treated, taxonomically, as a synonym of *Schinus Molle* L.

Schinus velutinus (Turcz.), comb. nov.

Duvaua velutina Turcz. Bull. Soc. Nat. Moscou **31**[1]: 467 (1858).
Litrea Molle Gay, Fl. Chile **2**: 45 (1846). Not *S. Molle* L.
Schinus chilensis Marchand, Rév. Anacard. 164 (1869).
Duvaua molle Bertero ex Marchand, l. c., in synonymy.
Schinus latifolius var. *tomentosus* Fenzl ex Engler in Martius, Fl. Brasil. **12**[2]: 389 (1876).

This is the shrub of central Chile having conspicuously hairy, usually velvety, leaves and stems. It is very different in appearance from the glabrous, and even glaucescent, *S. latifolius* (Gillies) Engler of the same region and certainly worthy of specific separation.

Schinus piliferus, sp. nov.

Frutex vel arbor 3–8 m. altus; ramulis inermibus vel non rariter spinescentibus subvelutinis pilis abundantibus gracilibus 0.5–1 mm. longis erectis vestitis; foliis 3–5.5 cm. longis 5–14 mm. latis saepe oblanceolatis supra medium latioribus rariter oblongo-obovatis vel oblongo-ellipticis et medium versus latioribus, margine integerrimis vel rariter supra medium sparse irregulariterque crenatis vel lobulato-dentatis, subtus pallidioribus cum nervis 5–10-jugatis saepe inconspicuis et costa infra medium pilifera (facie folii alibi glabra) rugosis, supra saepe enervatis costa infra medium non rariter pilifera notatis, apice obtusis vel rotundis rariter subacutis, basi saepe acutis, petiolo 1–2 rariter 3 mm. longo; inflorescentia 1–4 cm. longa foliis subaequilongi vel duplo breviore saepe evidenter pilulosa; pedicellis gracilibus 2–4 mm. longis alabastro globoso saepe duplo vel triplo longioribus; lobis calycis 4–5 ca. 0.5 mm. longis ovatis minute inconspicueque ciliolatis; petalis ellipticis 1.5–2 mm. longis; fructu ignoto.

ARGENTINA. Tucuman: Chañar Pozo, 300 m., *Venturi 485* (G); Siambon, 1500 m., *Venturi 10261* (G); Rio Lules, 400 m., *Venturi 2291* (G). Salta: Alemania, dept. Guachipas, slopes, 1300 m., tree 4 m. tall, Nov. 27, 1929, *Venturi 9830* (TYPE, Gray Herb.); Campo Duran, *Parodi 9171* (G); Sierra de la Candelaria, 800 m., *Venturi 9573* (G). Santiago del Estero: El Charco, 300 m., *Venturi 10113* (G). Jujuy: Rio San Francisco, 600 m., *Venturi 9735* (G).

This is the Argentine plant most closely related to *S. polygamus* of Chile. It differs from that plant in its paler, pubescent, evidently veined leaves and in its larger hairy inflorescences. In *S. piliferus* the midrib of the leaves are commonly pilose, especially on the under surface above the base. This character and its elongate usually distinctly short-hairy inflorescences distinguish the plant from all other species of the genus. The plant suggests *S. longifolius* (Lindl.) Speg. of eastern Argentina, but that is a glabrous shrub and has glomerate glabrous flowers. Among the species of western Argentina it may be readily distinguished from **Schinus fasciculatus** (Griseb.), comb. nov. (*Duvaua fasciculata* Griseb.) That is a distinctly much more spinescent shrub with short congested inflorescences and smaller leaves which are copiously hirtellous on both faces.

Schinus gracilipes, sp. nov.

Arbor 2–10 m. altus; ramulis gracilibus inermibus glabris vel inconspicue puberulentis; foliis ellipticis vel ovatis vel ovato-oblongis infra medium vel basim versus latioribus 3–10 cm. longis 1.5–4 cm. latis, basi obtusis vel non rariter late acutis vel subrotundis, apice obtusis, margine supra basim sinuatis, subtus pallidis glaberrimis vel perinconspicue puberulentis, nervis evidentibus saepe ca. 9–10-jugatis angulo 80°–90° a primario abeuntibus rugosis, supra viridibus saepe praesertim in costa puberulentis; petiolis gracilibus conspicuis 5–12 mm. longis supra canaliculatis; inflorescentia dimidium folium vix aequante puberulenta, bracteis ovatis ciliolatis vix 1 mm. longis, pedicellis tenuibus 3–5 mm. longis quam alabastro globoso 3–4-plo longioribus; lobis calycis 4 ovatis obtusis ciliolatis receptaculo duplo longioribus; petalis 4 ovatis virescentibus 1.5 mm. longis quam lobis calycis duplo longioribus; drupis globosis 6 mm. diametro, exocarpio lilacino nitido, meriocarpio valde resinoso.

ARGENTINA. Tucuman: El Cadillal, 600 m., *Venturi 5386* (G); Tapia, 750 m., Aug. 29, 1925, *Venturi 3887* (TYPE, Gray Herb.); Cerro de Taficillo, 1600 m., *Venturi 9996* (G); Tafi del Valle, 2500 m., *Venturi 2944* (G). Catamarca: El Sancho, 2500 m., Sept. 11,

1915, *Joergensen 991* (G). Salta: Sierra de la Candelaria, 1700 m., *Venturi 9571* (G).

This is the Argentine tree treated by Grisebach, Engler and others as *S. latifolius* (Gillies) Engler. That Chilean plant, however, is more glabrescent and has toothed leaves and very conspicuously shorter pedicels and much larger flowers. The Chilean and Argentine species are clearly distinct.

Schinus bumelioides, sp. nov.

Frutex vel arbor 1–10 m. altus; ramulis rigidis divaricatis spinescentibus cortice pallido glabro donatis; foliis glabris ellipticis vel oblongis 2–4 cm. longis 9–18 mm. latis medium versus vel paullo infra medium latioribus, apice obtusis vel rotundis, basi saepe rotundis vel obtusis sed rariter plus minusve acutis, margine integerrimis, subtus pallidis, nervis 6–8-jugatis inconspicue notatis, supra viridibus; petiolis 5–8 mm. longis rigidis gracilibus; inflorescentia glomerata petiolum paullo superante subglabra, bracteis ca. 0.5 mm. longis; pedicellis 2–3 mm. longis quam alabastro globoso 1–2-plo longioribus; lobis calycis 5 ovatis ca. 0.5 mm. longis inconspicue ciliolatis; petalis 5 obovatis ca. 2 mm. longis; fructu ignoto.

ARGENTINA. Tucuman: Tapia, 700 m., Aug. 18, 1929, *Venturi 9422* (TYPE, Gray Herb.); Rio Sali, 450 m., *Venturi 882* (G); Barranca Colorada 500–550 m., *Venturi 3530, 3800* and *5281* (G). Catamarca: Andalgalá, Sept. 9, 1915, *Joergensen 990* in pt. (G); dept. El Alto, 1250 m., *Venturi 7063* (G). Salta: Agua Caliente, 1000 m., *Venturi 5494* (G); Los Baños, 900 m., *Venturi 9330* (G). Jujuy: Sierra de Calilegua, dept. Ledesma, 700 m., *Venturi 5311* (G).

This is a relative of *S. sinuatus* (Griseb.) Engler, *S. spinosus* Engler, and *S. ferox* Hassler. Its entire-margined, elliptic or oblong leaves, slender petioles, and glabrous surfaces distinguish it from these relatives. *Schinus praecox* (Griseb.) Speg. is a very different plant with small spathulate leaves, 1–2 cm. long and 3–6 mm. broad.

Schinus microphyllus, sp. nov.

Frutex ca. 2 m. altus; ramulis divaricatis rigidis spinescentibus pilis minutis erectis abundantibus vestitis; foliis ellipticis vel obovatis 8–18 mm. longis 6–10 mm. latis, medium versus vel paullo supra medium latioribus puberulentis, margine integris vel sparse sinuato-dentatis, apice obtusis, basi obtusis vel acutis, subtus pallidioribus, nervis utrinque 1–3 prominulis; petiolis 1–3 mm. longis puberulentis supra canaliculatis; inflorescentia folio saepe aequilonga vel duplo longiore, rhachi 1–2 cm. longa pilis minutis erectis abundantibus vestita; pedicellis ca. 5 mm.

longis gracilibus alabastro globoso 3–4-plo longioribus; petalis 5 suborbicularibus virescentibus 2 mm. longis quam lobis calycis ovatis rotundis 3–4-plo longioribus; staminibus ca. 1 mm. longis; fructu ignoto.

PERU: above Argama, on trail to Andahuaylas, dept. Apurimac, roadsides and gulches, shrub 2 m. tall, fl. greenish, 3800 m., Nov. 5, 1935, *West 3747* (TYPE, Gray Herb.); Dept. Apurimac, 2500–2600 m., *Weberbauer 5839* (G).

A spinescent shrub most closely related to *S. andinus* of the Bolivian Plateau. It differs from that more southern species in its decidedly pungent branchlets, its distinctly pubescent (almost velvety) stems, its dull puberulent rather than lustrous upper leaf-surfaces, and its much more slender, longer, hairy inflorescences.

Schinus andinus (Engler), comb. nov.

Schinus dependens var. *andinus* Engler, in DC. Monog. Phanerog. **4**: 341 (1883).

BOLIVIA: Calderillo, 3300 m., *Fiebrig 2477* (G); Songo, *Bang 895* (G); near La Paz, 3000 m., *Bang 160* (G); near Sorata, 2650–2800 m., *Mandon 768* (G).

PERU: Tambo, dept. Ayacucho, 3100–3200 m., *Weberbauer 5552* (G).

This plant of the plateau is related to *S. microphylla* Johnston and to *S. longifolia* (Lindl.) Speg. From the latter, which ranges at low altitudes from eastern Bolivia to eastern Argentina and southern Brazil, it differs conspicuously in the smaller, proportionately much broader, leaves that have a sinuate margin and much fewer (1–3) pairs of obscure veins.

Cristaria adenophora, sp. nov.

Herba annua e radice crassa lignosa tortuosa oriens pallide viridis; caulibus pluribus ascendentibus usque 2 dm. vel ultra longioribus 2.5–5 mm. crassis laxe ramosis pilis simplicibus glanduliferis vestitis, internodiis paucis 2–5 cm. longis; foliis paucis; petiolo gracili laminae foliorum superiorum subaequilongo, inferiorum quam lamina subduplolongiori subtereti striato pilis simplicibus glanduliferis conspicue vestito; lamina ambitu ovatis vel late ovatis foliorum supra medium caulis gestorum maxima 2–3 cm. longa latitudine (1.8–3 cm. lata) longitudinem subaequante vel ea paullo breviori pilis stellatis (supra abundantibus velutinis; subtus sparcioribus) vestita et pilis simplicibus glanduliferis (praesertim supra) sparsis inconspicuis instructa breviter lateque (utrinque 5 mm. profunde) trilobata vel irregulariter 1–3 mm. profundeque lobulato-dentata, lobulis et lobis utrinque 1–5 integris apice saepe rotundis

vel obtusis; cymulis axillaribus subsessilibus vel usque 5 mm. longe pedunculatis; pedicellis floriferis 5–10 mm. longis gracilibus pilis glanduliferis simplicibus flavescentibus obtectis; calyce pilis stellatis longe graciliterque ramosis abundantibus villoso haud vel sparsissime glandulifero 5 mm. longo, lobis lanceolatis acutis 4 mm. longis basi imo usque 2 mm. latis; petalis purpureo-rubris ca. 9 mm. longis quam calycis lobis duplo longioribus; ovario glabro fructu 6 mm. diametro glaberrimo depresso alis exclusis 2 mm. alto alis lanceo-ovatis 2 mm. altis 1 mm. latis.

CHILE: Potrerillos, prov. Atacama, 2900 m., on golf-course, fl. magenta, March 25, 1933, *M. O'C. Greninger 18* (TYPE, Gray Herb.; ISOTYPE, Stanford University).

Evidently related to *C. glomerulata* Johnston, which also came from the golf course at Potrerillos Mine. This new species, however, is a coarser plant with fewer flowers, larger petals, much more hairy larger calyces, and much more broadly and sparsely lobed velvety leaves which are practically devoid of glandular hairs. The lower leaves of *C. adenophora* have much smaller blades and a proportionately longer petiole than do the middle and upper ones. The lower leaves of *C. glomerulata* are the largest and the whole plant is sordid and dark with glands and glandular secretions. In the new species the stems, petioles and pedicels are brown or tawny because of the glands, but the calyx and leaf-blades are clean and lighter color because of the lack of them.

Palaua mollendoensis (Ulbr.), comb. nov.

Malvastrum mollendoense Ulbrich, Bot. Jahrb. **42**: 120 (1908).

This remarkable species has a habit more in agreement with *Palaua* than with *Malvastrum*. In its technical characters, the "carpels" being in two incomplete superimposed series, it clearly belongs to the former genus.

Nototriche diminutiva (Phil.), comb. nov.

Malva diminutiva Phil. Cat. Pl. Itin. Tarapaca 8 (1891).
Malvastrum diminutivum (Phil.) Baker, Jour. Bot. **32**: 36 (1894).
Nototriche nana Hill, Kew Bull. **1928**: 19 (1928).

I have compared authentic material of *Malva diminutiva* with some of *Nototriche nana*. The species are unquestionably conspecific.

Azara petiolaris (Don), comb. nov.

Quillaja petiolaris Don, Edinburgh New Philos. Jour. **12**: 110 (Oct.-Dec. 1831).
Azara Gilliesii Hook. & Arnott, Bot. Miscel. **3**: 144 (Aug. 1832).

The original description of Don's species is as follows, — "Q. *petiolaris*, foliis longe petiolatis ovalibus dentatis subserratis. *Hab*. In Chili.

D. Cuming (V. s. sp. in Herb. Lamb.). *Folia* ovalia, dentata, subserrata, glabra, nitida sesqui v. bipollicaria. *Petioli* fere unciales. *Stipulae* parvae, caducae. *Flores* nondum vidi. *Obs.* Maxime affinis Q. saponariae, sed abunde diversa petiolis 6-plo longioribus." The sterile specimens described represent the plant generally known as *Azara Gilliesii* H. & A., as was long ago indicated by the authors of that species, Bot. Miscel. **3**: 305 (March 1833). Don's specific name, having priority, must become the accepted one for this well known tree of central Chile.

Argylia checoensis (Meyen), comb. nov.

Oxalis checoensis Meyen, Reise **1**: 406 (1834); Kunth in Engler, Pflanzenr. IV. **130**[Heft 95]: 216, fig. 18a-e (1930).
Argylia geranioides DC. Prodr. **9**: 235 (1845).

The type of *Oxalis checoensis* is labeled as collected near Copiapó at 3–4000 ft. The specific name, however, almost certainly refers to Mina de Checo, a mine in the hills southeast from Tierra Amarilla which was visited by Meyen. The plant represented is a form of *Argylia geranioides* DC. of the Bignoniaceae, and, indeed, is older than that species. In his recent monograph of *Oxalis*, Kunth, l. c., accepted Meyen's species as an *Oxalis* and erected a section for it.

Psilocarphus Berteri, nom. nov.

Micropus globiferus DC. Prodr. **5**: 460 (1840), not *P. globiferus* Nutt. (1840).
Psilocarphus globuliferus (DC.) Spegazzini, Anal. Soc. Cient. Argentina **48**: 330 (1899).
Micropus globuliferus DC. ex Speg, l. c. lapsu calami; pro synon.

CHILE: near Coquimbo, 1856, *Harvey* (G); Coquimbo, 1931, *Jaffuel 2682* (G); Coquimbo 1934, *Montero 1884* (G); Tiltil, rather dry sandy places somewhat shaded by shrubs, 700 m., 1927, *Montero 141* (G); Tiltil, 700 m., *Looser 742* (G); Cerro Cruz, Limache, 1931, *Garaventa* (G); Valle de Marga Marga, 250 m., 1929–33, *Jaffuel & Pirion 240, 2999* and *3091* (G); Rancagua, 1833, *Bertero 433* (G, photo. of type).

The name proposed above is based entirely upon *Micropus globiferus* DC. and so upon the plant collected by Bertero, no. 433, near Rancagua, Chile. It thus applies to that one of the two Chilean species of the genus which is most closely related to *P. tenellus* Nutt. of California, and which is separated from *P. chilensis* (Remy) Meigen by having an arachnoid indument which is frequently deciduous on the old leaves, and by having smaller heads which are surrounded and usually hidden by numerous broadly oblong obtusish involucral leaves. There are indications that this plant frequents drier and better drained soils than its relative, *P. chilensis*. As now known it is a plant endemic to central Chile.

This species of Chile was the first of its genus to be described. It has remained, however, poorly understood and its name has been given a great variety of applications. Much of the confusion enveloping it began when Nuttall, Trans. Am. Philos. Soc. **7:** 340 (1840), established the genus *Psilocarphus* and published the name, *Psilocarphus globiferus*. This latter has been variously interpreted, either as a new Californian species based upon material collected at Santa Barbara by Nuttall, or as a nomenclatorial transfer based upon *Micropus globiferus* DC. and hence upon the Chilean plant collected by Bertero. Though formerly thought to be conspecific, we now know that the plant collected by Nuttall and Bertero are distinct species. Only one of these two species can bear the name, *Psilocarphus globiferus*. Gray, Proc. Amer. Acad. **8:** 652 (1873) and Synop. Fl. 1^2**:** 228 (1878), first treated *P. globiferus* Nutt. as based upon *M. globiferus* DC. and hence as applicable to the Chilean plant. Later, however, Synop. Fl. 1^2**:** suppl. 448 (1887), he applied Nuttall's binomial to the Californian endemic. This treatment has since generally prevailed. Recently, however, Cabrera, Revista Chilena Hist. Nat. **40:** 230 (1936), has sponsored the name, "*Psilocarphus globiferus* (Bert.) Nutt." and has applied it to plants of California, Argentina and Chile. A consideration of the details attending the publication of Nuttall's binomial shows this to be incorrect.

When Nuttall published his binomial he preceded the trivial epithet by an asterisk, "*Psilocarphus *globiferus,*" he gave a description of the Californian plant, and finally he cited the following reference, "*Micropus globiferus* ? Decand." A study of Nuttall's publication will show that he placed the asterisk before generic names or species names when these were newly proposed new genera or new species. He did not place an asterisk beside specific names that had been transferred from another genus. This well known practice of Nuttall, and the fact that he cited the name, *Micropus globiferus* DC., with a question mark, is clear indication that he was publishing an independent species and one not identified with DeCandolle's Chilean species nor taxonomically based upon it. The name *Psilocarphus globiferus* Nutt., accordingly, should be applied only to the plant of southern California which Nuttall collected near Santa Barbara. Since Nuttall's species bears a name preoccupying the epithet "*globiferus,*" a new specific epithet under *Psilocarphus* is accordingly needed for the Chilean plant described as *Micropus globiferus* DC. The Chilean plant may be called, *Psilocarphus Berteri*.

Psilocarphus chilensis (Remy) Meigen, Bot. Jahrb. **17:** 281 (1893); Reiche, Anal. Univ. Chile **111:** 186 (1902) and Fl. Chile **4:** 36 (1905).

Bezanilla chilensis Remy in Gay, Fl. Chile **4:** 110, *t. 46* (1849).

CHILE: between Frai Jorge and Ovalle, 300 m., 1925, *Werdermann 927* (G); Batuco, 500 m., 1936, *Looser 3637, 3648* (G); Batuco, 1932, *Jaffuel 1781* (G).

ARGENTINA: ?? Tehuelchel, 300 m., 1929, *Donat 118* (G).

This plant is much coarser than *P. Berteri* and is enveloped in a very loose woolly tomentum and has very elongate involucral leaves which do not obscure the head. It is very much more closely related to the true *P. globiferus* Nutt. of California than to *P. Berteri* of Chile. The material from Patagonia which I have cited seems to be conspecific with that from Chile. In any case it is closely related to *P. chilensis* and can not be referred to *P. Berteri.* Cabrera, Revista Chilena Hist. Nat. **40:** 231 (1936), cited four other collections from Patagonia as conspecific with two Chilean collections of *P. chilensis* (from Batuco) and a Californian collection of true *P. globiferus* (from La Verne). He appears to have had no collections of *P. Berteri.*

When Remy proposed *Bezanilla chilensis*, he cited *Micropus globiferus* DC. as a synonym. His plate, however, seems to be a representation of the present species and his description applies best to it also. I believe that his species can be used in the sense I have here adopted.

ARNOLD ARBORETUM,
HARVARD UNIVERSITY.

NEW SPECIES, VARIETIES AND COMBINATIONS FROM THE COLLECTIONS OF THE ARNOLD ARBORETUM

ALFRED REHDER

Ulmus laevis Pall. var. **celtidea** (Rogov.), comb. nov.

Ulmus glabra sensu Trautvetter in Bull. Phys.-Math. Acad. Sci. St. Petersb. **15**: 375 (1857), non Hudson, nec Miller, teste Litvinof.

Ulmus pedunculata Foug. var. *celtidea* Rogovitch, Obozr. Rast. Fl. Kiefsk. Uchebn. Okr. 533 (1869). — Koeppen, Geog. Verbr. Holzgew. Eur. Russ. **2**: 33 (Beitr. Kenntn. Russ. Reich. ser. 3, VI) (1889). — Schmalhausen, Fl. Sredn. Iuzhn. Ross. **2**: 533 (1897). — Chitrovo in Izv. Obtch. Uzcl. Orl. Gub. **1**: 50, t. 1 (1907). — Elwes & Henry, Trees Gt. Brit. Irel. **7**: 1852 (1913).

Ulmus celtidea Litvinof in Schedae Herb. Fl. Ross. **6**: 167 (1908).

Ulmus celtidea f. *glabra* Litvinof, l. c.

This variety differs from the type chiefly in the oblong-lanceolate small leaves gradually narrowed into a slender acumen, broadly cuneate at the base, and coarsely and sharply doubly serrate, glabrous beneath or slightly pubescent, also in the fewer (usually 5–6) stamens and in the smaller fruit with upright tips. Litvinof raised it to specific rank but the characters by which it is distinguished do not seem to be sufficient for specific separation. A tree of this variety, received in 1910 at this Arboretum from the nursery of Regel and Kesselring at St. Petersburg, proved to be typical *U. laevis;* this agrees with the experience recorded by Henry (in Elwes & Henry, Trees Gt. Brit. Irel. **7**: 1852. 1913).

Ulmus laevis var. **celtidea** f. **pilosa** (Litv.), comb. nov.

Ulmus celtidea f. *pilosa* Litvinof in Schedae Herb. Fl. Ross. **6**: 168 (1908).

The type of this form was collected May 2 and 26, 1906 by W. Chitrovo in the province of "Orel, distr. Briansk. Ad ripas fl. Desna pr. lac. Orechewoje." This form of which there is a duplicate of the type specimen in this herbarium, differs from the typical *celtidea* in the pilose young branchlets and petioles and the scabrid leaves up to 10 cm. long.

Ulmus glabra Huds. f. **exoniensis** (K. Koch), comb. nov.

Ulmus montana var. 9. *fastigiata* Hort. ex Loudon, Arb. Frut. Brit. **3**: 1399 (1838). — Henry in Elwes & Henry, Trees Gt. Brit. Irel. **7**: 1866 (1913).

Ulmus glabra replicata Hort. Dur. ex Loudon, l. c. (1838), pro synon. praeced.

Ulmus Fordii Hort. ex Loudon, l. c. (1838), pro synon. *U. m.* var. *fastigiatae.*

Ulmus exoniensis Hort. ex Loudon, l. c. (1838), pro synon. *U. m.* var. *fastigiatae.*

Ulmus scabra g) *U. exoniensis* Hort. ex K. Koch, Dendr. **2**[1]: 416 (1872).

Ulmus exoniensis K. Koch in Wochenschr. Ver. Bef. Gartenb. Preuss. **15**: 150 (1872).

Ulmus montana a. *genuina 2. exoniensis* Boulger in Gard. Chron. n. ser. **12**: 298 (1879).

Ulmus scabra Mill. a. *pyramidalis* sensu Dippel, Handb. Laubholzk. **2**: 28 (1892) tantum quoad syn. *"fastigiata, exoniensis;"* non *U. scabra* c) *U. pyramidalis* K. Koch (1872).

Ulmus scabra var. *fastigiata* (Loud.) Rehder in Bailey, Cycl. Am. Hort. **4**: 1881 (1902). — Schneider, Ill. Handb. Laubholzk. **1**: 218 (1904).

Ulmus scabra I. *typica* 1. *genuina* lus. *fastigiata* (Schneid.) Ascherson & Graebner, Syn. Mitteleur. Fl. **4**: 563 (1911).

Ulmus glabra f. *fastigiata* (Loud.) Rehder in Mitt. Deutsch. Dendr. Ges. **24**(1915): 216 (1916); in Bailey, Stand. Cycl. Hort. **6**: 3410 (1917), pro var.; non Dippel.

Though "fastigiata" is the oldest varietal name of this form, it cannot be used on account of the older homonym *U. glabra fastigiata* Kirchn. which is a synonym of *U. carpinifolia* var. *cornubiensis*. The next oldest legitimate varietal epithet is apparently "exoniensis" in *U. montana* a. *genuina 2 exoniensis* Boulger, if *U. scabra* f. *U. exoniensis* Hort. ex K. Koch (l. c.) is ruled out as an illegitimate combination, though Koch validates here the epithet "exoniensis" by a good description.

Dippel cites K. Koch as the author of his *U. scabra* a. *pyramidalis*, but Koch's *U. scabra* c. *U. pyramidalis* does not belong here, since he describes the leaves as smooth above, similar to those of *U. tiliaefolia* Host which belongs to *U. carpinifolia*. Koch's variety may be referable to *U. carpinifolia* var. *cornubiensis*, since he states that it has the habit of a Lombardy poplar.

Ulmus glabra f. **monstrosa** (Schneid.), comb. nov.

Ulmus montana monstrosa Hort. ex Schelle, in Beissner, Schelle & Zabel, Handb. Laubholz-Ben. 87 (1903), nomen.

Ulmus scabra var. e. *nana* f. *monstrosa* Schneider, Ill. Handb. Laubholzk. **1**: 218 (1904).

Ulmus scabra I. *typica* 1. *genuina* m. *monstrosa* (Schneid.) Ascherson & Graebner, Syn. Mitteleur. Fl. **4**: 562 (1911).

A compact shrub often with fasciated branches and leaves 5–8 cm. long, partly pitcher-shaped at base and on a slender petiole to 2.5 cm. long.

Ulmus carpinifolia Gleditsch, Pflanzenverz. 354 (1773). — Rupp. ex Suckow, Oek. Bot. 40 (1777). — Borkhausen, Vers. Forstbot. Beschr. Holzart. 35 (1790); Theor.-Prakt. Handb. Forstbot. **1:** 839 (1800). — Schkuhr, Handb. **1:** 176 (1808). — Lindley, Syn. Brit. Fl. 226 (1829).[1] — Druce, Brit. Pl. List, ed. 2, p. 103 (1928); Comital Fl. Brit. Isles, 266 (1932).

Ulmus campestris Linnaeus, Sp. Pl. 225 (1735), pro parte.
Ulmus glabra Miller, Gard. Dict. ed. 8 (1768), non Huds. (1762), "*glabris*."
Ulmus sativa Du Roi, Harbk. Baumz. **2:** 502 (1772), non Miller (1768).
Ulmus campestris var. *glabra* Aiton, Hort. Kew **1:** 319 (1789).
Ulmus nuda Ehrhart, Beitr. **6:** 86 (1791), pro parte.
Ulmus foliacea Gilibert, Exerc. Phytol. **2:** 395 (1792). — Schneider in Oester. Bot. Zeitschr. **66:** 79 (1916). — Rehder in Bailey, Stand. Cycl. Hort. **6:** 3412 (1917). — Johanson in Svensk Bot. Tidskr. **15:** 8 (1921); in Lustgaard **5:** 62 (1924); in Bot. Notis. **1932:** 200. — Hayek, Prodr. Fl. Penins. Balc. **1:** 91 (1924). — Rehder, Man. Cult. Trees Shrubs, 188 (1927).
Ulmus campestris β. *U. carpinifolia* Rupp. ex Suckow, Anfangsgr. Theor. Angew. Bot. **2:** 138 (1786). — Borkhausen in Rhein. Mag. Naturk. **1:** 498 (1793). — Kittel, Taschenb. Fl. Deutschl. ed. 3, **1:** 276 (1853).
Ulmus nitens Moench, Meth. 333 (1794). — Henry in Henry & Elwes, Trees Gt. Brit. Irel. **7:** 1894 (1913). — Moss, Cambridge Brit. Fl. **1:** 89 (1914). — Lynch in Jour. Roy. Hort. Soc. **41:** 16, f. 11 (1915). — Rehder in Mitt. Deutsch. Dendr. Ges. **24**(1915): 218 (1916). — Stern in Jour. Bot. 70, suppl. p. 21 (1932). — Turrill in Kew Bull. **1933:** 232.
Ulmus surculosa var. *glabra* Stokes, Bot. Mat. Med. **2:** 37 (1812).
? *Ulmus reticulata* β. ? *sepearia* Dumortier, Fl. Belg. 25 (1827), pro parte.
Ulmus campestris Spielart b. *carpinifolia* G. F. W. Meyer, Chloris Hann. 80 (1836).
Ulmus campestris α. *nuda* Koch, Syn. Fl. Germ. 637 (1837), pro parte.
Ulmus campestris var. *laevis* Spach in Ann. Sci. Nat. sér. 2, **15:** 362 (1841). — Planchon in Ann. Sci. Nat. sér. 3, **9:** 273 (1848).
Ulmus campestris var. γ. *Orme glabre* Mathieu, Fl. For. 194 (1858) "synon: *U. nitens* Moench, *U. carpinifolia* Ehrh."
Ulmus suberosa var. *glabra* Syme in Sowerby, Engl. Bot. ed. 3, **8:** 138 (1868).
Ulmus campestris c. *laevis* 1. *carpinifolia* (Lindl.) Boulger in Gard. Chron. n. ser. **12:** 298 (1879).
Ulmus glabra a. *typica* f. 1. *carpinifolia* Pospichal, Fl. Oester. Küstenl. **1:** 347 (1897).
Ulmus sativa Mill. g. *carpinifolia* (Lindl.) Druce, List Brit. Pl. 63 (1908).

[1]According to Moss, Cambridge Brit. Fl. **2:** 89 (1914), *U. carpinifolia* Lindl. represents *U. glabra* × *nitens*.

Ulmus vulgaris var. *carpinifolia* (Math. & Fl.) Rouy, Fl. France, **12**: 266 (1910).

Ulmus campestris a. *glabra* 3. *carpinifolia* Ascherson & Graebner, Syn. Mitteleur. Fl. **4**: 555 (1911).

For additional citation of literature see Schneider in Oester. Bot. Zeitschr. **66**: 79 (1916) and Stearn in Jour. Bot. **70**: suppl. p. 21 (1932).

The species under discussion was included by Linnaeus and many later authors in the species *U. campestris*, a name now proposed as a *nomen ambiguum rejiciendum*,[1] a proposal which will doubtless be accepted by the next International Botanical Congress. In dividing the Linnean concept of *U. campestris* into several species, the name *U. campestris* was kept by most English authors for the English elm, *U. procera* Salisb., while most botanists of continental Europe applied it to the species under discussion which is the elm most widely distributed in Europe. During the past twenty-five years various botanists, abandoning the name *U. campestris* as of uncertain application, have used three different names for the species here called *U. carpinifolia*, namely *U. glabra* Mill., *U. foliacea* Gilib. and *U. nitens* Moench. The first of these names is invalidated by the earlier homonym *U. glabra* Huds. which is the valid name for the species known also as *U. scabra* Mill. and *U. montana* Stokes. The second name is also an illegitimate name, since it is evidently a renaming of *U. campestris* L. without any attempt to separate it as a distinct species from the Linnean *U. campestris* which is quoted simply as a synonym. Gilibert states clearly in the preface that he has changed such Linnean names which seemed meaningless to him; he says (p. xliv): "mea nomina trivalia feci, quae attributi plantae adhaerentis et sensibilis ideam excitant; arbitraria plurima nihil significantia, desumpta a statione, viribus, etc. repudiavi." The third name *U. nitens* Moench, is also a renaming of a species already described under the name *U. carpinifolia* cited by Moench as a synonym and credited by him to Ehrhart, but I have not been able to find mention of this name in Ehrhart's works. Evidently *U. carpinifolia* Gleditsch (1773) is the oldest available name applicable to this species; it is based on "Ulmus carpini folio seu cortice arboris albido" of Ruppius Fl. Jen. ed. Haller. 330 (1745), as is clearly shown by the citation under *U. carpini folio*[2] in Gleditsch, Syst. Einleit. Forstwiss. **1**: 240 (1775) where Ruppius is cited. The brief description in German, of which that of *U. nitens* by Moench is hardly superior, and

[1]cf. Sprague & Green in Kew Bull. **1933**: 503; see also Suringar in Mitteil. Deutsch. Dendr. Ges. **41**: 39-41 (1929), and Kew Bull. **1935**: 74.

[2]In his Systematische Einleitung Gleditsch still retains the prelinnean names, while in his Pflanzenverzeichniss published two years earlier he had already adopted Linnean binomial nomenclature.

the comparison with the other species described indicates clearly the species Gleditsch had in mind, though the Latin phrases added apparently only as synonyms are contradictory and do not apply to the same species. The description by Suckow (1777 and 1786) who credits the species to Ruppius, refers only to the whitish bark. Borkhausen (1790) enumerates it as *U. carpinifolia* Gleditsch and says that it differs from *U. campestris* only in the smoother grayish or whitish bark and somewhat smaller leaves. As appears from the synonymy given above, the name *U. carpinifolia* has been used by several later authors for the species and has been employed as the name of a subdivision of a binomial by Suckow (1786), Borkhausen (1793), by G. F. W. Meyer (1836), Kittel (1853), Boulger (1879), Pospichal (1897), Druce (1908), Rouy (1910), Ascherson & Graebner (1911) and Moss (1914). By Moench (1794) it is cited as a synonym of his *U. nitens*, by Spach (1841) and by Planchon (1848) as a synonym of *U. campestris* var. *laevis*, by Koch (1837) as a synonym of his *U. campestris* a. *glabra*, by Mathieu (1858) as a synonym of his *U. campestris* var. γ. by Borbas (Bekesvarm. Fl. 55. 1881) under *U. glabra* and by Schneider (1916) as a synonym of *U. foliacea*.

As *Ulmus carpinifolia* appears to be the oldest and only valid name applicable to the species under discussion, the following new combinations become necessary.

Ulmus carpinifolia f. **variegata** (Dum. Cours.), comb. nov.

Ulmus campestris var. *U. glabra variegata* Dumont de Courset, Bot. Cult. ed. 2, **6**: 384 (1811).

Ulmus glabra 9. *variegata* Loudon, Arb. Frut. Brit. **3**: 1405 (1838).

Ulmus nitens var. *variegata* (Dum. Cours.) Henry in Elwes & Henry, Trees, Gt. Brit. Irel. **7**: 1895 (1913).

Ulmus foliacea var. *variegata* Rehder in Stand. Cycl. Hort. **6**: 3413 (1917).

A form with the leaves variegated with white.

None of the names of variegated forms given by Weston, Bot. Univ. **1**: 314–315 (1770) can be applied with certainty to this form of the smooth-leaved elm, since none of his three species of English elms can be identified with this species; his *U. campestris* represents the English elm, *U. glabra* the Wych elm which is *U. glabra* Huds., not Mill., and *U. hollandica* is the Dutch elm.

Ulmus carpinifolia f. **pendula** (Schneid.), comb. nov.

Ulmus campestris f. *pendula* Dippel, Handb. Laubholzk. **2**: 24 (1892), non David, nec Kuntze.

Ulmus glabra var. d. *pendula* (Dipp.) Schneider, Ill. Handb. Laubholzk. **1**: 220 (1904), pro parte.

Ulmus glabra var. d. *pendula* f. *Wentworthii* Schneider, l. c. (1904).
Ulmus campestris a. glabra *a. vulgaris* 1. *pendula* (Dipp.) Ascherson & Graebn. Syn. Mitteleur. Fl. **4**: 554 (1911).
Ulmus campestris var. *pendula* Rehder in Bailey, Cycl. Am. Hort. **4**: 1882 (1902).
Ulmus nitens var. *pendula* (Rehd.) Henry in Elwes & Henry, Trees Gt. Brit. Irel. **7**: 1893 (1913).
Ulmus foliacea var. *pendula* Rehder in Bailey, Stand. Cycl. Hort. **6**: 3413 (1917).

A form with pendulous branches. The plant described as *U. campestris pendula* David in Rev. Hort. sér. 2, **4**: 101 (1845) seems to belong according to the description either to *U. pumila* L. or *U. parvifolia* Jacq., and *U. campestris* 4b. *pendula* Kuntze, Taschenfl. Leipzig, 214 (1867) is probably *U. glabra* f. *pendula* (Loud.) Rehd.

Ulmus carpinifolia f. **tiliaefolia** (Host), comb. nov.

Ulmus tiliaefolia Host, Fl. Austr. **1**: 329 (1827).
Ulmus glabra f. *tiliaefolia* Borbas, Békésvarm. Fl. 55 (1881).
Ulmus glabra var. a. *typica* f. *tiliaefolia* (Host.) Schneider, Ill. Handb. Laubholzk. **1**: 220 (1904).
Ulmus campestris a. *glabra* 1. *tiliaefolia* (Host) Ascherson & Graebner, Syn. Mitteleur. Fl. **4**: 555 (1911).

A form with ovate leaves rounded or subcordate and usually not strongly oblique at the base.

Ulmus carpinifolia f. **betulaefolia** (Loud.), comb. nov.

Ulmus campestris 11. *betulaefolia* Loudon, Arb. Frut. Brit. **3**: 1376 (1838).
Ulmus betulaefolia Loddiges Cat. (1836) ex Loudon l. c. (1838) pro synon. praeced.
Ulmus campestris a. nuda subvar. *betulaefolia* Hort. Vilv. ex Wesmael in Bull. Soc. Hort. Belg. **1862**: 389 (1863).
Ulmus campestris c. *laevis 2. betulaefolia* (Loud.) Boulger in Gard. Chron. n. ser. **12**: 298 (1879).
? *Ulmus sativa* Mill. f. *angustifolia* Druce, List Brit. Pl. 63 (1908), nom. nud.
Ulmus nitens var. *betulaefolia* (Loud.) Henry in Elwes & Henry, Trees Gt. Brit. Irel. **7**: 1896 (1913).
? *Ulmus carpinifolia* b. *angustifolia* Druce, Brit. Pl. List, ed. 2, p. 103 (1928), nom. nud.

A tree of pyramidal habit with ascending branches and elliptic to elliptic-oblong leaves 4–8 cm. long, narrowed towards the unequal base.

Ulmus carpinifolia var. **Hunnybuni** (Moss) Druce, Brit. Pl. List, ed. 2, p. 103 (1928).

Ulmus nitens var. *hunnybuni* Moss, Cambridge Fl. **2**: 90, pl. 90, 91 (1914).

Large tree with the lower branches spreading, the upper somewhat tortuous; leaves rather narrow, narrow-elliptic or narrow-ovate to oblong-ovate to oblong-obovate, 5–10 cm. long, distinctly doubly serrate, acuminate, very unequal at base; fruit obovate 14–18 mm. long.

Ulmus carpinifolia var. **Sowerbyi** (Moss) Druce, Brit. Pl. List, ed. 2, p. 103 (1928).

Ulmus glabra Smith, Engl. Bot. **32**: 2248, t. (1811), synon. exclud.
Ulmus tortuosa Host, Fl. Austr. **1**: 330 (1827).
Ulmus nitens var. *sowerbyi* Moss, Cambridge Brit. Fl. **2**: 90 (1914). — Lynch in Jour. Roy. Hort. Soc. **41**: 16, fig. 12 (1915).

Similar to var. *Hunnybuni*, but a smaller tree with the upper branches very tortuous, the leaves smaller, acute, and the fruits smaller, elliptic to obovate.

Ulmus carpinifolia var. **cornubiensis** (West.), comb. nov.

Ulmus campestris 7. cornubiensis Weston, Bot. Univ. **1**: 315 (1770).
Ulmus campestris β. stricta Aiton, Hort. Kew, **1**: 319 (1789), pro parte.
Ulmus reticulata α. stricta (H. H. Lond. nec dec.) Dumortier, Flor. Belg. 25 (1827).
Ulmus stricta Lindley, Syn. Brit. Fl. 227 (1829).
Ulmus campestris var. *cornubiensis* Loudon, Arb. Frut. Brit. **3**: 1376 (1838).
Ulmus campestris d. *fastigiata* (Audib. Cat.) Spach in Ann. Sci. Nat. sér. 2, **15**: 362 (1841). — Planchon in Ann. Sci. Nat. sér. 3, **9**: 273 (1848).
Ulmus glabra 2. fastigiata Kirchner in Petzold & Kirchner, Arb. Musc. 560 (1864).
Ulmus glabra var. c. *stricta* (Loud.) Schneider, Ill. Handb. Laubholzk. **1**: 220 (1904).
Ulmus sativa c. *stricta* (Lindl.) Druce, List Brit. Pl. 63 (1908).
Ulmus nitens var. *stricta* (Ait.) Henry in Elwes & Henry, Trees Gt. Brit. Irel. **7**: 1888 (1913).
Ulmus foliacea var. *stricta* (Ait.) Rehder in Bailey, Stand. Cycl. Hort. **6**: 3412 (1917).
(? ×) *Ulmus stricta* (Lindl.) Bancroft in Jour. Bot. **75**: 344 (1937).

A narrow pyramidal tree with ascending branches. The oldest name for this variety is Weston's *U. campestris cornubiensis;* though it is only briefly characterized by the words "cornubiensis, foliis minoribus," there can be no doubt to which elm the name applies, since the tree was well known in England as Cornish elm. By several English authors this is considered a distinct species under the name of *U. stricta* Lindl. with the following form as a variety.

Ulmus carpinifolia var. **cornubiensis** f. **sarniensis** (Loud.), comb. nov.

Ulmus campestris 8. *sarniensis* (Lodd.) Loudon, Arb. Frut. Brit. **3**: 1376 (1838).
Ulmus campestris Wheatleyi Simon-Louis, Cat. **1869**: 98. — Bean in Gard. Chron. ser. 3, **41**: 149, fig. 67 (1907).
Ulmus nitens var. *Wheatleyi* (Simon-Louis) Henry in Elwes & Henry, Trees Gt. Brit. Irel. **7**: 1891, pl. 412, fig. 21 (1913).
Ulmus stricta var. *Wheatleyi* Bean, Trees Shrubs Brit. Isl. **1**: 86, t.; **2**: 620 (1914).
Ulmus foliacea var. *Wheatleyi* Rehder in Bailey, Stand. Cycl. Hort. **6**: 3412 (1917).
(? ×) *Ulmus sarniensis* (Moss) Bancroft in Jour. Bot. **75**: 345 (1937).
Ulmus stricta var. *sarniensis* Moss in Gard. Chron. ser. 3, **51**: 199 (1912).

Closely related to the preceding variety, but with narrower head formed of stiffly ascending long branches, with broader leaves and flowers with white, not pink, stigmas. Loudon's description is unsufficient but is apparently applicable to this form, since it is called "Jersey elm."

Ulmus carpinifolia var. **cornubiensis** f. **Webbiana** (Simon-Louis), comb. nov.

? *Ulmus campestris* 17. *concavæfolia* Hort. ex Loudon, Arb. Frut. Brit. **3**: 1378 (1838).
Ulmus campestris Webbiana Lee ex Simon-Louis, Cat. **1869**: 97.
Ulmus glabra var. *Webbiana* Lee ex Hartwig, Ill. Gehölzb. 392 (1892).
Ulmus nitens var. *Webbiana* (Simon-Louis) Henry in Elwes & Henry, Trees Gt. Brit. Irel. **7**: 1895 (1913).
Ulmus foliacea var. *Webbiana* (Lee) Rehder in Bailey, Stand. Cycl. Hort. **6**: 3413 (1917).

A form of var. *cornubiensis* with leaves folded longitudinally.

Ulmus carpinifolia var. **Dampieri** (Wesm.), comb. nov.

Ulmus campestris α. *nuda* subvar. 6. *fastigiata Dampieri* Hort. Vilv. ex Wesmael in Bull. Féd. Soc. Hort. Belg. **1862**: 389 (1863).
Ulmus montana 3. *Dampieri* Hort. ex Kirchner, Arb. Musc. 563 (1864).
Ulmus scabra var. *Dampieri* Hort. ex Hartwig, Ill. Gehölzb. 393 (1892).
× *Ulmus Dippeliana* f. *Dampieri* (Kirchn.) Schneider, Ill. Handb. Laubholzk. **1**: 218 (1904).
Ulmus nitens var. *Dampieri* Henry in Elwes & Henry, Trees Gt. Brit. Irel. **7**: 1894 (1913).
Ulmus foliacea var. *Dampieri* (Kirchn.) Rehder in Bailey, Stand. Cycl. Hort. **6**: 3412 (1917).

This variety is of fastigiate habit with upright curved branches and crowded broad leaves, deeply toothed, almost lobulate, with crenate-serrate teeth. It is similar in habit to *U. glabra* var. *exoniensis* (K. Koch) Rehd. and has been confused with that variety.

Ulmus carpinifolia var. **Dampieri** f. **Wredei** (Jühlke), comb. nov.

Ulmus Dampieri var. *Wredei* Jühlke in Hamb. Gart.-Blumenzeit. **33**: 485 (1877).

Ulmus campestris Wredei Hort. ex Lauche, Deutsch. Dendr. 347 (1880).

Ulmus montana var. *Dampieri aurea* Wrede ex Jaeger & Beissner, Ziergeh. ed. 2, 403 (1884).

Ulmus montana var. *Dampieri Wredei* Ruempler, Gartenbau-Lex. 930 (1890). — Rehder in Möller's Deutsch Gärtn.-Zeit. **13**: 160, fig. (1898).

Ulmus scabra var. *Dampieri* var. *Wredei* (Jühlke) Hartwig, Ill. Gehölzb. 393 (1892).

Ulmus montana var. *fastigiata aurea* Hort. ex Nicholson, Kew Hand-list Trees Shrubs, **2**: 141 (1896).

Ulmus Dippeliana f. *Wredei* (Hort.) Schneider, Ill. Handb. Laubholzk. **1**: 218, fig. 136p (1904).

Ulmus nitens f. *Wredei* Rehder in Mitt. Deutsch. Dendr. Ges. **24**(1915): 218 (1916).

Ulmus foliacea var. *Wredei* Rehder in Bailey, Stand. Cycl. Hort. **6**: 3413 (1917).

This is a yellow-leaved form of the preceding variety and like that, has been confused with *U. glabra* var. *fastigiata* (Loud.) Rehd.

Ulmus carpinifolia var. **umbraculifera** (Trautv.), comb. nov.

Ulmus campestris var. *umbraculifera* Trautvetter in Act. Hort. Petrop. **2**: 590 (1873). — Spaeth in Monatschr. Ver. Gartenb. Preuss. **22**: 19, fig. 1 (1879).

Ulmus glabra var. a. *typica* f. *umbraculifera* (Dipp.) Schneider, Ill. Handb. Laubholzk. **1**: 220 (1904).

Ulmus densa Litvinov in Sched. Herb. Fl. Ross. **6**: 163, no. 1991, t. 1, 2 (1908). — U. S. Bur. Pl. Indust. Bull. Pl. Introd. **78**: 478, t. (1912).

Ulmus campestris a. *glabra* α. *vulgaris* 1. *umbraculifera* (Spaeth) Ascherson & Graebner, Syn. Mitteleur. Fl. **4**: 553 (1911).

Ulmus nitens var. *umbraculifera* (Trautv.) Henry in Elwes & Henry, Trees Gt. Brit. Irel. **7**: 1893 (1913).

Ulmus foliacea var. *umbraculifera* (Trautv.) Rehder in Bailey Stand. Cycl. Hort. **6**: 3412 (1917).

This variety forms a dense subglobose head and also differs in its rather small often nearly simply serrate leaves. It is planted as a street tree in Turkestan and Persia and was introduced into European gardens from Persia about 1878.

Ulmus carpinifolia var. **umbraculifera** f. **gracilis** (Spaeth), comb. nov.

Ulmus campestris umbraculifera gracilis Spaeth, Cat. no. **100**: 121 (1897).

Ulmus glabra a. *typica* f. *gracilis* (Spaeth) Schneider, Ill. Handb. Laubholzk. **1**: 220 (1904).

Ulmus campestris a. *glabra* α. *vulgaris* 1. *gracilis* (Schneid.) Ascherson & Graebner, Syn. Mitteleur. Fl. **4**: 553 (1911).
Ulmus nitens var. *umbraculifera gracilis* (Spaeth) Henry in Elwes & Henry, Trees Gt. Brit. Irel. **7**: 1893 (1913).
Ulmus foliacea var. *gracilis* (Spaeth) Rehder in Bailey, Stand. Cycl. Hort. **6**: 3412 (1917).

A form of the preceding variety with slenderer more crowded branches and smaller leaves. Originated in Spaeth's nursery near Berlin.

Ulmus carpinifolia var. **umbraculifera** f. **Koopmanni** (Spaeth), comb. nov.

Ulmus Koopmanni Lauche ex Spaeth, Cat. no. **62**[1885–86]: 6, 101 (1885).
Ulmus campestris var. *Koopmanni* Hort. ex Nicholson in Kew Hand-list Trees Shrubs, **2**: 135 (1896), nomen.
Ulmus glabra a. *typica* f. *koopmanni* (Spaeth) Schneider, Ill. Handb. Laubholzk. **1**: 220 (1904).
Ulmus campestris b. *nuda 2. Koopmanni* (Lauche) Ascherson & Graebner, Syn. Mitteleur. Fl. **4**: 557 (1911).
Ulmus nitens var. *Koopmanni* (Spaeth) Rehder in Mitt. Deutsch. Dendr. Ges. **24**(1915): 218 (1916).
Ulmus foliacea var. *Koopmanni* (Lauche) Rehder in Bailey, Stand. Cycl. Hort. **6**: 3412 (1917).

A form of var. *umbraculifera* similar in leaf, but with an ovoid head if grafted high, shrubby and stoloniferous if propagated by cuttings. Henry (in Elwes & Henry, Trees Gt. Brit. Irel. **7**: 1927, 1913) refers this form as a variety to *U. pumila* L., but the cultivated plants I have seen do not belong to that species.

Ulmus carpinifolia var. **suberosa** (Moench), comb. nov.

Ulmus suberosa Moench, Verz. Bäume Weissenst. 136 (1785).
Ulmus tetranda Schkuhr, Bot. Handb. **1**: 178, t. 58b (1791).
Ulmus campestris 6. *U. fungosa* Dumont de Courset, Bot. Cult. **3**: 700 (1802).
Ulmus campestris β. *suberosa* (Ehrh.) Wahlenberg, Fl. Carpat. 71 (1814).
Ulmus campestris f. *suberosa* (Ehrh.) Voss, Vilmorin Blumengärt. **1**: 906 (1895).
Ulmus glabra b. *suberosa* (Moench) Gürke in Richter & Gürke, Pl. Eur. **2**: 72 (1897). — Schneider, Ill. Handb. Laubholzk. **1**: 220 (1904).
Ulmus vulgaris β. *suberosa* (Koch) Rouy, Fl. France, **12**: 266 (1910).
Ulmus nitens var. *suberosa* (Moench) Henry in Elwes & Henry, Trees Gt. Brit. Irel. **7**: 1885 (1913).
Ulmus foliacea var. *suberosa* (Moench) Schneider in Oester. Bot. Zeitschr. **66**: 79 (1916).

This variety differs chiefly in the corky-winged branches, in the usually shrubby habit and the small leaves often more or less rough above.

Ulmus carpinifolia var. **suberosa** f. **propendens** (Schneid.), comb. nov.

Ulmus suberosa var. *pendula* Lavallée, Arb. Segrez. 236 (1877), nom. nud.

Ulmus campestris var. *microphylla pendula* Hort. ex Nicholson in Kew Hand-list Trees Shrubs, **2**: 135 (1896), nom. nud., huc ducendum secundum Henry in Elwes & Henry, Trees Gt. Brit. Irel. **7**: 1888 (1913).

Ulmus campestris suberosa pendula Siesmayer in Möller's Deutsch. Gärtn.-Zeit. **16**: 163, fig. (1901), non *U. campestris pendula* David, nec Ktze., nec Dipp.

Ulmus glabra var. *suberosa* f. *propendens* Schneider, Ill. Handb. Laubholzk. **1**: 220 (1904).

Ulmus campestris B. *suberosa* a. *fruticosa* 1. *propendens* (Schneid.) Ascherson & Graebner, Syn. Mitteleur. Fl. **4**: 560 (1911).

A form of the preceding variety with pendulous branches.

Ulmus carpinifolia var. **italica** (Henry), comb. nov.

Ulmus nitens var. *italica* Henry in Elwes & Henry, Trees Gt. Brit. Irel. **7**: 1892, t. 411, fig. 9 (1913).

Ulmus foliacea var. *italica* (Henry) Rehder in Bailey, Stand. Cycl. Hort. **6**: 3412 (1917).

A geographical variety found in southern Europe and Algeria and differing chiefly in the leaves having 14–18 pairs of lateral veins.

Photinia Tsaii, sp. nov.

Frutex 0.5–1.5 m. altus vel arbor ad 7 m. alta, ramulis initio dense floccoso-tomentosis mox glabratis et demum glabris fusco-brunneis lenticellatis. Folia coriacea, lanceolata vel oblonga, 4–7 cm. longa et 10–17 mm. lata, acuminata, basi in petiolum 3–6 mm. longum attenuata, dense serrulata vel crenato-serrulata dentibus subadpressis vel leviter incurvis, supra rugulosa glabra, subtus reticulata, venis utrinque 8–11 curvatis et ante marginem anastomosantibus ut costa prominentibus, initio subtus tomento floccoso detergibili obtecta, mox glabrescentia, demum ut petioli glaberrimi. Flores non visi. Corymbus fructiferus 4–5 cm. diam., congestus, ramulis et pedicellis glabratis dense et conspicue lenticellatis, pedicellis 2–5 mm. longis; fructus ovoideus, 8–10 mm. longus, 6–8 mm. latus, ruber, glaber, dentibus calycis triangularibus erectis pubescentibus coronatus; ovarium tertia vel quarta parte superiore semiglobosa excepta cupulae adnatum, 2–3-loculare; semina 2–6, fusco-brunnea, 4–4.5 mm. longa.

YUNNAN: Shang-pa Hsien, alt. 1500–2000 m., *H. T. Tsai, 54959*, Oct. 28, 1933 (type, in herb. Arnold Arb.); *54688*, Sept. 28, 1933; *58945*, Oct. 24, 1934.

This new species seems most nearly related to *P. stenophylla* Hand.-Mazz., which is easily distinguished by the glabrousness of the branches and leaves, by the smaller inflorescence with slender smooth branchlets and pedicels. It may also be compared with *P. loriformis* W. W. Sm. which chiefly differs in the persistent grayish or fulvous appressed tomentum of the under side of the leaves and their remote spinulose serration, and by the absence of lenticels from the branches and the inflorescence. *Photinia loriformis*, which is remarkable for its dimorphous foliage, occurs also in southern Szechuan where it was collected near Hui-li-chuo by C. Schneider (no. 4068, March 24, 1914).

Prunus tenella Batsch, Beytr. Entw. Pragm. Gesch. Drey Natur-Reiche, 29 (1801).

Amygdalus nana Linnaeus, Sp. Pl. 473 (1753). — Pallas, Fl. Ross. 12, t. 6 (1784). — Curtis, Bot. Mag. **5**: t. 161 (1792). — Schmidt, Oester. Baumz. **4**: 25, t. 205 (1822). — Spach in Ann. Sci. Nat. sér. 2, **19**: 113 (1843).

Amygdalus georgica Desfontaines, Hist. Arb. Arbriss. **2**: 221 (1809). — Jaume St.-Hilaire, Fl. & Pom. Franç. **4**: t. 364 (1831).

Prunus nana (L.) Stokes, Bot. Mat. Med. **3**: 103 (1812). — Focke in Engler & Prantl, Nat. Pflanzenfam. III. **3**: 54 (1888). — Non Du Roi.

Amygdalus nana var. *georgica* Schmidt, Oester. Baumz. **4**: 25, t. 204 (1822). — DC. msc. ex Seringe in DeCandolle, Prodr. **2**: 530 (1825). — Schneider, Ill. Handb. Laubholzk. **1**: 598, fig. 333c[1] (1906).

Amygdalus nana α. *vulgaris* DC. mss. ex Seringe in DeCandolle, Prodr. **2**: 530 (1825). — Medvyedyef, Dereb. Kust. Kabkas. 79 (1883).

Amygdalus fructicosa Wenderoth in Schrift. Beförd. Ges. Naturwiss. Marburg, **2**: 252 (1831). — Schlechtendal in Bot. Zeit. **23**: 339 (1863), "*fruticosa.*"

Amygdalus Ledebouriana Schlechtendal in Abhandl. Naturf. Ges. Halle, **2**: 21 (1854); in Hamburg. Gart. Blumenzeit. **11**: 305 (1855).

Amygdalus Heuckeana Schlechtendal in op. cit. 22 (1854); in op. cit. **11**: 305 (1855).

Amygdalus Pallasiana Schlechtendal in op. cit. 14 (1854); in op. cit. **11**: 301 (1855); in Bot. Zeit. **23**: 341, t. 12, fig. B, 1 (1865).

Prunus nana α. *typica* Beck, Fl. Niederöstr. 817 (1891); in Reichenbach, Ic. Fl. Germ. **25, 2**: 7, t. 88, fig. 1–5 (1913).

Prunus nana f. *georgica* (Desf.) Voss, Vilmorin's Blumengärt. **1**: 232 (1894).

Prunus nana var. a. *georgica* (DC.) Schneider, Ill. Handb. Laubholzk. **1**: 599, fig. 333c[1] (1906). — Ascherson & Graebner, Syn. Mitteleur. Fl. **6**, **2**: 141 (1906).

Since *Prunus nana* (L.) Stokes is a later homonym of *P. nana* Du Roi, the next oldest name *P. tenella* Batsch has to take its place under the genus *Prunus*.

The species shows considerable variation in the size and shape of the

leaves and of the fruit, in the length of the calyx-lobes, also in the more or less intense coloring of the flowers; several species have been distinguished but the characters gradually pass into each other and none of them seem to be concomitant. Therefore, only one variety is here maintained, characterized chiefly by broader generally obovate leaves, and several forms of horticultural rather than botanical interest.

Prunus tenella f. **alba** (Schneid.), comb. nov.

Amygdalus nana L. γ. *flore albo* Koch, Hort. Dendr. 138 (1853). — Mouillefert, Traité Arb. Arbriss. **1**: 394 (1892).

Prunus nana var. a. *georgica* f. *alba* Schneider, Ill. Handb. Laubholzk. **1**: 599 (1906).

Prunus nana var. *alba* Bean, Trees Shrub Brit. Isles, **2**: 245 (1914).

This differs from typical *P. tenella* in its white flowers.

Prunus tenella f. **angustifolia** (Spach), comb. nov.

Amygdalus nana L. γ. *angustifolia* Spach in Ann. Sci. Nat. sér. 2, **19**: 111 (1843).

Prunus nana var. *georgica* f. *angustifolia* Schneider, Ill. Handb. Laubholzk. **1**: 599 (1906).

This form differs from the type in its very narrow linear-lanceolate leaves.

Prunus tenella f. **Gessleriana** (Kirchn.), comb. nov.

? *Amygdalus nana* δ. *flore purpureo* Koch, Hort. Dendr. 139 (1853).

Amygdalus Gessleriana Hort. ex Kirchner in Petzold & Kirchner, Arb. Musc. 241 (1864).

Amygdalus nana speciosa Carrière in Rev. Hort. **1872**: 118; **1874**: 370, pl.

Amygdalus nana var. *speciosa* Mouillefert, Traité Arb. Arbriss. **1**: 394 (1894).

Prunus nana f. *Gessleriana* Voss, Vilmorin's Blumengärt. **1**: 232 (1894). — Schneider, Ill. Handb. Laubholzk. **1**: 599 (1906).

Prunus nana A. *Georgica* b. *Gessleriana* (Schneid.) Ascherson & Graebner, Syn. Mitteleur. Fl. **6**, **2**: 141 (1906).

Prunus nana rubra Anon. in Gard. Chron. ser. 3, **52**: 390, pl. (1912).

Prunus nana var. *Gessleriana* [Nicholson in] Kew Hand-list Trees Shrubs, 209 (1902), nomen. — Bean, Trees Shrubs Brit. Isles, **2**: 245 (1914).

Prunus nana var. *rubra* Hort. ex Bailey, Stand. Cycl. Hort. **5**: 2832 (1916).

The chief character of this form is the intensely red color of the flowers particularly the buds which are described by Kirchner (l. c.) as beautifully carmine-red. The colored plates cited above bear out this statement.

Prunus tenella var. **campestris** (Besser), comb. nov.

Amygdalus campestris Besser, Enum. Pl. Volhyn. 46, 58 (1822). — Host, Fl. Austr. **2**: 2 (1831). — Reichenbach, Fl. Germ. Excurs. 646 (1832).

Amygdalus nana δ. campestris Seringe in DeCandolle, Prodr. **2**: 530 (1825).

Amygdalus Besseriana Schott in Cat. Hort. Vindob. 1818 ex Seringe, l. c. (1825), pro synon. praeced. — Schlechtendal in Abh. Naturf. Ges. Halle, **2**: 17 (1854); in Bot. Zeit. **23**: 341, t. 12, fig. B2 (1864).

Amygdalus nana var. *β*. A. *Besseriana* Schott ex Bosse, Vollst. Handb. Blumengärt. **1**: 254 (1840).

Amygdalus sibirica Loddiges, Bot. Cab. **16**: t. 1599 (1829), descript. manca. — Tausch, in Flora, **17**: 491 (1834). — Schlechtendal in Abh. Naturf. Ges. Halle, **2**: 20 (1854); in Hamburg. Gart. Blumenzeit. **11**: 270 (1855).

Amygdalus nana β. latifolia Ledebour, Fl. Alt. **2**: 210 (1830); Fl. Ross. **2**: 2 (1844). — Spach in Ann. Sci. Nat. sér. 2, **19**: 111 (1843).

Amygdalus nana var. 5. *sibirica* Lodd. Cat. ex Loudon, Arb. Frut. Brit. **2**: 674 (1838).

Amygdalus Gaertneriana Schlechtendal in Abh. Nat. Ges. Halle, **2**: 18 (1854); in Hamburg. Gart. Blumenzeit. **11**: 262 (1855); in Bot. Zeit. **23**: 341, t. 12, fig. B, 3 (1865).

Amygdalus nana 2. sibirica Tausch ex Kirchner in Petzold & Kirchner, Arb. Musc. 241 (1864).

Amygdalus nana b. *latifolia* Medvyedyef, Dereb. Kust. Kabkas. 79 (1883). — Akinfiyef in Trudi Obshch. Ispyt. Prirod. Kharkof Univ. **27**: 276 (Fl. Centr. Cauc.) (1892).

Prunus nana β. campestris Beck, Fl. Niederoestr. 817 (1891); in Reichenbach, Ic. Fl. Germ. **25**, **2**: 8, t. 88, fig. 6–9 (1913). — Schneider, Ill. Handb. Laubholzk. **1**: 599, fig. 333c (1906).

? *Prunus nana α. typica* f. *spathulata* Beck, l. c. (1891).

Prunus nana f. *campestris* Ser. ex Voss, Vilmorin's Blumengärt. **1**: 232 (1894).

This variety differs from the type chiefly in its broader and larger leaves, elliptic or elliptic-oblong to obovate-elliptic or oblong-obovate, at least on the sterile branches, narrower sepals more than half as long as the tube, usually narrower petals and suborbicular fruit. None of these characters, however, seems to be entirely stable and reliable. The color of the flower is given by Besser as white, but Ledebour (Fl. Ross. **2**: 2) states that the plants raised from seed of *A. campestris* sent by Besser himself had pink flowers, and as almost all later authors describe this variety as having pink flowers, I have enumerated below the white-flowered plant as a distinct form of this variety.

Prunus tenella var. **campestris** f. **albiflora** (Schneid.), comb. nov.

Prunus nana var. *campestris* f. *albiflora* Schneider, Ill. Handb. Laubholzk. **1**: 599 (1906).

Prunus nana β. *campestris* lus. *albiflora* Ascherson & Graebner, Syn. Mitteleur. Fl. **6, 2:** 141 (1906).

Amygdalus latifolia alba Hort. ex Schneider l. c. (1906), pro synon. praeced. — Ascherson & Graebner, l. c. (1906), pro synon. praeced.

? *Prunus nana* var. *cochinchinensis* Bailey, Cycl. Am. Hort. **3:** 1456 (1901); Stand. Cycl. Hort. **5:** 2832 (1916); not *Amygdalus cochinchinensis* Lour.

This differs from *P. nana* var. *campestris* in its white flowers. The normal color of that variety is apparently pink, but Besser described his *P. campestris* as white-flowered (see the remarks under var. *campestris*).

Of the following varieties and forms I have seen no specimens:

Amygdalus nana β *biserrata* Spach in Ann. Sci. Nat. sér. 2, **19:** 110 (1843).

Amygdalus nana microflora Carrière in Rev. Hort. **1872:** 340. — Mouillefert, Traité Arb. Arbust. **1:** 394 (1892).

Amygdalus nana campanuloides Carrière, l. c. — Mouillefert, l. c.

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NOMENCLATURAL NOTES ON HYPERICUM

HENRY J. LOTT

Hypericum tubulosum Walter var. **Walteri** (Gmel.), comb. nov.

Hypericum petiolatum Walter, Fl. Carol. 191 (1788). — Non Linnaeus (1763).

Hypericum Walteri Gmelin, Syst. Nat. **2**: 1159 (1791), as *Hypericon Walteri*. — Lott in Jour. Arnold Arb. **19**: 151 (1938).

Professor Fernald kindly drew my attention to the invalidity of the combination *Hypericum Walteri* var. *tubulosum* (Walt.) Lott. Since *H. tubulosum* Walt. (1788) antedates *H. Walteri* Gmel. (1791), the former name must be maintained for the species, with *H. Walteri* var. *tubulosum* as a synonym, and *H. Walteri* reduced to varietal rank.

Hypericum fasciculatum Lamarck, Encycl. Méthod. **4**: 160 (1797).

Hypericum aspalathoides Willdenow, Sp. Pl. **3**: 1451 (1803).

Hypericum galioides var. *cubense* & var. *axillare* Griseb., Cat. Pl. Cubens. 39 (1866). — **Synon. nov.**

Hypericum limosum Grisebach, Cat. Pl. Cubens. 39 (1866). — **Synon. nov.**

The extremes of this species are remarkably distinct; at one end of the series is a form having leaves which do not exceed 5 mm., and at the other a form in which all the leaves are over 2 cm. long. The habitat, habit, fasciculation of the leaves, inflorescence, length of sepals in relation to petals, and the size and shape of the capsule are also exceedingly variable characters on the specimens which I have seen. After a careful study of well over one hundred sheets of this species in the herbarium of the Arnold Arboretum and of the Gray Herbarium, I find, as Coulter did when he monographed the North American species of *Hypericum*, that the forms of *H. fasciculatum* intergrade so gradually as to make segregation impracticable.

If Lamarck's type material of *H. fasciculatum* consists, as Coulter states (in Bot. Gaz. **11**: 85. 1886, & in Gray, Synop. Fl. N. Am. **1**: 286. 1897), of the short-leaved form, this leaf-form certainly cannot be separated and called *H. aspalathoides*, as some taxonomists do. Coulter's statement, however, is undoubtedly erroneous. There is nothing which indicates that he ever saw the type, and those who, like Gray, actually examined type material applied the name *H. fasciculatum* to the long-

leaved form. Lamarck's description of the leaves, "Les feuilles sont . . . moins courtes que les entrenoeuds, longues d'environ un demi-pouce sur une largeur qui excède rarement un tiers de ligne.", unmistakably applies to the long-leaved form, but it is possible that Coulter misinterpreted Lamarck's description, for the clause "les feuilles sont moins courtes que les entrenoeuds" can be very easily misread as "the leaves are shorter than the internodes." This apparent slight misinterpreteion would be sufficient to lead one into error.

Taxonomists who distinguish the short-leaved form of this species either as *H. aspalathoides* Willd. or *H. fasciculatum* var. *aspalathoides* (Willd.) Torr. & Gray, have overlooked the fact that Willdenow did not describe a new species under this name. Willdenow, disregarding priority, proposed the new name *H. aspalathoides* for Lamarck's *H. fasciculatum* because he preferred to use the epithet *fasciculatum* for *H. fasciculatum* Michaux (1803), non Lamarck (1797). Willdenow's description of *H. aspalathoides* is an abridged Latin translation of Lamarck's description without original additions. It appears that even the specific name *aspalathoides* is taken from the description of Lamarck who, describing the leaves, states, "Il a, pour ainsi dire, le feuillage d'un génèvrier ou de certains *aspalathus* . . ."

Torrey and Gray were apparently the first (Fl. N. Am. **1:** 672. 1840) to restrict the use of Willdenow's name to the short-leaved form of *H. fasciculatum*. They proposed *H. fasciculatum* var. *aspalathoides* for their previously described *H. fasciculatum* var. *β*, and cited in the synonymy "H. aspalathoides *Willd.* (H. rosmarinifolium, *Kinn,* in *herb. Willd.*!)". When traveling in Europe, Gray saw, according to the citation, in the herbarium of Willdenow a specimen of the short-leaved form of *H. fasciculatum* labeled with the herbarium name of Kinn,[1] *H. rosmarinifolium*, and identified as *H. aspalathoides*. Torrey and Gray concluded that this was the type-specimen of Willdenow's *H. aspalathoides*, but the very text of Willdenow's Species Plantarum shows this conclusion to be incorrect. In the preface (Sp. Pl. **1:** vii. 1797), Willdenow states, "Plantas Herbarii proprii, quas vel vivas (v. v.) vel siccas (v. s.) vel sine flore vivas (v. v. s. fl.) vel sine flore siccas (v. s. s. fl.) vel modo cum fructu siccas (v. s. c. fr.) vidi, adhibitis heic indicatis signis notavi, ut quisque videret, quaenam vegetabilia ex aliorum descriptionibus descripta assumserim." The lack in Willdenow's description of any such abbreviated reference to a specimen is a certain indication that

[1]Barnhart (in Bartonia, **9:** 38-39. 1926) says: "Matthias Kinn was a German who came to America in the latter part of the eighteenth century to collect plants and seeds for exportation to his native land." See also: Meehan in Gard. Monthly, **6:** 260 261, 338-339 (1864). Harshberger, Botanists of Philadelphia, 184 (1899).

at that time he did not have Kinn's specimen, or, at least, that this specimen had not been identified as *H. aspalathoides*. This evidence that Willdenow published *H. aspalathoides* without having seen a specimen strengthens the conclusion that he merely changed the name *H. fasciculatum* to *H. aspalathoides*, and did not describe a new species.

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SEVEN BINOMIALS PROPOSED AS NOMINA AMBIGUA

ALFRED REHDER, ERNEST J. PALMER and LEON CROIZAT

Pinus maritima Mill. — The name *Pinus maritima* Mill. Gard. Dict. ed. 8, no. 7 (1768) has been applied to three different species. Most authors applied the name to the pine named later *P. Pinaster* Ait., although they did not always quote Miller as the author, but often other authors describing the same species as Miller. Some of these authors are: Du Roi, Harbk. Baumz. **2:** 42 (1772); Lamarck, Fl. Franç. **2:** 201 (1778); Gmelin, Syst. Nat. ed. 13, **2:** 1072 (1791), based on Duhamel, Arb. Arbust. **2:** t. 28, 29 (1755); Poiret in Lam. Enc. Méth. **5:** 337 (1804), based on Gmelin, l. c.; DC. & Lam., Fl. Franç. ed. 3, **3:** 275 (1805); Voss in Mitt. Deutsch. Dendr. Ges. **1907:** 91; Suringar in Mitt. Deutsch. Dendr. Ges. **1927:** 296; Fitschen in Beissn., Handb. Nadelh. ed. 3, p. 405 (1930); Hegi, Ill. Fl. Mittel-Eur. ed. 2, **1:** 138 (1935). The following authors have applied the name *P. maritima* to *P. halepensis* Mill.: Lambert, Descr. Gen. Pinus, t. 9, 10 (1803); Willd., Sp. Pl. **4:** 497 (1805), based on Lambert, l. c.; Aiton, Hort. Kew, ed. 3, **5:** 315 (1813). A few authors have used the *P. maritima* for *P. nigra* Arn. as: Koch, Syn. Fl. Germ. 667 (1837), K. Koch, Dendr. **2**^{2}**:** 287 (1873), and Aschers. & Graebn., Syn. Mitteleur. Fl. ed. 2, **1:** 331 (1912) cite "P. maritima Mill.?" as a synonym of *P. nigra*, also Beissn., Handb. Nadelh. 238 (1891) cites *P. maritima* Ait. as a synonym of *P. nigra*. Schwarz (in Notizbl. Bot. Gart. Mus. Berlin, **18:** 226. 1936; **19:** 135. 1938) gives good reasons for the identity of *P. maritima* and *P. nigra* and transfers the varieties of *P. nigra* Arnold (*P. austriaca* Höss) to *P. maritima*. Almost all other authors from the second decade of last century to the beginning of the present century have cited *P. maritima* with various authors only as a synonym or do not mention it at all, as: Spreng. Syst. Veg. **3:** 886 (1826); Carrière, Traité Conif. 365 (1855); Beissn., l. c. (1891); Aschers. & Graebn., op. cit. **1:** 216 (1897); Rouy, Fl. France, **14:** 362 (1913). In view of the confusing use of the name *P. maritima*, it seems advisable to add this name to the list of *nomina ambigua rejicienda*, as already proposed by Aschers. & Graebn. op. cit. **1:** 216 (1897); ed. 2, **1:** 335 (1913) and Graebner in Mitt. Deutsch. Dendr. Ges. **1908:** 68.

A. R.

Betula alba L. — The name *Betula alba* L. was applied by Linnaeus (Spec. Pl. 982. 1753) to all the European species of *Betula* except *B. nana*. He was followed by most of the early botanists, also by some later authors as: Wahlenberg, Fl. Suec. 623 (1824–6), Fries, Fl. Scan. 145 (1835), Hooker, Brit. Fl. ed. 3, **1:** 411 (1835), Spach in Ann. Sci. Nat. ser. 2, **15:** 186 (1841), Benth., Handb. Brit. Fl. **2:** 751 (1865), Regel in DC. Prodr. **16**^{2}**:** 162 (1868), Fiori & Paoletti, Fl. Anal. Ital. **1:** 263 (1896–8). The first to distinguish two species was Roth, Tent. Fl. **1:** 404 (1788) who distinguished *B. pendula* and reserved *B. alba* for the species later called *B. pubescens* Ehrh. With the same conception *B. alba* was used by K. Koch, Dendr. **2**^{1}**:** 649 (1872), Willkomm, Forstl. Fl. 302 (1887), Dippel, Handb. Laubh. **2:** 172 (1892), Schneider, Ill. Handb. Laubh. **1:** 116 (1904). The opposite view was taken by Borkhausen, Forstb. **1:** 479 (1800), who applied the name *B. alba* to the species called *B. pendula* Roth (*B. verrucosa* Ehrh.); he was followed by Willd., Sp. Pl. **4:** 462 (1805); Lam. & DC., Fl. Franç. ed. 3, **3:** 301 (1805); Sprengel, Syst. Veg. **3:** 854 (1820); Koch, Syn. Fl. Germ. 662 (1837); Hartman, Skand. Fl. ed. 5, 212 (1849); Ledeb., Fl. Ross. **3:** 650 (1850), Marshall in Moss, Cambr. Brit. Fl. **2:** 81 (1914). The majority of later botanists, however, followed Ehrhart, Beitr. **6:** 98 (1791) and abandoned the name *B. alba* altogether, applying the name *B. verrucosa* or *B. pendula* to one of the species and *B. pubescens*, *B. odorata* Bechst. or *B. tomentosa* Reith. & Abel to the other, in some cases distinguishing more than one species. Some of these authors are: Fries, Summa Veg. Scand. 211, 212 (1846); Blytt, Norges Fl. **2:** 400, 401 (1874); Hempel & Wilh., Bäume Sträuch. **2**^{1}**:** 18, 24 (1894); Hjelt, Consp. Fl. Fenn. **2:** 1, 6 (1902); Winkler in Engl. & Prantl, Nat. Pflanzenfam. IV. **61:** 75, 81 (1904); Hayek, Fl. Steyerm. **1:** 104, 105 (1908); Hegi, Ill. Fl. Mittel-Eur. **3:** 76, 78 (1909); Henry & Elwes, Trees Gr. Brit. Irel. **4:** 962, 966 (1909); Rouy, Fl. France, **12:** 254 (1910); Lindman, Svensk Fanerog. 201, 202 (1918); Gunnarson, Monog. Skand. Betul. 55, 63 (1925); Komarov, Fl. U. S. S. R. **5:** 291, 295 (1936). In view of the fact that the name *B. alba* has been applied to two different species and that the overwhelming majority of recent authors has abandoned the name altogether as of dubious application, it seems advisable to place *B. alba* L. on the list of *nomina ambigua* and thus bring the procedure of these later authors in conformity with the Rules of Nomenclature.

A. R.

Quercus rubra Linnaeus. — This name was based by Linnaeus (Spec. Pl. **2:** 996. 1753) on two different species. The first two syno-

nyms refer to the southern red oak or Spanish oak named by Michaux *Q. falcata,* while the two synonyms enumerated by Linnaeus under *β* are apparently referable to the northern red oak. Du Roi in 1771 (Obs. Bot. 35) applied *Q. rubra* L. to the northern red oak, a form of which was described as *Quercus ambigua* Michx. f., Hist. Arb. Am. **2:** 120. (1812), not *Q. ambigua* Humb. & Bonpl. (1809) = *Q. borealis* Michx. f., N. Am. Sylv. **1:** 98 (1819). All later authors followed Du Roi in applying *Q. rubra* L. to the northern red oak, until in 1915 C. S. Sargent (in Rhodora, **17:** 39 and **18:** 45) drew attention to the fact that the first two synonyms upon which Linnaeus' description was based, refer to *Q. falcata* Michx. Sargent therefore proposed to restore the name *Q. rubra* L. to the oak generally called *Q. falcata* Michx., and use the name *Q. borealis* Michx. for the common red oak. Unfortunately Michaux' name is based on the more northern form with smaller acorn and deeper cup, while the very widely distributed form with large acorn and shallow cup which represents the form generally understood under *Q. rubra,* will have to be distinguished as *Q. borealis* var. *maxima* (Marsh.) Ashe. For nearly 150 years the name *Q. rubra* has been applied universally to the red oak and is still used in this sense by many authors, while by others, as Sargent, Ashe, Rehder, it is used for the Spanish oak in accordance with its original application, thus causing great confusion in the name of this silviculturally and horticulturally important species widely distributed in its native country and extensively planted in Europe. The name *Q. rubra* should, therefore, be rejected as a *nomen ambiguum* and *Q. falcata* Michx. used for *Q. rubra* L. sensu stricto, while the name *Q. borealis* Michx. f. with its variety *Q. borealis* var. *maxima* (Marsh.) Ashe should be applied to *Q. rubra* Du Roi.

A. R.

Quercus serrata Thbg. — The name (*Quercus serrata* Thbg., Fl. Jap. 176 (1784) has been applied by subsequent authors up to 1925 to two other species of eastern Asia; only *Q. serrata* Willd. Sp. Pl. **4**[1]**:** 431 (1805) and Pers. Syn. Pl. **2:** 568 (1807) are referable to the true *Q. serrata,* since they are based solely on Thunberg's description. *Quercus serrata* Thbg. was redescribed by Blume, in Mus. Bot. Lugd.-Bat. **1:** 295 (1850) as *Q. glandulifera,* a name which has been used by all authors up to 1925 for this species. By Siebold & Zuccarini in Abh. Akad. Muench. **4**[3]**:** 226 (1846) the name has been applied to an oak named later *Q. acutissima* by Carruthers in Jour. Linn. Soc. **6:** 33 (1862). Following Siebold & Zuccarini the name *Q. serrata* was used for this oak by many authors as DC. Prodr. **16**[2]**:** 50 (1864); Hook. f., Fl. Brit. Ind. **5:** 601 (1888); Skan in Jour. Linn. Soc. **26:** 520 (1899); Shirasawa,

Icon. Ess. For. Jap. **1:** t. 26, fig. 1–12 (1900); Komarov in Act. Hort. Petrop. **22:** 74 (Fl. Mansh. II) (1903); Schneider, Ill. Handb. Laubholzk. **1:** 178 (1904); Nakai in Jour. Coll. Sci. Tokyo, **31:** 208 (Fl. Kor. II) (1911); Rehd. & Wils. in Sargent, Pl. Wils. **3:** 217 (1916); Nakai, Fl. Sylv. Kor. **3:** 22 (1917); Chun, Chinese Econ. Trees, 93 (1922). By Carruthers (l. c.) Thunberg's name was applied to the species described in 1850 as *Q. variabilis* Blume in Mus. Bot. Lugd.-Bat. **1:** 297. He was followed by Schottky in Bot. Jahrb. **47:** 638 (1912); Nakai in Mag. Bot. Tokyo, **29:** 57 (1915) and Fl. Sylv. Kor. **3:** 22 (1917); Koidzumi in Bot. Mag. Tokyo, **30:** 205 (1916). The identity of *Q. serrata* Thbg. with *Q. glandulifera* Bl. was not recognized until Koidzumi saw Thunberg's type in Upsala and published in 1925 a note in Bot. Mag. Tokyo, **39:** 313; his identification was accepted by Nakai, in Bot. Mag. Tokyo, **40:** 165 (1926). The writer when in Upsala in 1928 also examined Thunberg's types which consist of three specimens, branches with pistillate and staminate flowers and fruits, and can confirm Koidzumi's identification. In view of the fact that Thunberg's name had been applied until 1925 to two different species, and that the restoration of the name to another species universally known as *Q. glandulifera* Bl. would cause much confusion in the nomenclature of these widely distributed species, it seems advisable to place *Quercus serrata* on the list of *nomina ambigua* and use for the three species involved the names *Q. glandulifera* Bl. (*Q. serrata* Thbg.), *Q. acutissima* Carruthers and *Q. variabilis* Bl., as has already been done by A. Camus in her monograph "Les Chênes, atlas **1:** 45 (1934); **2:** 19, 20, 127 (1936); text **1:** 571, 572, 581 (1938).

A. R.

Crataegus coccinea L. — The name *Crataegus coccinea* was published by Linnaeus in the first edition of Species Plantarum, **1:** 476. 1753, with the following description and notes:

"CRATAEGUS foliis ovatis repando-angulatis, serratis glabris. *Hort. cliff.* 187. *Hort. ups.* 126. *Gron. virg.* 54. *Roy. lugdb. 272.*

Mespilus apii folio, virginiana spinis horrida, fructu amplo coccineo. *Pluk. alm.* 249. 249. *t. 46. f. 4.*

Mespilus spinosa f. Oxycantha virginiana maxima. *Angl. hort.* 49. *t. 13. f. 1.*

Habitat in Virginia, Canada.

Variat cum validis spinis lateralibus & absque spinis."

As pointed out by Sargent (in Bot. Gaz. **31:** 12. 1901; Rhodora, **11:** 182. 1909) and by W. W. Eggleston (in Rhodora, **10:** 76. 1908) the first two citations refer to two distinct plants probably belonging to different sections of the genus, neither of which can be identified with certainty;

and the Plukenet specimen preserved in the British Museum is so incomplete as to be unidentifiable; while the plant depicted in the plate in Angl. Hort. 49, t. 13, f. 1 is clearly *Crataegus Phaenopyrum* (L. f.) Medic. Since, according to Sargent, the only specimen named *Crataegus coccinea* by Linnaeus found in the Linnaean Herbarium is a plant from the Upsala Garden of the pubescent form of *Crataegus rotundifolia* Moench, a common species of northeastern North America, and since none of the other plants referred to in the description were identifiable, he suggested that this be taken as the type of the species; and for the glabrous form he proposed the new combination, *Crataegus coccinea* var. *rotundifolia* (Moench) Sarg.

In a further discussion of the subject in Rhodora, l. c., Sargent proposed that the name *Crataegus coccinea* L. should be discarded because of the fact that the description embraced elements altogether incoherent and was a source of permanent confusion and error, and that the name *Crataegus rotundifolia*[1] Moench should be held valid for the glabrous variety of that species, while for the pubescent variety represented in the Linnaean herbarium he proposed the name *Crataegus rotundifolia* var. *pubera*.

Descriptions of *Crataegus coccinea* in the earlier works in which it is mentioned are generally so brief and vague as to be of no value in differentiating it from other allied species, and the plates and figures published throw little additional light on it, as they obviously represent more than one species or in some cases imaginary composites of more than one species. The colored plate in Watson, Dendr. Brit. **1:** t. 62 (1825), apparently represents a species of the Coccineae group, but it can scarcely be identified with any living plant. The plate in Bot. Mag. for 1835, t. 3432, may perhaps represent *Crataegus pedicellata* Sarg., or *C. pedicellata* var. *gloriosa,* but the description goes beyond the limits of that species. A figure of the leaves and fruit in Loudon, Arb. et. Frut. Brit. **2:** f. 564 suggests *Crataegus intricata* J. Lange, but the description on p. 816, of the habit and fruit of the tree is not that of a species of the Intricatae group and is scarcely consistent with any known species.

The treatment in American manuals and floras is equally confused. The description in Torrey & Gray, Fl. N. Am. **1:** 465 (1840) is evidently a composite one, as is further proved by the list of synonyms and citations appended. The description and illustration in Sargent, Silva of N. Am. **4:** 95, t. 180 best represents *Crataegus pedicellata* or a closely related form as later understood by Sargent. In the first edition of

[1]Since *Crataegus rotundifolia* Moench is a later homonym of *C. rotundifolia* Lam., the name is illegitimate and cannot be maintained.

Gray's Manual, 128 (1848), the plant is described as smooth or downy, while in subsequent editions down to the fifth, 1867, it is said to be glabrous throughout. In the sixth edition, 1889, it is described as having the shoots villous-pubescent and the fruit subglobose or obovate ½′ broad. In the seventh edition the genus *Crataegus* was treated by Mr. W. W. Eggleston, and he used the name *Crataegus coccinea* for a shrubby species of the Intricatae group, *C. modesta* Sarg., based upon its supposed identity with the plant from which the figure cited by Linnaeus, Pluk. Alm. 249, t. 46, f. 4. Sargent, however, in Rhodora, l. c., held that this interpretation was based upon a misunderstanding and that the Plukenet plant could not possibly have been *C. modesta*. Eggleston in subsequent publications (in Britton & Brown, Ill. Fl. ed. 2, **2:** 317, f. 2396. 1913; Deam, Trees Indiana, 209, t. 96. 1921; House, Ferns Fl. Plants New York, 245 [N. Y. State Mus. Bull. **254**] 1924) seems to have accepted Sargent's conclusion, and he definitely applied the name *C. coccinea* to *C. pedicellata* Sarg., giving a number of other species as synonyms.

In the first edition of Britton & Brown, Ill. Fl. **2:** 242, f. 1998 (1897), the description and figure may well represent *Crataegus macrosperma* Ashe or some closely related species of the Tenuifoliae group.

The name *Crataegus coccinea* L. appears in nearly all of the local floras and plant lists of the northeastern United States, and many specimens are found in herbaria, but an examination of these shows the utter confusion that has arisen as to the identity of the species. A very large number of species, as distinguished by later authors, have been placed under this name and these include plants of obvious morphological and genetic differences belonging to almost every section of the genus having lobed or incised leaves.

In view of this situation and the apparent impossibility of determining the identity of the plant that should be taken as the Linnaean type of the species, it seems most desirable to abandon the name *Crataegus coccinea* L. altogether and to take up the next available names for the different plants that have been confused with it. *Crataegus pedicellata* Sarg. would thus become the valid name for the species rather widely distributed in northeastern North America that has perhaps most frequently been identified as *C. coccinea,* although there seems to be no positive evidence in the original description or citations for that interpretation. Probably a number of other species can properly be referred to this as synonyms or as varieties. E. J. P.

Crataegus tomentosa L. — The name *Crataegus tomentosa* was published by Linnaeus in Sp. Pl. ed. 1, **1:** 476 (1753), with the following description:

"CRATAEGUS foliis cuneiformi-ovatis serratis subangulatis subtus villosis ramis spinosis.

Mespilus inermis, foliis ovato-oblongis serratis, subtus tomentosis. *Gron. virg.* 55.

Habitat in Virginia."

The first paragraph does not seem to be consistent with the characters of the species that has generally been accepted as *Crataegus tomentosa* L., which is a small tree or arborescent shrub, widely distributed in the eastern and central parts of North America, with rather ample oblong-ovate leaves pubescent on the under surface, and with unarmed or sparingly armed branches. The last paragraph, so far as it goes, might very well apply to this species, but a serious doubt arises as to this from the fact that the species in question is not known in the Chesapeake Bay region, from which presumably Clayton's plant came, and unfortunately the specimen has not been found, so it seems impossible to resolve the doubt.

W. W. Eggleston pointed out these inconsistencies (in Rhodora, **10:** 78. 1908) and he held that the name *Crataegus tomentosa* should properly be applied to *Crataegus uniflora* Muench. In support of this view he cited the fact that in Sp. Pl. ed. 2, **1:** 682 (1762) Linnaeus adds: "Mespilus virginiana grossulariae foliis *Pluk. phyt.* 100. *f. 1;*" and that Plukenet says of this in his Alm. 249 (1696): "Mespilus virginiana grossulariae foliis, fructu rubro minore. Phytogr. Tab. 100. f. 1. an Oxyacanthus folio parvo subrotundo, flore unico, theca foliacea incluso summitatibus ramulorum insidente Banisteri."

There can be little doubt that the last quotation refers to *Crataegus uniflora* Muench., but the evidence does not seem convincing that this is the plant which Linnaeus intended to describe as *Crataegus tomentosa,* since no specimen of this well-marked species is known that was so named by him. Eggleston seems to have accepted this view in his later publications (in Britton & Brown, Ill. Fl. ed. 2, **2:** 320, f. 2405 (1913); in House, Ferns and Flow. Pl. New York, 418 [N. Y. State Mus. Bull. **254**] 1924), as he restored the name *Crataegus uniflora* Muench. to the shrubby species with usually single or rarely two or three flowers, and took up the name *Crataegus Calpodendron* (Ehrh.) Medic., Gesch. Bot. 83 (1793), for the species usually accepted as *C. tomentosa.*

According to Sargent (in Rhodora, **11:** 182. 1909), who examined the sheet in the Linnaean herbarium labeled *Crataegus tomentosa,* this consists of two specimens collected by Kalm, without locality, one of which is *C. tomentosa* as usually understood, and the other some thick-leaved species of the Tomentosae group.

No such confusion has arisen in the use of the name *Crataegus*

tomentosa as is the case with *Crataegus coccinea*, and the former name has long and consistently been applied to a single species by authors and competent collectors. For this reason Sargent maintained that there was no good reason for abandoning the name.

However, since in the absence of a type specimen it seems impossible to determine the identity of the plant to which the name *Crataegus tomentosa* should properly be restricted, and since upon the face of the evidence it seems extremely doubtful that either of the citations in the original description referred to the plant that has so long passed as this species, it seems best that the name should be abandoned and that the next available name, which in this case is clearly *Crataegus Calpodendron* (Ehrh.) Medic., should be used for this plant.

E. J. P.

Tilia alba Ait. — The original publication (Hort. Kew. **2:** 230. 1789) states "Native of North America. Cult. 1767 by Mr. James Gordon. Flowers unknown." Henry (in Elwes & Henry, Trees Gt. Brit. Irel. **7:** 1675. 1913) affirms that the type in the British Museum, inscribed *T. alba* in Solander's own handwriting, though bearing neither flower nor fruit, is without doubt a branch of the common European lime, identical with *T. tomentosa* var. *argentea* Henry. Henry's understanding of the specimen that represents the "type" of *T. alba* may or may not be correct. Circumstantial evidence indicates that Gordon, a well known gardener at Mile End, probably cultivated an American "silvery" linden. Gordon was well known (cf. Loudon, Arb. Frut. Brit. **1:** 77. 1854), Ellis writing about him to Linnaeus in flattering terms. The great majority of the species credited as importations of Gordon (cf. Loudon, op. cit. 82; Aiton, Hort. Kew.) are American, with few from the Eastern Mediterranean (e. g. *Salvia cretica*) or from the Atlantic Islands (*Ilex Perado*). It is very unlikely that in 1767 Gordon had material introduced from Hungary or the Balkans. The question is thus raised whether the "type" mentioned by Henry truly represents Gordon's linden. In my opinion there is hardly a chance that it does. Koch (Dendr. **1:** 478. 1869) is justified in stating that the silvery linden originally known in England is the American one, and he rationally accounts for the appearance of *T. tomentosa* in Cassel mentioning the trade that connected southern Germany with Hungary at the time of Moench.

The use of Aiton's binomial has seldom been legitimately restricted to a North American linden. Wangenheim (Beytr. Forstwiss. **3:** 55. 1787) and the editor of Du Roi's second edition (Harbk. Baumz. **3:** 115. 1800) had knowledge of an American "silvery" linden, and the use of *T. alba* made in Du Roi's work, is correct in my opinion, with the excep-

tion of *T. tomentosa* being accepted therein as a synonym of *T. alba*. The great majority of botanists, however, have confused *T. alba* Ait. with *T. alba* Waldst. & Kit. = *T. tomentosa* Moench. The second edition of the Hortus Kewensis subscribes to this confusion; it adopts the understanding of *Tilia alba* as of Willdenow (Sp. Pl. **2:** 1162. 1799), Martyn (in Miller's Dict., 1803), Borkhausen (Handb. Forstbot. **2:** 1223. 1803), Desfontaines (Hist. Arb. Arbriss. France, **2:** 42. 1809), Ventenat (Monog. Gen. Tilleul, 12. 1802). Steven (in Bull. Soc. Nat. Mosc. **4:** 262. 1832) appears to have been aware that *T. alba* Waldst. & Kit. and *T. alba* Ait. are different species. Michaux reinstated *T. alba* (Hist. Arb. Am. Sept. 3, 1813), reducing *T. heterophylla* Vent. to synonymy, for which he was censored by Nuttall (N. Am. Sylva, **1:** 91. 1842).

A critical revision of the literature establishes: a) *T. alba* Ait. is an American linden; b) *T. alba* Waldst. & Kit. is an Hungarian linden; c) the type, technically speaking, is a sterile branch that may or may not represent *T. tomentosa* of our understanding; if it is this species, which Henry claims, there is contradiction between the letter of the publication and the geographic origin of the type; d) *T. alba* under various authorships, and with much attending confusion of synonymy has been used by Willdenow, Borkhausen, Martyn, Desfontaines, Ventenat, Nuttall, etc. for the European *T. tomentosa;* e) *T. alba* has been understood as an American linden by the editor of Du Roi, Michaux the elder, Steven, K. Koch.

In consideration of the uncertainty attaching to the type and of the indifferent use of the binomial, it seems best to reject altogether *T. alba* Ait. accepting in its stead: *T. tomentosa* Moench, *T. heterophylla* Vent., and *T. neglecta* Spach which can be attributed to species of reliable typification, and are well established in taxonomic and horticultural usage.

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A CRITICAL CONSIDERATION OF HOUTTUYN'S NEW GENERA AND NEW SPECIES OF PLANTS, 1773–1783

E. D. MERRILL

IN EXAMINING the very extensive literature of systematic botany one notes a number of references to plants named and described by M. Houttuyn, including such species as the common nutmeg, *Myristica fragrans* Houtt., two other species of the same genus, certain other common and widely distributed species in the Indo-Malaysian region, such as *Melochia umbellata* (Houtt.) Stapf, and a fair number of species characteristic of Japan and of South Africa. Even although these binomials are the accepted ones for certain well-known species, very little seems to be known regarding the work of their author. In standard reference works one may note a number of errors in citation, which are largely due to the following facts: Houttuyn's rarely consulted major botanical work is not available in many botanical libraries; it was issued under two entirely different Dutch titles; bibliographically it has been almost wholly and illogically subordinated to certain works of Linnaeus, with which it has little in common except that the Linnaean system of classification was used; shortly after the individual volumes of the original Dutch edition were issued they formed the chief basis of a German publication, the "Vollständiges Pflanzensystem" of Christmann and Panzer, the latter work being illustrated by the same plates, and many authors have confused the latter work with that of Houttuyn; and finally the work was essentially one of a popular rather than of a strictly technical nature.

There has been increasing evidence in recent years, as this or that botanist has resurrected and adopted binomials proposed by Houttuyn between 1773 and 1783, that a considerable number have been over-

looked by all botanists since his publication was issued. A rather critical examination of the fourteen volumes of his "Natuurlyke historie" appertaining to the plant kingdom shows that this is indeed the case, and that in the original work of Houttuyn and in that of Christmann and Panzer approximately 160 validly published new binomials (including the 33 published by error in Panzer's index; see p. 307) appear that have not been included in any published nomenclator or index, out of a total of about 210 that were proposed and published by these authors. Of these about 34 were based on specimens from Japan, 40 on material from the Indo-Malaysian region, 57 on specimens or pre-Linnaean references representing the African flora, chiefly from South Africa, and about 29, largely by bibliographic citation, on the plants of Europe, 14 on species from the eastern United States, about 8 from tropical America, and a few from other regions. In view of this situation it has seemed worth while to make a rather critical examination not only of Houttuyn's original work, but also of that of Christmann and Panzer, since their "Vollständiges Pflanzensystem" was very largely based on Houttuyn's original Dutch work. This has been done not only with a view to listing these new binomials, some accepted by all botanists, many others entirely overlooked, but also to placing them in synonymy or otherwise, as far as their status can be determined with reasonable certainty from the records available, in relation to binomials proposed by their predecessors, contemporaries and successors.

Houttuyn actually named and described, as new, the following genera, all of which, with the exception of *Myrobalanifera* Houtt., have hitherto been properly placed in botanical literature, although some of them were not listed, or actually placed in reference to other generic names, until the present century: *Assa* Houtt. = *Tetracera* Linn., *Basteria* Houtt. (non Mill.) = *Berkleya* Ehrh., *Crinita* Houtt. = *Pavetta* Linn., *Houttuynia* Houtt. = *Ixia* Linn. (not *Acidanthera* Hochst. to which it is currently reduced), *Myrobalanifera* Houtt. = *Terminalia* Linn., *Pallasia* Houtt. = *Calodendrum* Thunb. (1782), *Reynoutria* Houtt. = *Polygonum* Linn. (*Pleuropterus* Turcz.), *Renealmia* Houtt. = *Villarsia* Vent., *Truellum* Houtt. = *Polygonum* Linn. (*Chylocalyx* Hassk., *Echinocaulon* Spach), and *Visenia* Houtt. = *Melochia* Linn.

The task of collating the two works and determining what binomials were originally proposed as new therein has not been an easy one. Houttuyn's work, because of arrangement and typography and because no comprehensive index was prepared, is rather difficult to consult. Assuming, as proves to be the case, that the arrangement of genera and species was essentially that of the twelfth edition of Linnaeus' "Systema

naturae" (1767), each entry in Houttuyn has not only been checked against those in Christmann and Panzer, but also against the entries in Linnaeus' work mentioned above, and Murray's edition 13 (1774) of Linnaeus' "Systema vegetabilium" which in turn was a revision of that part of edition 12 of the "Systema naturae" appertaining to the plant kingdom. Where binomials were noted that did not appear in these works, slips were prepared that were later checked on "Index Kewensis" and other standard publications. A serious attempt was made to locate all new binomials in all groups of plants, whether such binomials had been recognized by Houttuyn's and by Christmann and Panzer's contemporaries and successors or not. The results of this study are embodied in the present paper.

Some of the difficulties encountered are due to the fact that Houttuyn did not consistently indicate his new names as such, and where Christmann and Panzer, for one reason or another in accepting Houttuyn's new species, which they did not always do, changed the specific names or interpolated additional species from one source or another, they did not indicate their new names as such. Houttuyn's normal procedure was to drop a footnote from each species to include the pre-Linnaean and Linnaean references, if it were a Linnaean species, and if it were a new one, to provide a short Latin diagnosis followed by the conventional *mihi* or by an abbreviation of his name. He was, however, far from consistent and a considerable number of his new binomials are not indicated as such and in many cases Latin diagnoses are lacking, although cursory Dutch descriptions were provided. In several cases where he indicated certain binomials as new by the addition of the conventional *mihi* or by an abbreviation of his name, these were not actually new names because he merely accepted previously published binomials of other authors and furthermore gave the literature citations to the original places of publication. *Fucus corneus*, Nat. Hist. II. **14:** 316. *t. 101. f. 2.* 1783, *F. capillaceus* l. c., and *Byssus penicillum* l. c. are indicated by Houttuyn as new by the addition of *mihi* following the short Latin diagnoses, and these binomials are credited by Panzer, Pflanzensyst. **13**(1)**:** 337. *t. 101. f. 3.* 1787 to Houttuyn. They are the earlier *Fucus corneus* Gmel. Hist. Fuc. 144. *t. 14. f. 3.* 1768, *F. capillaceus* Gmel. op. cit. 146. *t. 15. f. 1,* and *Byssus penicillum* Scop. Diss. Pl. Subter. (Diss. Sci. Nat.) 91. *t. 2.* 1772, as both Houttuyn and Panzer give the literature citations to the earlier binomials of Gmelin and Scopoli. *Aletris bifolia* Burm. f. (1768), Houttuyn, Nat. Hist. II. **12:** 408. 1780, Panzer, Pflanzensyst. **11:** 480. 1784; *Rheedia lateriflora* Linn. (1753), Houttuyn, op. cit. II. **3:** 2. 1774, Christmann, op. cit. **2:** 4. 177, and

Phalangium ramosum* Burm. f. Prodr. Fl. Cap. 3. 1768, Houttuyn, op. cit. II. **12: 115. 1780, Panzer, op. cit. **11:** 128. 1784, are exactly similar cases. The "Index Kewensis" entry of the latter is *Phalangium ramosum* "Houtt. Handleid. xii. 114; Poir. Encycl. v. 250," but all that Houttuyn did was to accept the much earlier, but hitherto overlooked, binomial of Burman f.

In a somewhat different category are a number of binomials accredited to Houttuyn in current literature, which he certainly did not propose as new, but merely misapplied or misinterpreted binomials of earlier authors. Thus *Tarchonanthus camphoratus* Linn., as far as Houttuyn is concerned, Nat. Hist. II. **6:** 34. 1776, Christm. Pflanzensyst. **4:** 344. 1779, is strictly the Linnaean species, yet *Tarchonanthus camphoratus* Houtt. appears in botanical literature, the "Index Kewensis" entry being Houtt. ex DC. Prodr. **5:** 430. 1836. De Candolle cites a Houttuyn specimen as being in the Delessert Herbarium, and this specimen does not represent the Linnaean species but is *Brachylaena elliptica* (Thunb.) Less. Further examples are discussed under *Wisteria floribunda* DC.; *Pueraria Thunbergiana* Benth., *Satyrium coriifolium* Sw., and *Microlepia strigosa* Presl in the following paper. No attempt has been made to locate the numerous entries of this type in systematic literature; in general they should be cited, if cited at all, as *Polypodium cristatum* sensu Houtt., non Linn., *Dolichos trilobus* sensu Houtt., non Linn., etc. for Houttuyn certainly did not propose such binomials as new ones.

At the present time, and for the past hundred years or so for that matter, the very extensive and rather well illustrated works of Houttuyn and of Christmann and Panzer are little known and less consulted. In preparing his edition of the "Species plantarum" (1797–1821) Willdenow accepted a considerable number of the new species proposed by Houttuyn, reducing others to synonymy. He took his data, however, from Christmann and Panzer's work, not from Houttuyn's original. For one reason or another he did not account for all the new names proposed by Houttuyn in synonymy or otherwise, actually overlooking more than he accounted for or reduced. It seems to be reasonably clear that no botanist or bibliographer has made a really searching examination of the two works with a view to recording the new binomials, much less attempting to place them in relation to those proposed by other botanists. Steudel, in compiling his "Nomenclator botanicus," seems to have been

*Binomials indicated by an asterisk in this paper represent those that, while validly published at the places indicated, chiefly in Houttuyn's "Natuurlyke historie" and in Christmann and Panzer's "Pflanzensystem," do not appear in "Index Kewensis" and its supplements published to date, or in standard reference works appertaining to the cellular and vascular cryptogams, or if they do appear therein there are serious errors in the citations.

content with recording those Houttuyn binomials that were accepted by Willdenow and his contemporaries and immediate successors, for he did not even include many of the binomials listed in the comprehensive alphabetic index that forms volume 14 of Christmann and Panzer's work. The compilers of "Index Kewensis" apparently placed too much dependence on Steudel's work, for the present study shows that there are over 150 binomials in the Houttuyn and Christmann and Panzer volumes that do not appear in that standard work nor in any of the supplements published to date. Within the present century some of the Japanese botanists, (Makino, Koidzumi, Masamune and others) have accepted certain of the Houttuyn binomials originally based on Japanese specimens and in 1926 Danser* elucidated the status of two overlooked or at least not placed genera proposed by Houttuyn, *Reynoutria* and *Truellum*.

It is probable that the very inconspicuous entries regarding these works in Pritzel's "Thesaurus" have helped to maintain their obscurity. In the first edition of that work in 1851 Pritzel included Houttuyn's work as an independent item (no. 4730) giving its full title and the number of pages in each volume; yet the equally important work of Christmann and Panzer was not granted an independent entry but appears with its full title and bibliographic detail subordinated to entry no. 6010, Linnaeus' "Systema plantarum," as a German edition of that work, *germanice*. In the standard second edition of Pritzel's work (1872), Houttuyn's work is subordinated to Linnaeus' "Systema naturae" (item 5405) in a four line entry as a Dutch edition of that work, *hollandice*, without even mention of its author's name; while that of Christmann and Panzer remains subordinated to item 5431, Linnaeus' "Systema plantarum," as in the first edition, *germanice*. The only place in this edition of Pritzel's work in which Houttuyn's name appears in reference to "Natuurlyke historie" is in the Christmann and Panzer title "nach Anleitung des holländischen *Houttuyn*'schen Werkes übersetzt," while Houttuyn's "Handleiding" is not even mentioned! Other evidence of the relative obscurity of both works is that Rehder† overlooked these extensive publications of Houttuyn and of Christmann and Panzer entirely in compiling the very exhaustive "Bradley bibliography," while Schindler‡ in 1928, in his critical examination of the post-Linnaean con-

*Danser, B. H. Die systematische Stellung der Houttuyn'schen Gattungen Reynoutria und Truellum. Bull. Jard. Bot. Buitenz. III. **8**: 25-31. *f. 1-2.* 1926.

†Rehder, A. The Bradley bibliography. A guide to the literature of the woody plants of the world published before the beginning of the twentieth century. Publications of the Arnold Arboretum No. 3. **1**: i-xii. 1-566. 1911; **2**: i-vi. 1-926. 1912; **3**: i-x. 1-806. 1915; **4**: i-xii. 1-589. 1914; **5**: i-xxxii. 1-1008. 1918.

‡Schindler, A. K. Die Desmodiinen in der botanischen Literatur nach Linné. Repert. Sp. Nov. Beih. **49**: 1-371. 1928.

siderations of the species of *Desmodium* and allied genera, also overlooked both works, although at least one new binomial was involved in the group in which he was especially interested.

Probably another reason why little attention has been given to these works in the past century or so is their popular rather than scientific nature. Both Houttuyn and Christmann and Panzer attempted to popularize Linnaeus' work by publishing in Dutch and in German what had been previously available in printed form only in the then universally used Latin of the professional botanists. It is clear, however, that at the time of its publication Houttuyn's work must have attracted considerable attention for the 14 volumes of the "Natuurlyke historie" appertaining to plants were immediately reissued under another title, "Handleiding tot de plant- en kruidkunde" (see p. 304), and soon after issue the individual volumes were made the essential basis of the German work of Christmann and Panzer, the "Pflanzensystem" (1777–1788), and Müller translated the volumes appertaining to the animal kingdom into German (1774–76) (see p. 305). These "popular" editions were the precursors of more or less similar works in English and in French.

In both works the general sequence of species follows edition 12 of Linnaeus' "Systema naturae" (1767) and Murray's edition 13 of Linnaeus' "Systema vegetabilium" (1774), but other than in the arrangement and in the binomials there is little in common between Houttuyn's greatly amplified work and the model, as to arrangement and nomenclature, on which it was based. For all practical purposes it is an independent work and bibliographically it should be so treated. What Houttuyn did was to amplify the 753 pages of that part of the Linnaean work appertaining to plants into 14 volumes containing somewhat over 8600 pages of text, supplemented by 105 distinctly good copper plates on which about 275 species of plants were delineated. Christmann and Panzer's "Vollständiges Pflanzensystem" should be similarly treated from a bibliographic point of view.

Pertinent to the above observation is the following quotation from the British Museum (Natural History) library catalogue **3:** 1128. 1910: "Among the works professing to be further editions of the 'Systema Naturae' but which have nothing in common therewith, save that the Linnean classification is adopted in them are: — M. Houttuyn's 'Natuurlyke Historie' — 1761–85; P. L. S. Müller's 'Des Ritters C. von Linné' — Vollständiges Natursystem — 1773–76; and P. Kostlin's badly printed *précis* of Müller—1781–82." To this list I would add the work of Christmann and Panzer as it has no more in common with the "Systema naturae," "Systema plantarum" or the "Systema vegetabilium" than

has that part of Houttuyn's work (Deel II) on which it was largely based.

In his "Thesaurus" ed. 1 (1851) under Linnaeus' "Systema naturae" (item 5978) Pritzel includes an eight line entry for P. L. S. Müller's six volume and supplement work entitled "Des Ritter's *C. von Linné* vollständiges Natursystem —" (1773–76). Thinking that perhaps this might contain further overlooked binomials, the set in the Arnold Arboretum library which conforms in all respects to Pritzel's entry was examined. The entire work is devoted solely to zoölogy. In the second edition of his "Thesaurus" (1872) Pritzel gives the same reference in abbreviated form, indicating, however, eleven volumes and an atlas of 195 colored plates issued in 1773–1800; this I have not seen, and so do not know whether or not it contains the parts on botany.

Martinus Houttuyn was born at Hoorn, the Netherlands, in 1720, taking his doctor's degree at Leyden University in 1749, his thesis being "Dissertatio spasmologica spasmorum theoriam exhibens." Dr. C. A. Backer informs me that in the standard Dutch biographical works he has been confused with his namesake Maarten (Latin: Martinus) Houttuyn who practised medicine at Hoorn. The Martinus Houttuyn with whom we are concerned was also born at Hoorn, but established himself in Amsterdam where he died April 27, 1798. He seems never to have occupied any official position and not to have practised medicine, but devoted his entire energies to natural history, becoming a very prolific author.

It seems to be clear, from one of the titles accredited to him, that he, Houttuyn, maintained some kind of a natural history museum. He may well have been a dealer in natural history specimens as indicated from the following passage quoted from Rees "Cyclopedia" **18**(1811): "HOUTTUYNIA, in Botany, received its name in compliment to Dr. Houttuyn, of Amsterdam, a collector and merchant of natural curiosities, one of the people who subscribed towards the expense of sending Thunberg to Japan, by which he enriched both his collections and his purse, in the true spirit of a Dutch virtuoso and patron." This is, in a way, confirmed by the fact that the Japanese plants and at least some of those from the Cape of Good Hope that he described in his "Natuurlyke historie" were received from Thunberg, and largely, at least, under the binomials assigned to them by Thunberg. In a number of cases he published the Thunbergian binomials previous to the issue of Thunberg's "Flora Japonica" in 1784.

He was elected a member of the "Zeeuwsch genootschap van kunsten en wetenschappen" (Zealand society of arts and sciences) July 28, 1775, and was also a member of the "Hollandsche maatschappij der weten-

schappen" (Netherlands society of science). He published a number of papers on various phases of natural history (see p. 229). His most extensive work, and that by which he is best known, the "Natuurlyke historie" is in many respects a remarkable publication, although it is now little known and less consulted. In it he assembled an enormous mass of data, but essentially his work seems to have been more that of a compiler, and as a popularizer of natural science, than as an originator.

His major work was published by his father, Franz Houttuyn, a bookseller or publisher in Amsterdam. In 1765 Franz Houttuyn apparently died, for in 1766, with the appearance of the "Erste deels, negende stuk," i.e. I. 9, the publishers became the "Erven van F. Houttuyn" (the heirs of F. Houttuyn), and 1784, with the "Derde deels, vierde stuk," i.e. III. 4, J. van den Burgh en Zoon in Amsterdam.

Houttuyn's name is perpetuated in botany by the genus *Houttuynia* (Saururaceae) named by Thunberg in 1784 as *Houtuynia*. Slight variant spellings are *Houtouynia* Pers. (1797), *Houttouynia* Batsch (1802), and *Hottuynia* Cramer (1803). Because of the earlier homonym *Houttuynia* Houtt. (1780) of the Iridaceae, Thunberg's generic name should be conserved for otherwise, being a preoccupied name, some botanists would unhesitatingly accept *Polypara* Lour. (1790) to designate this saururaceous genus. *Houttuynia* Houtt. (1780) has been universally interpreted as a synonym of *Acidanthera* Hochst. (1844), but the type and sole species, *H. capensis* Houtt., proves to be an *Ixia;* accordingly *Houttuynia* Houtt. becomes a synonym of *Ixia* Linnaeus (1753). The generic name *Hovttinia* Necker (1790) (*Houttinia* Steud. 1841) = *Calla* Linn.

For an individual who published as extensively as did Houttuyn, it is rather curious to note how relatively little his extensive works are consulted today. His major taxonomic work, the "Natuurlyke historie" is, of course, long since outmoded. Most of the essential taxonomic data included therein, except those items that originated with him and which have hitherto been overlooked, have been much more easily accessible to professional botanists in other standard works; and if Houttuyn's contemporaries and successors for one reason or another ignored or overlooked genera and species that he named and described, this was of little consequence to the botanists of the nineteenth century who worked under rules rather different from those obtaining today.

The following Houttuyn bibliography has been compiled to give some graphic idea of his contributions in the publication field, and to place on record in a medium available in the larger botanical libraries of the world an accessible record of these. Those titles in quotations

have not been actually examined by me, but were taken from A. J. van der AA "Biographische woordenboek der Nederlanden" 8(2): (1867), who there gives several other references to his sources of information regarding Houttuyn and his work.

Houttuyn, M. "Spasmologia spasmorum theoriam exhibens." 1749?

——— "Handleiding tot de chirurgie of heelkonst, volgens het Hoogduitsch van J. Z. Platnerus. Met vele nieuwe aanmerkingen verrijkt door M.H., Amst., 1764."

——— "Nederlandsche Vogelen . . . beschreeven door C. Nozeman . . . en verder na zyn ed. overlyden, door M. Houttuyn." 5 vol. 1770–1829.

See entries under HOUTTUYN, M. and NOZEMAN, C. Cat. Libr. Brit. Mus. (Nat. Hist.) **2**: 881. 1904, **3**: 1455. 1910.

——— Houtkunde. Verzameling van in- en uitlandsche houten — [1–108]. 1–58. [1–6]. *t. 1–106* [1773] –91. Another issue in 1795 with a supplement of six plates.

This is item 4729 in Pritzel's "Thesaurus" ed. 1, 1851, and no. 4291 in edition 2, 1872, where the full title is given. Besides two Dutch titles it also has others in German, English, French, and Latin. Houttuyn's name is appended to the preface, dated Amsterdam, Sept. 12, 1791. It was published by J. C. Sepp. A German edition, with 48 plates, was issued in Nürnberg by Seeligmann, 1773-78.

——— Natuurlyke historie of uitvoerige beschryving der dieren, planten en mineraalen, volgens het samenstel van den Heer Linnaeus, met naauwkerige afbeeldingen 1761–85.

For bibliographic details see p. 302.

——— "Handleiding tot de plant- en kruidkunde benevens eene uitvoerige beschrijving der boomen, planten, heesters, kruiden, varens, mossen, bol- en grasplanten, volgens het zamenstel van C. Linnaeus. Nieuwe uitgave." **1** (1773, or ? 1774)–**14** (1783).

This is a reprint of the fourteen volumes forming "Deel II" of the "Natuurlyke historie" with a new title page, otherwise not differing from the original. Most of the "Index Kewensis" and all of the "Index Londinensis" references are to this work. See p. 304.

——— "Het mikroskoop gemakkelijk gemaakt door H. Baker, 3de druk met pl., nevens een aanshangsel betreffende nieuwe waarnemingen, enz., Amst. 1778, 8°."

——— "Vertoog over de veranderlike steenen, oculi mundi genaamd, met afb. t.a.p., 1781, pl. 311."

——— "Beschrijving van eenige Japansche visschen en andere zeeschepselen. t.a.p., 1782, p. 311."

——— Het onderscheidt der salamanderen ven de haagdissen in 't algemeen, en van de gekkoos in 't byzonder, aagetoond. Verh. Zeeuwsch. Genoots. Wetensch. Vlissingen **9**: 305–336. *1 t.* 1782.

——— Beschryving van eenige Oostindische tin-ersten. Op. cit. 337–350. 1782.

——— "Bedenkingen over der sterflijkheit en het getal des volks in Amsterdam, Amst., 1783 8°."

——— "Faujas de Saint Fond, beschrijving der proefnemingen met konstige lugtbollen; uit het Fransch met aanteekeningen verrijkt door M.H., Amst., 1784, 2 d., 8°, pl."

——— Het onderschied der zwarte en witte peper, en afbeelding van 't gewas der staartpeper. Verh. Zeeuwsch. Genoots. Wetensch. Vlissingen **10**: 604–613. *2 t.* 1784.

——— De echte benzoin-boom en kamferboom van Sumatra. Verh. Holland. Maatsch. Wetensch. **21**: *257–287. t. 7–8.* 1784.

——— Beschryving van Malakse tin-erts, en derzelver mynen. Verh. Zeeuwsch. Genoots. Wetensch. Vlissingen **11**: 383–389. 1786.

——— Aanmerkinge over de kaneel, op Ceylon gemaakt, door Cas. Petr. Thunberg, *Med. et Botan. Professor te Upsal;* vertaald en met eenige aanteekeningen vermeerderd. Op. cit. **12**(1): *296–312.* 1786.

——— "Aanmerkinge over de rupsen, die de boomen in het voorjahr zoodanig benadeelen, dat zij in den zomer geheel vrugten bladerloos staan, en over de middelen, die men, tot voorkoming daarvan in 't werk stellen, t.a.p., 1786, D. 1, St. 11, bl. *327.*"

——— "Animalium musaei Houttuyniani index. Amst. 1787."

——— Aanmerkingen over de herfstraaden, of het vliegende spinrag in de lugt. Nieuwe Algem. Vaderl. Let.-Oefening. **3**(*2*): 520–523. 1788.

——— "Bericht aangaande de echte oleum cajupoeti, inzonderheid betreffende derzelver afkomst, en hoe zij onlangs alhier van folia cajupoeti is gestookt. In Hedend. Vad. Letteroef. D. 111, st. 11, bl. 102."

——— Natuurlijke . . . afbeeldingen en beschrijvingen der Spoken . . . door C. Stoll [Continued by M. Houttuyn] *2* vol. [1788] — 1813.

See entries under Houttuyn, M. and Stoll, C. Cat. Libr. Brit. Mus. (Nat. Hist.) **2**: 881. 1904, **5**: 2028. 1915.

——— Aanmerkingen over de bloemen van den nooten-moskat-boom. Verh. Holland. Maatsch. Wetensch. **26**: *211–231. t. 7.* 1789.

Pages 225-230 by E. P. Swagerman under the subtitle: Beschryving der afbeeldingen op de plaat. The species not named; it is ***Myristica fragrans*** Houtt.

——— "Afbeelding der artseny-gewassen med derzelver Nederduitsche en Latynsche beschryvingen." 6 vol. 1796–1800.

Edited by D. L. Oskamp and J. C. Krauss. The Dutch descriptions are taken from Houttuyn's "Natuurlyke historie." See entries under Houttuyn, M. and Oskamp, D. L., Cat. Libr. Brit. Mus. (Nat. Hist.) **2**: 880. 1904, **3**: 1482. 1910.

Considering the relatively early date at which Houttuyn published his botanical work (1773–83), the number of new binomials that he proposed, and further that about 160 of these, actually and legitimately published by him and by Christmann and Panzer, have been entirely or almost entirely overlooked up to this time, the number of nomenclatural changes resulting from this study are surprisingly few. As the status of the various species has been determined I have merely applied in each

case the rules of the International Code of Botanical Nomenclature. Where changes in previously accepted specific names have been indicated, because of priority, such changes have been made. Most of these substitutions apply to species originally described by Houttuyn on the basis of material received by him from Japan, Ceylon, India, the Malay Archipelago and South Africa, a very few, and these chiefly bibliographic, applying to species from other parts of the world, including several from the northeastern United States.*

I have attempted to account for each new binomial published by Houttuyn and by Christmann and Panzer, and in connection with this task I have adjusted the synonymy where necessary, under the at present generally accepted rules of procedure. I have added such synonyms and citations as seem to me to be desirable to explain the accepted name in each case, normally including references to standard floras or monographic treatises. Binomials that are not included in "Index Kewensis" or in any of its supplements published to date, or in similar works dealing with the names of cryptogamic plants, are indicated by an asterisk; and in some cases where the current entries are erroneous as to the citation, these are similarly indicated.

In previous studies of this kind, that may perhaps be classed as taxonomic-bibliographic for want of a better term, I have repeatedly expressed my attitude† regarding more or less obscure species described by early authors where the actual types were either never prepared as botanical specimens, or if preserved as such, are no longer extant. Wherever the status of such a species can be determined with reasonable certainty from the published record, supplemented by field, library, and herbarium research, they should be accepted, even if such binomials do at times replace currently accepted ones proposed by later authors. All available data and information appertaining to the proper elucidation of this or that species should be used, and the utilization of such items as local names, economic uses, habitats, time of flowering or fruiting, etc., is just as legitimate as is merely the scanning of a usually cursory, often incomplete, and totally inadequate original description. Under all generally accepted rules of nomenclature the printing of a binomial

*Merrill, E. D. On Houttuyn's overlooked binomials for native or introduced plants in eastern North America. Rhodora **40**: 288-293. *t. 495*. 1938 (Contr. Gray Herb. **122**: 288-293. *t. 495*).

†**Merrill, E. D.** Osbeck's Dagbok öfwer en Ostindsk Resa. Am. Jour. Bot. **3**: 571-588. 1916; An interpretation of Rumphius's herbarium Amboinense. [Philip.] Bur. Sci. Publ. **9**: 1-595. 1917; Species Blancoanae; a critical revision of the Philippine species of plants described by Blanco and by Llanos. [Philip.] Bur. Sci. Publ. **12**: 428. 1918; A review of the new species of plants proposed by N. L. Burman in his Flora indica. Philip. Jour. Sci. **19**: 329-388. 1921; A commentary on Loureiro's Flora Cochinchinensis. Trans. Am. Philos. Soc. II. **24**(2): 1-445. 1935.

accompanied by a description constitutes valid publication. Certain publications such as Gandoger's "Flora Europae" have been outlawed by appropriate action, but no botanist has even suggested that overlooked binomials, in a publication in which many of those published have been listed and accepted, should be ignored. Until we reach that happy or unhappy state when a list of conserved binomials shall have been prepared, discussed, and accepted, or until such time as overlooked binomials, published before a certain date, shall have been outlawed, we shall have to accept them and do the best we can with them. In a work like the one under discussion it may be more difficult for a conservative botanist to accept a considerable number of nomenclatural changes *en bloc* than it would be for him to accept them as they appeared, one at a time, in widely scattered papers of this or that botanist. But in the case of binomials that have remained not even listed in botanical literature since their publication 145 to 155 years ago, until they are at least *listed* they would, for the most part, continue to be overlooked. Accordingly having located a considerable number of hitherto unrecognized names, I have not been content with merely listing them, but have in each case made a serious attempt to determine their status; i.e., whether the names should be accepted under current rules, or placed as synonyms, or left in that most unsatisfactory category of *incertae sedis*.

Houttuyn's "Natuurlyke historie" was published in Amsterdam between the years 1761 and 1785. The work is divided into: "Deel I, 18 stuk, Dieren," 1761–73; "Deel II, 14 stuk, Planten," 1773–83; and "Deel III, 5 stuk, Mineraalen," 1780–85. Deel II was immediately reprinted under another title: "Handleiding tot de plant- en kruidkunde" etc. (see p. 304). The references in this paper are all to Deel II of the original "Natuurlyke historie," consistently cited as II, **1:**, II, **2:** etc. The full title and essential bibliographic data follow:

Houttuyn, M. Natuurlyke historie of uitvoerige beschryving der dieren, planten en mineraalen, volgens het samenstel van den Herr Linnaeus, met naauwkerige afbeeldingen. **1:** [1–18]. 1–500. *t. 1–10.* 1761; **2:** [1–4]. 1–504. *t. 11–21.* 1761; **3:** [1–4]. 1–564. [1–4]. *t. 22–28.* 1762; **4:** [1–6]. 1–452. *t. 29–36.* 1762; **5:** [1–8]. 1–618 [1–8]. *t. 37–49.* 1763; **6:** [1–4]. 1–558. [1–4]. *t. 50–56.* 1764; **7:** [1–4]. 1–446. *t. 57–62.* 1764; **8:** [1–8]. 1–525. [1–67]. *t. 63–70.* 1765; **9:** i–vi. [1–6]. 1–640. *t. 71–76.* 1766; **10:** [1–6]. 1–528. *t. 77–83.* 1766; **11:** [1–8]. 1–750. [1–6]. *t. 84–92.* 1767; **12:** [1–6]. 1–624. *t. 93–98.* 1768; **13:** [1–6]. 1–534. [1–10]. *t. 99–106.* 1769; **14:** [1–4]. 1–530. [1–2]. *t. 107–114.* 1770; **15:** [1–4]. 1–458. *t. 115–119.* 1771; **16:** [1–6]. 1–630.

[1–10]. *t. 120–125*. 1771; **17:** [1–6]. 1–614. *t. 126–138*. 1772; **18:** i–xxv. [1–5]. 1–226 [1–422]. *t. 139–143*. 1773. II. **1:** i–x. [1–10]. 1–438. [1–2]. *t. 1–5*. 1773, De palmboomen; **2:** i–viii. [1–6]. 1–616. [1–2]. *t. 5–11*. 1774, De boomen; **3:** [1–6]. 1–688. [1–12]. *t. 12–17*. 1774, De boomen; **4:** [1–6]. 1–564. *t. 18–23*. 1775, De heesters; **5:** [1–10]. 1–576. *t. 24–29*. 1775, De heesters; **6:** [1–6]. 1–648. [1–12]. *t. 30–37*. 1776, De heesters; **7:** [1–4]. 1–832. *t. 38–44*. 1777, De kruiden; **8:** [1–6]. 1–784. *t. 45–52*. 1777, De kruiden; **9:** [1–6]. 1–760. *t. 53–60*. 1778, De kruiden; **10:** [1–6]. 1–828. *t. 61–69*. 1779, De kruiden; **11:** [1–6]. 1–456. [1–29]. *t. 70–76*. 1779, De kruiden; **12:** [1–6]. 1–558. [1–6]. *t. 77–86*. 1780, De bolplanten; **13:** [1–4]. 1–616. [1–6]. *t. 87–93*. 1782, De grasplanten; **14:** [1–6]. 1–698. [1–14]. *t. 94–105*. 1783, De varens, mossen, enz. III. **1:** i–viii. [1–12]. 1–552. *t. 1–12*. 1780; **2:** [1–10]. 1–700. [1–8]. *t. 13–24*. 1781; **3:** [1–6]. 1–638. [1–4]. *t. 25–34*. 1782; **4:** [1–8]. 1–498. *t. 35–41*. 1784; **5:** [1–6]. 1–360. [1–232]. *t. 42–48*. 1785.

In this single work it will be noted that Houttuyn printed in excess of 21,500 pages of text, including introductory matter and indices, illustrated by 296 copper plates depicting selected animals, plants, and minerals. Deel II, treating the plant kingdom, includes about 8600 pages of text, indices, and introductory matter, illustrated by 105 copper plates depicting about 275 species of plants. In most sets the plates are black and white, but in the set of Deel II in the Arnold Arboretum library, all figures are hand colored. If we compare this with the Linnaean work with which it has very generally been associated, we find that edition 12 of the "Systema naturae" (1766–68) contained but about 2370 printed pages, with three plates, and that Murray's edition 13 of the "Systema vegetabilium" contained but 844 pages, while that part of edition 12 of Linnaeus' "Systema naturae" dealing with plants contains only 753 pages. In the "Na-berig" to the last part (14) of Deel II [1]. 1783, Houttuyn stated that he had included all the species of plants known to the elder Linnaeus, as well as various others that appeared to him to be new, mostly from South Africa, Japan, Ceylon and the East Indies (Malay Archipelago). He suggested the possibility of publishing a general index. This was never issued, so that one has to be content with the generic indices in volumes 2, 3 (to 1, 2, 3), 6 (to 4, 5, 6), 11 (to 7, 8, 9, 10, 11), 12, 13, and 14. The lack of a comprehensive general index makes the work a distinctly difficult one to consult except when referred to through the corresponding parts of Christmann and Panzer's "Pflanzensystem," and the comprehensive index that forms the concluding volume of that work. Unfortunately the latter authors

do not give page references to the entries in the Houttuyn volumes on which their work was largely based.

The fourteen volumes of Houttuyn's "Natuurlyke historie" forming Deel II, treating the plant kingdom, were immediately reissued under the following title:

Houttuyn M. Handleiding tot de plant- en kruidkunde benevens eene uitvoerige beschrijving der boomen, planten, heesters, kruiden, varens, mossen, bol- en grasplanten, volgens het zamenstel van C. Linnaeus. Nieuwe uitgave met 105 platen. Te Amsterdam bij Lodewyk van Es.

This differs from the "Natuurlyke historie" only in the title-pages. Nearly all the entries in "Index Kewensis" are to this issue, abbreviated to "Handleid.," rather than to the original "Natuurlyke historie," and all the entries in "Index Londinensis" (1929–31) to the illustrations are to "Houttuyn, Handl. Pl. & Kruidk.," which is but natural as the "Handleiding" only is available in the Kew library where both indices were prepared. There are possibly some differences in the dates of issue of some of the individual volumes as between the two series. Miss M. L. Green informs me that the dates are pencilled on the title-pages of the Kew set, Volume I, 1774 (but 1773 is printed at the end of the preface); volume 3, 1775; volume 5, 1776; and volume 11, 1780; the corresponding dates on the title pages of the same volumes of the "Natuurlyke historie" are 1773, 1774, 1775, and 1779. In all other volumes of the Kew set the pencilled dates are the same as those in the original "Natuurlyke historie." There is no record at Kew as to the origin of the pencilled dates on the various volumes of the "Handleiding" nor is it known by whom they were written. In the following consideration of Houttuyn's new species I have taken the dates of issue as they are printed on the several volumes of the "Natuurlyke historie." Some bibliographic difficulties have developed in the past because of the standard "Index Kewensis" citations to the "Handleiding" and because Pritzel did not mention this title in either edition of his "Thesaurus." I judge that this reissue is much less common in libraries than is the original "Natuurlyke historie." The only copy I have seen listed in a number of published library catalogues is the set at Kew on which the "Index Kewensis" and "Index Londinensis" entries were based, and this copy is clearly the basis of Jackson's entry in his "Guide to the literature of botany" 16. 1881. The title is listed in Bibl. Contr. Lloyd Library **2:** 585. 1916, but there is no set in that library.

Houttuyn followed the Linnaean precedent of printing his binomials

as marginal entries. For each species it was his normal procedure to print a footnote in which references to contemporary and pre-Linnaean literature were given; and where Latin diagnoses for his new species occur, these also appear as footnotes. In spite of the fact that a very high percentage of all entries are Linnaean binomials, it is often difficult to determine this fact without checking against other published works. While numerous references are given to binomial literature, the works of Linnaeus, Burman f., Thunberg, Bergius, Murray, Forskål, and others, those to pre-Linnaean literature are much more numerous than to post-Linnaean works; and very frequently all references under a Linnaean binomial are to pre-Linnaean publications with none to binomial literature. Occasionally from what proves to be a Linnaean binomial the footnote reference is to a Latin diagnosis devoid of literature references. While all suspicious binomials have been checked it is fully realized that some of the new ones proposed by Houttuyn and by Christmann and Panzer may have been overlooked by me, but it is hoped that most of them have been detected.

The essential bibliographic data regarding Christmann and Panzer's "Pflanzensystem" are given below:

Christmann, G. F. and **Panzer, G. W. F.** Des Ritters Carl von Linné Königlich Schwedischen Leibarztes &c vollständiges Pflanzensystem nach der dreyzehnten* lateinischen Ausgabe und nach Anleitung des holländischen Houttuynischen Werkes übersetzt und mit einer ausführlichen Erklärung ausgefertiget. **1:** 1–798. [1–2]. *t. 1–11 & 5b.* 1777; **2:** [1–6]. 1–548. [1–28]. *t. 12–17 & 12b, 16a, 16b, 16c.* 1777; **3:** [1–2]. 1–683. *t. 18–25 & 19b, 24b.* 1778; **4:** [1–6]. 1–709. [1–65]. *t. 26–37.* 1779; **5:** [1–2]. 1–870. *t. 38–44b & 41b, 42b.* 1779; **6:** [1–6]. 1–696. *t. 45–51 & 50b.* 1780; **7:** [1–2]. 1–548. [1–2]. *t. 51b–57 & 53b, 55b.* 1781; **8:** [1–6]. 1–794. *t. 57b–65 & 57c.* 1782; **9:** [1–6]. 1–630. [1–2]. *t. 66–69 & 66b.* 1783; **10:** [1–6]. 1–381. [1–184]. *t. 70–76.* 1783; **11:** [1–6]. 1–664. [1–16]. *t. 77–86.* 1784; **12:** [1–6]. 1–810. [1–31]. *t. 87–93.* 1785; **13**(1): [1–6]. 1–562. [1–22]. *t. 94–102.* 1786; **13**(2): [1–10]. 1–565. [1–15]. *t. 103–105.* 1787; **14:** [1–4]. 1–614. 1788.

In the work of Christmann and Panzer the sequence of species is essentially that of Houttuyn. To a very large degree their work was based on that of Houttuyn, but it is not an exact translation. Some of Houttuyn's descriptions and discussions are shortened, others amplified, and particularly in the later volumes a considerable number of species were added from other works, notably from Linnaeus f. "Supplementum

*With volume **12**: (1785) this became vierzehnten.

plantarum" (1781), and in volumes 12 and 13, various items from Thunberg's "Flora Japonica" (1784).

The arrangement of data is rather different from that of Houttuyn, the binomials appearing as center heads rather than as marginal entries, followed by brief German diagnoses, with few to many literature references, and then the cursory descriptions, discussions, notes, etc. The illustrations, printed from Houttuyn's plates, follow the same sequence in arrangement, and in the numbering of the plates and figures. Seventeen extra plates were interpolated, these being numbered 5b, 12b, etc., and carry but one species on a plate. They thus added the illustrations of 17 species to Houttuyn's list. None of the Christmann and Panzer illustrations are listed in "Index Londinensis," the total being about 292 species.

Christmann and Panzer did not always accept the Linnaean binomial adopted by Houttuyn where two were available for the same species. *Rumex aegyptius* Linn. Syst. Nat. ed. 10, **2:** 990. 1759 (Houttuyn, II. **8:** 392. 1777) was replaced by *R. aegyptiacus* Linn. Sp. Pl. 335. 1753 (Christmann, **6:** 370. 1780). *Gnaphalium plantagineum* Linn. Syst. Nat. ed. 12, **2:** 545. 1767 (Houttuyn, II. **10:** 602. 1779) was replaced by *G. plantaginifolium* Linn. Sp. Pl. 850. 1753 (Panzer, **9:** 305. 1783). *Euphorbia officinarum* Linn. Sp. Pl. 451. 1753 (Houttuyn, II. **8:** 736. 1777) was replaced by *E. officinalis* Forsk. Fl. Aeg.- Arab. 94. 1776 (Christmann, **7:** 37. 1781). *Chaerophyllum temulum* Linn. Sp. Pl. 258. 1763 (Houttuyn, II. **8:** 179. 1777) was replaced by *C. temulentum* Linn. Fl. Suec. ed. 2, 94. 1755 (Christmann, **8:** 179. 1777). *Campanula rhomboidea* Murr. Syst. Veg. ed. 13, 173. 1774 (Houttuyn, II. **7:** 585. 1779) was replaced by *C. rhomboidalis* Linn. Sp. Pl. 165. 1753 (Christmann, **5:** 578. 1779); and *Tradescantia virginiana* Linn. Sp. Pl. 288. 1753 (Houttuyn, II. **8:** 329. 1777) was replaced by *T. virginica* Linn. Syst. Nat. ed. 10, **2:** 975. 1759 (Christmann, **6:** 311. 1780).

In checking approximately 8800 binomials that appear in the comprehensive general index forming volume 14 of Christmann and Panzer's "Pflanzensystem" on the second edition of Steudel's "Nomenclator botanicus," about 90 binomials were noted in the "Pflanzensystem" volume that were not included in Steudel's work. These are mostly the names of Linnaean species, nearly all of which appear in "Index Kewensis." Perhaps the most curious result of this check was the discovery that thirty-three new binomials, none appearing in "Index Kewensis" nor in Steudel's work, were actually published in Panzer's index. They are merely listed below without further discussion in this paper, for the

reason that most if not all of them were due to errors in transcription. Just what species was intended in each case is clearly indicated by the number preceding each specific name in combination with the page reference.

Aegilops squamosa* Panzer, Pflanzensyst. **14: 6. 1788 = *A. squarrosa* Linn.

**Asclepias rubescens* Panzer, op. cit. 29 = *A. purpurascens* Linn.

**Aspalathus asteroides* Panzer, op. cit. 30 = *A. Astroites* Linn.

**Campanula striata* Panzer, op. cit. 53 = *C. stricta* Linn.

**Carthamus Carduncul*us Panzer, op. cit. 58 = *C. Carduncellus* Linn.

**Centella pilosa* Panzer, op. cit. 63 = *C. villosa* Linn.

**Chrysanthemum indum* Panzer, op. cit. 68 = *C. indicum* Linn.

**Cistus squamosus* Panzer, op. cit. 71 = *C. squamatus* Linn.

**Clitoria Galactica* Panzer, op. cit. 74 = *C. Galactia* Linn.

**Ehretia spinifolia* Panzer, op. cit. 100 = *E. spinosa* Jacq.

**Erigeron carolinum* Panzer, op. cit. 104 = *E. carolinianum* Linn.

**Euphorbia Medusae* Panzer, op. cit. 109 = *E. Caput-Medusae* Linn.

**Globba maritima* Panzer, op. cit. 123 = *Globba marantina* Linn.

**Helianthus rubens* Panzer, op. cit. 131 = *H. atrorubens* Linn.

**Hyacinthus scriptus* Panzer, op. cit. 137 = *H. nonscriptus* Linn.

**Marrubium dictamnus* Panzer, op. cit. 172 = *M. pseudodictamnus* Linn.

**Martynia longifolia* Panzer, op. cit. 172 = *M. longiflora* Linn.

**Ophioxylon serpinum* Panzer, op. cit. 292 = *O. serpentinum* Linn.

**Ophrys nana* Panzer, op. cit. 192 = *O. alata* Linn.

**Orchis Burmannia* Panzer, op. cit. 193 = *O. Burmanniana* Linn.

**Passiflora perforata* Panzer, op. cit. 201 = *P. perfoliata* Linn.

**Polycarpon islandicum* Panzer, op. cit. 214 = *Koenigia islandica* Linn.

**Protea piniflora* Panzer, op. cit. 222 = *P. pinifolia* Linn.

**Queria minor* Panzer, op. cit. 215 = *Lechea minor* Linn.

**Rubus parviflorus* Panzer, op. cit. 235 = *Rubus parvifolius* Linn.

**Ruta Patavia* Panzer, op. cit. 237 = *R. Patavina* Linn.

**Sauvagesia aphylla* Panzer, op. cit. 242 = *Galax aphylla* Linn.

**Solandra depauperata* Panzer, op. cit. 259 = *Hermas depauperata* Linn.

**Solidago aurea* Panzer, op. cit. 260 = *S. Virgaurea* Linn.

**Trigonella Graeca* Panzer, op. cit. 276 = *T. Foenum Graecum* Linn.

**Wachendorfia thyrsifolia* Panzer, op. cit. 288 = *W. thyrsiflora* Linn.

**Xylophylla pinnata* Panzer, op. cit. 289 = *Staphylea pinnata* Linn.
**Xylophylla trifolia* Panzer, l. c. 289 = *Staphylea trifolia* Linn.

Bibliographically and botanically Houttuyn and Christmann and Panzer have received scant recognition in spite of the extent of their published works. Certainly they did not crave publication credit, for as authors their names do not appear on a single title page of the 51 volumes involved (or on the 65 volumes if one wishes to include the "Handleiding" reprint of the "Natuurlyke historie"). There is no indication of authorship of Houttuyn's work, that I have detected, until five years after publication commenced when the preface to I. **9:** vii. July 21, 1766 bears his name. This appears again in I. **18:** xxv. May 20, 1773; II. **1:** x. November 25, 1773; and II. **2:** viii. November 30, 1780. The "Na-berigt" to II. **11:** 432. 1779 is signed by Houttuyn, and at the end of the last volume, III. **5:** 360. 1785, is a short poem followed by his name.

Christmann and Panzer are equally modest, for there is no indication of authorship of their 14 volumes until one scans the "Vorbericht" to **12:** [2], April 17, 1785 which is signed "Dr. Panzer" and the "Vorbericht" to **13**(2)**:** [2]. 1787, which is signed by G. W. F. Panzer, May 1, 1787. He there states: "Diesem ohngeachtet habe mich beeifert, denienigen Beyfall, den dieses Werk bisher erhalten, und den Herr Rath und *D*. Christmann, ausübender Artz zu Urach im Würtembergischen gründete—wenigstens nicht zu vermindern: den die sieben ersten Bände dieses Werkes sind die Arbeit dieses gelehrten Artzes—die sieben letzten aber die meinige—eine Nachricht, die ich, um nicht ungerecht gegen die Bemühungen dieses verdienstvollen Mitarbeiters zu sein, hier nur bekannter zu machen für nöthig erachte." Volume **13**(2) closes the actual text, for volume **14** consists of the indices only, and its "Vorbericht" is signed G. W. F. Panzer, March 31, 1788.

In examining the illustrations one occasionally notes an error in identification. Houttuyn occasionally depicted what he thought might represent a species allied to the Linnaean one discussed, sometimes citing the Linnaean binomial in the explanation of the figures, sometimes not. Thus the illustration under *Acalypha australis* Linn.; Houtt. Nat. Hist. II. **11:** *t. 72. f. 2.* 1779, Panzer, Pflanzensyst. **10:** *t. 72. f. 2.* 1783, represents *Boehmeria longispica* Steud. (*B. japonica* Miq.). It manifestly was not intended to represent *Acalypha australis* Linn., for following the description of the latter Houttuyn gives cursory descriptions of three other plants from Arabia, the West Indies, and Japan; and his illustration was based on the Japanese plant. The description and synonymy

of *Polypodium cristatum* Linn.; Houtt. Nat. Hist. II. **14:** 183. 1783, Panzer, Pflanzensyst. **13**(1): 207. 1786 appertains to the European form = *Dryopteris cristata* (Linn.) A. Gray. The fern illustrated in both works, *t. 99. f. 3,* represents a Japanese species that Houttuyn thought might represent the Linnaean one. The illustration represents *Microlepia strigosa* (Thunb.) Presl; yet *Polypodium cristatum* Houtt. appears as an independently published binomial in Christensen's "Index filicum," with the reference, however, to Panzer's work rather than to the original one of Houttuyn. The Japanese grass illustrated as *Paspalum distichum* Linn.; Houtt. Nat. Hist. II. **13:** *t. 89. f. 4.* 1784, Panzer, Pflanzensyst. **12:** 219. *t. 89. f. 4.* 1785, clearly represents the very different *Eriochloa villosa* Kunth, but the description given by Houttuyn applies to the Linnaean species. Under *Tamus cretica* Linn.; Houtt. Nat. Hist. II. **11:** 357. 1779, Panzer, Pflanzensyst. **10:** 278. 1783, the illustration, *t. 74. f. 1–2,* represents a Japanese plant, not identified with *Tamus cretica* Linn., depicting staminate and pistillate forms of *Dioscorea quinqueloba* Thunb. The description of synonymy of *Carex limosa* Linn.; Houtt. Nat. Hist. II. **13:** 533. 1782, Panzer, Pflanzensyst. **12:** 695. 1785, appertains to the European form, but the Japanese species illustrated, *t. 93. f. 2,* represents a different species of *Carex.*

Besides the rather numerous binomials that Houttuyn originated to represent species that he considered to be previously unnamed and undescribed, and those proposed by Christmann and Panzer, where for one reason or another they changed specific names, a considerable number of minor changes occur in other binomials, largely if not entirely due to typographical errors. Among those noted are: *Allium Ascalonium* Panzer, **11:** 230. 1784 = *Allium ascalonicum* Linn.; *Amaryllis Beliadonna* Houtt. II. **12:** 172. 1780 = *Amaryllis Belladonna* Linn.; *A. sarnicusis* Houtt. II. **12:** 175. 1780 = *A. sarniensis* Linn.; *Atropa Belladenna* Houtt. II. **7:** 655. 1777 = *A. Belladonna* Linn.; *A. meandagora* Christm. **5:** 660. 1779 = *A. Mandragora* Linn.; *Bubon ummiferum* Houtt. II. **8:** 131. 1777 = *B. gummiferum* Linn.; *Cactus Pitahaia* Houtt. II. **5:** 160. 1775 = *C. Pitajaya* Jacq.; *Convolvulus cantrabica* Christm. **5:** 543. 1779 = *C. cantabrica* Linn.; *Dorstenia Drakenia* Houtt. II. **7:** 358. 1777 = *D. Drakena* Linn.; *Erythrina dicta* Christm. **5:** 852. 1779 = *E. picta* Linn.; *Eupatorium Dalen* Houtt. II. **6:** 17. 1776 = *E. Dalea* Linn.; *E. zcilanicum* Houtt. II. **6:** 20. 1776 = *E. zeylanicum* Linn.; *Gentiana saponnaria* Christm. **5:** 852. 1779 = *G. saponaria* Linn.; *Ixia monadelphica* Panzer, **11:** 43. 1784 = *I. monadelphia* Burm. f.; *Knoxia zeylonica* Christm. **5:** 272. 1779 = *K. zeylanica* Linn.; *Lapathum Acetoselia* Houtt. II. **8:** 412. 1777 = *L.*

Acetosella Scop.; *Malva Sherardina* Houtt. II. **10:** 54. 1779 = *M. Sherardiana* Linn.; *Mimosa fernanbucana* Houtt. II. **6:** 449. 1776 = *M. pernambucana* Linn.; **Osmunda adianthifolia* Panzer, **13**(1): 60. 1786 = *O. adiantifolia* Linn.; *Quercus primus* Christm. **2:** 301. 1777 = *Q. Prinos* Linn.; *Rosa sinita* Houtt. II. **5:** 206. 1775 = *R. sinica* Murr.; *Salix myrrtillodes* Christm. **4:** 559. 1779 = *S. myrtilloides* Linn.; *Salvia spina* Christm. **5:** 159. 1779 = *S. spinosa* Linn.; *Scandix Anthrisans* Houtt. II. **8:** 170. 1777 = *S. Anthriscus* Linn.; *Solanum insamum* Christm. **5:** 389. 1779 = *S. insanum* Linn.; *Tremella Nostoch* Panzer, **13**(2): 545. 1787 = *T. Nostoc* Linn.; *Valeriana Calcatripa* Houtt. **7:** 187. 1777 = *V. Calcitrapae* Linn.

One notes, here and there in systematic literature, a very few actual references to Houttuyn herbarium specimens notably in the collections at Leiden, Copenhagen, and Geneva. Most of the specimens actually accredited to Houttuyn, whether in the Rijks Herbarium at Leiden, or in the Burman (Delessert) herbarium at Geneva, prove on examination to bear no data that would indicate Houttuyn plants; some are definitely from Van Royen's herbarium. The only authentic Houttuyn specimen that I have actually seen is *Myristica fragrans* Houtt. in Vahl's herbarium at Copenhagen and even this was originally named *M. aromatica* Sw., and does not bear Houttuyn's binomial; but on the back of the sheet it is inscribed "ded. Dr. Houttuyn." It is of course possible that Van Royen and Burman received some material from Houttuyn but it is just as likely that they named certain specimens that they received from other sources by consulting Houttuyn's work. Yet as Houttuyn dealt in natural history material one might logically expect that both Van Royen and Burman acquired botanical specimens from him. All attempts to locate a Houttuyn herbarium have failed, and the probability is that most of his actual types are no longer extant.

In the course of this study which has been continued at intervals over a period of several years, I have been under obligations to a number of individuals for data and information including Dr. H. Lam, Dr. J. T. Koster, and Dr. S. J. Van Ooststroem of Leiden, Dr. O. Hagerup, Copenhagen, Dr. B. P. G. Hochreutiner and Dr. Charles Baehni, Geneva; Miss M. L. Green and Mr. J. Hutchinson, Kew, Mr. J. E. Dandy, British Museum, and Mr. S. Savage, Linnaean Society, London. Dr. R. H. Compton of Kirstenbosch, Union of South Africa, has supplied me with critical notes on certain of Houttuyn's South African species that I

*This variant apparently commenced with the following entry: *Osmunda adianth.* Linn. Syst. Nat. ed. 10, 2: 1319. 1759. It is repeated in ed. 12, **2:** 685. 1767, and as *Osmunda adianthifolia* in Murray, Syst. Veg. ed. 13, 779. 1774. It is not listed in Christensen's "Index filicum."

could not place to my own satisfaction. The assistance rendered has enabled me to settle a number of problems that otherwise would have had to remain unsolved.

FUCACEAE

Splachnidium Greville

Splachnidium rugosum (Linn.) Grev. Syn. Alg. XXXVI. 1830; Mitch. & Whit. in Murray, Phycol. Mem. **1:** 1–10. *t. 1–3.* 1892; DeToni, Syll. Alg. **3:** 223. 1895.

Ulva rugosa Linn. Mant. **2:** 311. 1771.

Fucus verrucosus* Houtt.* Nat. Hist. II. **14: 309. 1783, non Gmel.

Fucus variolosus* Houtt. op. cit. Aanwyz. Plaat. [4]. 1783; Panzer, Pflanzensyst. **13(1): 369. *t. 101. f. 2.* 1786.

Houttuyn's description was based on a Cape of Good Hope specimen, and his species is manifestly identical with *Splachnidium rugosum* (Linn.) Grev. The species was clearly indicated as new, with no references to earlier literature. The earlier *Fucus verrucosus* Gmel. Hist. Fuc. 136. *t. 14. f. 1.* 1768 is apparently a synonym of *Gracilaria confervoides* (Linn.) Grev. Houttuyn clearly intended to describe his species as *Fucus variolosus* as this is the name he used in the description of the plate and was the one correctly accepted by Panzer; in the text, by error, he used the specific name *verrucosus*. I have found no references in algological literature to Houttuyn's species.

FUNGI

Fomes Fries

Fomes sp. ?

Helvella subterranea* Houtt. Nat. Hist. II. **14: 649. *t. 105. f. 3.* 1783; Panzer, Pflanzensyst. **13**(1): 509. 1786, **13**(2): *t. 105. f. 3.* 1787.

This was clearly indicated as a new species by "mihi" following Houttuyn's description. It was based on a specimen from the Dorothea silver mine, Clausthal, in the Hartz Mountains, Germany. It is perhaps a sterile polyporaceous plant, possibly *Fomes* sp.

Hexagonia Fries

Hexagonia sp.

Peziza limbosa* Houtt. Nat. Hist. II. **14: 659. *t. 105. f. 5.* 1783; Panzer, Pflanzensyst. **13**(1): 521. 1786, **13**(2): *t. 105. f. 5.* 1787.

This was clearly indicated by Houttuyn as a new species, his description being based on a specimen from Ceylon. It is perhaps the same as

*Throughout this paper those binomials preceded by an asterisk indicate those that do not appear in "Index Kewensis" or its supplements published to date; or if they appertain to cryptogamous plants, do not appear in the standard works appertaining to the fungi, mosses, and pteridophytes. In some cases the asterisk has been added where currently accepted citations are radically wrong.

Hexagonia Königii Berk., type also from Ceylon, but which is reduced by some authors to *H. apiaria* Fries, Epicr. Syst. Myc. 497. 1836–38; Sacc. Syll. Fung. **6**: 358. 1888 (*Polyporus apiarius* Pers. in Gaudich. Bot. Frey. Voy. 169. *t. 2. f. 2.* 1826), type from Rawak. In such case Houttuyn's specific name would have priority.

BRYACEAE

Bryum Dillenius

Bryum argenteum Linn. Sp. Pl. 1120. 1753; Panzer, Pflanzensyst. **13**(2): 257. 1787.

Bryum argentatum* Houtt. Nat. Hist. II. **14: 438. 1783.

Houttuyn's slight change in the specific name was doubtless unintentional. *Bryum argentatum* C. Muell. Bot. Jahrb. **5**: 83. 1883, from Ascension Island, apparently needs a new name.

POLYPODIACEAE

Asplenium Linnaeus

Asplenium Trichomanes Linn. Sp. Pl. 1080. 1753; Houtt. Nat. Hist. II. **14**: 130. 1783.

Asplenium trichomanoides* Linn. Syst. Nat. ed. 12, **2: 690. 1867; Panzer, Pflanzensyst. **13**(1): 145. 1786.

Panzer followed Linnaeus, Syst. Nat. ed. 12, **2**: 690: 1767, in adopting the specific name *trichomanoides,* rather than accepting the original spelling of 1753, *Trichomanes*. By error Christensen indicates it in his "Index filicum" as: "*A trichomanoides* Houtt. Pfl. Syst. **13**[1]: 145. 1786." The original author is Linnaeus, not Houttuyn; Christensen's reference is to Panzer's work, not that of Houttuyn.

Cyrtomium Presl

Cyrtomium falcatum (Linn. f.) Presl, Tent. Pterid. 86. 1836.

Polypodium falcatum Linn. f. Suppl. 446. 1781.
Polypodium japonicum Houtt. Nat. Hist. II. **14**: 167. *t. 98. f. 3.* 1783, Panzer, Pflanzensyst. **13**(1): *t. 98. f. 3.* 1786.
Polystichum falcatum Diels in Engl. & Prantl, Nat. Pflanzenfam. I. **4**: 194. 1899.

Houttuyn's species, clearly indicated by him as new, was based on a Japanese specimen received from Thunberg. The entry in Christensen's "Index filicum" is correct for both the Houttuyn and the Panzer references.

Cyclophorus Desvaux

Cyclophorus hastatus (Thunb.) C. Chr. Ind. Fil. 199. 1905.

Acrostichum hastatum* Thunb. in Houtt. Nat. Hist. II. **14: 68. *t. 95. f. 2.* 1783; Thunb. Fl. Jap. 331. *t. 34.* 1784; Panzer, Pflanzensyst. **13**(1): 79. *t. 95. f. 2.* 1786.

Christensen gives Thunberg, Fl. Jap. 331. *t. 34.* 1784 as the place of publication of *Acrostichum hastatum* Thunb., but the binomial was actually published one year earlier by Houttuyn.

Didymochlaena Desvaux

Didymochlaena truncatula (Sw.) J. Sm. Jour. Bot. Hook. **4:** 196. 1842.

Aspidium truncatulum Sw. Jour. Bot. Schrad. **1800**(*2*) : 36. 1801.
Adiantum lunulatum Houtt. Nat. Hist. II. **14:** 209. *t. 100. f. 1.* 1783; Panzer, Pflanzensyst. **13**(1) : *252. t. 100. f. 1.* 1786; non Burm. f. 1768.

Houttuyn clearly indicated his species as new, although his specific name was invalidated by the earlier *Adiantum lunulatum* Burm. f. (1768) = *A. philippense* Linn. Christensen's entry in the "Index filicum" is correct for both Houttuyn's and Panzer's references except that in the first there is no citation of the illustration.

Dryopteris Adanson

Dryopteris sophoroides (Thunb.) O. Ktze. Rev. Gen. Pl. 813. 1891.

Polypodium sophoroides Thunb. Trans. Linn. Soc. **2:** 341. 1794.
Polypodium acuminatum* Houtt. Nat. Hist. II. **14: 181. *t. 99. f. 2.* 1783.
Polypodium dichotomum Panzer, Pflanzensyst. **13**(1) : 204. *t. 99. f. 2.* 1786; non Thunb. (1784).
Dryopteris acuminata Nakai, Bot. Mag. Tokyo **42:** 217. 1928; Ching, Sinensia **3:** 323. 1933; non Watts (1916).

Polypodium acuminatum Houtt. was clearly indicated as a new species. The entry in Christensen's "Index filicum," by error, is to "Houtt. Pfl. Syst. **13**[1] **:** 204. *t. 99. f. 2.* 1786." *Polypodium dichotomum* Panzer is a new name, not indicated as such, the first entry in Christensen being, by error, to "Houtt. Nat. Hist. **14:** 181. 1783," the second reference to the "Pflanzensyst." being correct. Houttuyn's specimen was from Japan, received by him from Thunberg. Nakai has clearly shown that *Polypodium acuminatum* Houtt. is identical with *P. sophoroides* Thunb., but the specific name selected by Houttuyn is invalid in *Dryopteris*.

Microlepia Presl

Microlepia marginata (Panzer) C. Chr. Ind. Fil. 212. 1905; 427. 1906.

Polypodium marginatum Panzer, Pflanzensyst. **13**(1) : 199. 1786.
Polypodium marginale Thunb. ex Murr. Syst. Veg. ed. 14, 937. 1784, Fl. Jap. 337. 1784, non Linn. 1753.

Christensen, "Index filicum" 427. 1906 erroneously cites Houttuyn as the author of *Polypodium marginatum*. Houttuyn did not consider the species but Panzer interpolated it in his "Pflanzensystem" taking his

description from Thunberg's "Flora Japonica," and deliberately proposing a new name *marginatum* because the specific name that Murray and Thunberg used was invalidated in *Polypodium* by the earlier *P. marginale* Linn. = *Dryopteris marginalis* A. Gray.

Microlepia strigosa (Thunb.) Presl, Epim. 95. 1849.

Trichomanes strigosum Thunb. Fl. Jap. 339. 1784.
Polypodium cristatum sensu Houtt. Nat. Hist. II. **14**: 183. *t. 99. f. 3.* 1783; Panzer, Pflanzensyst. **13**(1): 208. *t. 99. f. 3.* 1786, *quoad nota et illus.*; non Linn.

Christensen's entry in his "Index filicum" is to Houttuyn in Panzer's work of 1786. Houttuyn considered the European *Polypodium cristatum* Linn. = *Dryopteris cristata* A. Gray, but following the entry he discussed and illustrated a Japanese plant that he thought might represent the Linnaean species. It is the very different *Microlepia strigosa* (Thunb.) Presl.

Nephrolepis Schott

Nephrolepis acuminata (Houtt.) Kuhn, Ann. Mus. Bot. Lugd-Bat. **4**: 286. 1869.

Ophioglossum acuminatum Houtt. Nat. Hist. II. **14**: 49. *t. 94. f. 3.* 1783; Panzer, Pflanzensyst. **13**(1): 53. *t. 94. f. 3.* 1786.

A characteristic Malaysian species, Houttuyn's type being from Java. The entry in Christensen's "Index filicum" is correct except that the page reference is given as 94, and there is no reference to the plate and figure. This was clearly indicated by Houttuyn as a new species.

Pellaea Link

Pellaea pteroides (L.) Prantl, Bot. Jahrb. **3**: 420. 1882.

Adiantum pteroides Linn. Mant. **1**: 130. 1767; Houtt. Nat. Hist. II. **14**: 218. 1783.
Adiantum pteridioides* Panzer, Pflanzensyst. **13(1): 264. 1786.
Pteris orbiculata Houtt. Nat. Hist. II. **14**: 108. *t. 96. f. 3.* 1783; Panzer, Pflanzensyst. **13**(1): 120. *t. 96. f. 3.* 1786.

The entry for *Pteris orbiculata* Houtt. in Christensen's "Index filicum" is essentially correct except that he did not cite the illustration in the first reference. The reduction is manifestly correct. *Pteris orbiculata* Houtt. was clearly indicated as a new species, his specimen being from South Africa. *Adiantum pteridioides* Panzer was doubtless due to an error in transcribing the Linnaean binomial.

Polypodium Linnaeus

Polypodium trilobum Houtt. Nat. Hist. II. **14**: 148. *t. 98. f. 1.* 1783; Panzer, Pflanzensyst. **13**(1): 166. *t. 98. f. 1.* 1786.

Polypodium incurvatum Blume, Enum. Pl. Jav. 126. 1828, Fl. Jav. Fil. 151. *t. 65.* 1828; v. Ald. v. Ros. Mal. Ferns 663. 1909.

Houttuyn's species is listed by Christensen "Index filicum" as "Houtt. Hist. Nat. **14:**—t—1783, ed. Germ. Pfl. Syst. **13**[1]**:** 166. *t. 98. f. 1.* 1786—Batavia." No reduction was indicated. *Polypodium trilobum* Houtt., indicated by Houttuyn as new, replaces *P. incurvatum* Blume. His type was from Java.

Pteris Linnaeus

Pteris ensiformis Burm. f. Fl. Ind. 230. 1768; Houtt. Nat. Hist. II. **14:** 92. 1783.

Pteris ensifolia* Panzer, Pflanzensyst. **13(1): 106. 1786, non Poir.

Acrostichum trifoliatum* Houtt. Nat. Hist. II. **14: 79. *t. 95. f. 3.* 1783; Panzer, Pflanzensyst. **13**(1): 90. *t. 95. f. 3.* 1786, *in nota et quoad illus.;* non Linn.

Panzer's use of the specific name *ensifolia* was doubtless due to an error in transcription. Houttuyn's illustration of *Acrostichum trifoliatum* was based on a Ceylon specimen, briefly discussed in a note following the entry *Acrostichum trifoliatum* Linn. (= *Trismeria trifoliata* Diels). The entry in Christensen's "Index filicum" is to Panzer's work, not to Houttuyn's original. This is a case where the citation should probably be *sensu* Houtt., non Linn., for Houttuyn did not intend *Acrostichum trifoliatum* as a new binomial.

Quercifilix Copeland

Quercifilix zeilanica (Houtt.) Copel. Philip. Jour. Sci. **37:** 409. 1928, as *zeylanica.*

Ophioglossum zeilanicum Houtt. Nat. Hist. II. **14:** 43. *t. 94. f. 1.* 1783; Panzer, Pflanzensyst. **13**(1): 47. *t. 94. f. 1.* 1786.
Osmunda trifida Jacq. Coll. **3:** 281. *t. 20. f. 3.* 1789.
Acrostichum quercifolium Retz. Obs. **6:** 39. 1791.
Onoclea quercifolia Willd. Schrift. Ak. Erfurt. **1802:** 27. 1802.
Gymnopteris quercifolia Bernh. Schrad. Neu. Jour. Bot. **1**(2): 20. 1806.
Dendroglossa quercifolia Fée, Gen. 80. *t. 7B. f. 3.* 1850–52.
Polybotrya quercifolia Mett. Fil. Lechl. **2:** 12. 1859.
Leptochilus zeylanicus C. Chr. Ind. Fil. 16. 1905, 388. 1906.

The entry in Christensen's "Index filicum" is correct, except that the specific name is spelled *zeylanica.* The species was clearly indicated by Houttuyn as new.

Woodwardia Smith

Woodwardia orientalis Sw. Jour. Bot. Schrad. **1800**(2): 76. 1801.

Blechnum japonicum Houtt. Nat. Hist. II. **14:** 113. *t. 97. f. 1.* 1783, *in nota;* Panzer, Pflanzensyst. **13**(1): 124. *t. 97. f. 1.* 1786; non Linn. f. (1781).

Blechnum japonicum Houtt., not indicated as a new species, except in the description "als een nieuwe soort," was casually published independently of *Blechnum japonicum* Linn. f. Suppl. 445. 1781 = *Woodwardia japonica* (Linn. f.) Sm. *Woodwardia orientalis* Sw. is often placed as a synonym of *W. radicans* Sm.

GLEICHENIACEAE

Gleichenia Smith

Gleichenia glauca (Thunb.) Hook. Sp. Fil. **1**: 4. *t. 3B*. 1844.

Polypodium glaucum* Thunb. in Houtt. Nat. Hist. II. **14: 177. 1783; Thunb. in Murray, Syst. Veg. ed. 14, 938. 1784; Thunb. Fl. Jap. 338. 1784; Panzer, Pflanzensyst. **15**(1): 200. 1786.

I am not certain that the species described by Houttuyn in 1783 as *Polypodium glaucum* is the same as the one described by Thunberg in 1784 under the same name, although Houttuyn's specimen was from Thunberg, and "met den nevensgaanden bynaam gedoopt." Panzer, however, repeats the description of *Polypodium glaucum* Thunb. on p. 239 and that of Houttuyn, with a discussion, on p. 200, crediting the latter binomial to Houttuyn, considering that the fern Thunberg described in Murray, Syst. Veg. ed. 14, 938. 1784, and Thunb. Fl. Jap. 338. 1784 as *Polypodium glaucum* represents a species different from the one Houttuyn described under Thunberg's binomial one year earlier.

Gleichenia linearis (Burm. f.) C. B. Clarke, Trans. Linn. Soc. II. Bot. **1**: 428. 1880.

Polypodium lineare Burm. f. Fl. Ind. 235. *t. 67. f. 2*. 1768.
Polypodium pedatum Houtt. Nat. Hist. II. **14**: 175. 1783; Panzer, Pflanzensyst. **13**(1): 196. 1786.

The entry in Christensen's "Index filicum" is essentially correct, except that he credited both references to Houttuyn; the second one is to Panzer's work. Houttuyn's material was from Japan; he clearly indicated his species as a new one.

OSMUNDACEAE

Osmunda Linnaeus

Osmunda lancea Thunb. in Murr. Syst. Veg. ed. 13, 928. 1784, Fl. Jap. 330. 1784.

Osmunda japonica Houtt. Nat. Hist. II. **14**: 57. *t. 95. f. 1*. 1783; Panzer, Pflanzensyst. **13**(1): 62. *t. 95. f. 1*. 1786, *in nota*, non Thunb. Nova Acta Soc. Sci. Upsal. II. **3**: 209. 1780 (reprint Miscel. Pap. Jap. Pl. Thunb. 23. 1935), Fl. Jap. 330. 1784.

The form Houttuyn described, but did not indicate as a new species, is clearly, as Panzer indicated, the one characterized by Thunberg in

1784 as *O. lancea* Thunb. Christensen, "Index filicum," gives the citation to Panzer's work (erroneously crediting this to Houttuyn), querying: "an etiam in Houtt. Nat. His. **14:** 1783?" The two citations refer to the same species. The entry in the "Index filicum" for **Osmunda japonica* Thunb. should be changed to read Nova Acta Soc. Sci. Upsal. II. **3:** 209. 1780, as Thunberg fortunately published a formal diagnosis of it here four years before it appeared in his "Flora Japonica."

OPHIOGLOSSACEAE

Botrychium Swartz

Botrychium virginianum (Linn.) Sw. Schrad. Jour. **1800**(2): 111. 1801.

Osmunda virginiana Linn. Sp. Pl. 1064. 1753; Houtt. Nat. Hist. II. **14:** 52. 1783.

Osmunda virginica* Linn. Syst. Nat. ed. 12, **2: 685. 1767; Murr. Syst. Veg. ed. 13, 779. 1774; Reichard, Syst. Pl. 379. 1780; Panzer, Pflanzensyst. **13**(1): 57. 1786.

The entry in C. Christensen, "Index filicum," by error, is "Houtt. Pfl. Syst. **13**[1]**:** 57. 1786." The original author was Linnaeus.

GRAMINEAE

Anthephora Schreber

Anthephora hermaphrodita (L.) O. Ktze. Rev. Gen. Pl. **2:** 759. 1891; Hitchc. Man. Gr. West Ind. 98. *f. 58*. 1936.

Tripsacum hermaphroditum Linn. Syst. Nat. ed. 10, **2:** 1261. 1759; Houtt. Nat. Hist. II. **13:** 509. 1782.

Tripsacum hermaphroditicum* Panzer, Pflanzensyst. **12: 655. 1785.

Anthephora elegans Schreb. Beschr. Gräs. **2:** 105. *t. 44*. 1810.

Panzer's slight change in the specific name was probably an inadvertent one.

Bromus Linnaeus

Bromus ciliatus Linn. Sp. Pl. 76. 1753; Houtt. Nat. Hist. II. **13:** 313. 1782; Britt. & Brown, Illus. Fl. N. States Canada ed. 2, **1:** 276. *f. 666*. 1913.

Bromus ciliaris* Panzer, Pflanzensyst. **12: 429. 1785.

The publication of the specific name *ciliaris* by Panzer was undoubtedly due to an error in transcription on his part.

Chloris Swartz

Chloris capensis (Houtt.) comb. nov.

Andropogon capense* Houtt. Nat. Hist. II. **13: Aanwyz. Plaat. [2]. *t. 103*.

f. 3. 1782; Panzer, Pflanzensyst. **12:** Verzeich. Kupfertaf. [4]. *t. 93. f. 3.* 1785.

Andropogon muticus sensu Houtt. op. cit. 579, Panzer, op. cit. 758, non Linn.

Chloris petraea Thunb. Prodr. Pl. Cap. 20. 1794; Stapf in Thiselton-Dyer, Fl. Cap. **7:** 643. 1900, *cum. syn.*

Stapf cites both of the Houttuyn synonyms but *Andropogon capense* Houtt. escaped the notice of the compilers of "Index Kewensis" and its supplements. The type of *Andropogon muticum* Linn. Sp. Pl. ed. 2, 1482. 1763 was a specimen from the Cape of Good Hope, but there is no specimen in the Linnaean herbarium. From the description it seems clearly not to be the same as *Chloris petraea* Thunb.

Danthonia de Candolle

Danthonia lupulina (Linn. f.) Roem. & Schult. Syst. **2:** 690. 1817; Stapf in Thiselton-Dyer, Fl. Cap. **7:** 523. 1899.

Avena lupulina* Linn. f. Suppl. 113. 1781; Panzer, Pflanzensyst. **12: 489. 1785; Thunb. Prodr. Pl. Cap. 23. 1794.

The original description of *Avena lupulina* Linn. f. was based on a specimen from Thunberg, but the younger Linnaeus published his description twelve years in advance of Thunberg; Houttuyn did not include it in his "Natuurlyke historie."

Festuca Linnaeus

Festuca maritima Linn. Sp. Pl. 75. 1753; Aschers. & Graebn. Syn. Mittel-Europ. Fl. **2**(1)**:** 540. 1900; Hegi, Ill. Fl. Mittel-Europ. **1:** 330. 1908.

Triticum hispanicum* Reichard, Syst. Pl. **1: 240. 1779.

Triticum hispanicum* Houtt. Nat. Hist. II. **13: 441. 1782.

Triticum hispanicum Willd. Sp. Pl. **1:** 479. 1797.

Houttuyn's binomial, not, however, indicated as new, was based on a reference to "*Triticum* Cal. sexfloris, Flosc. secundis, apice Aristatis Mant. 325" (i.e., Linn. Mant. **2:** 325. 1771) and on "*Festuca* (*maritima*) spica lineari secunda recta. Flor. adpressis subaristatis, Sp. Pl. II. p. 110. Loefl. Itin. 44." The slightly earlier *Triticum hispanicum* Reich., also overlooked in "Index Kewensis," was based on the same references. The description in the second edition of the "Species Plantarum" does not differ from that in the first edition except in the addition of the page in the Loefling reference. Its basis was a Loefling specimen from Spain. Jackson states that the original specimen of *Festuca maritima* Linn. is not in the Linnaean herbarium. However, in the *Triticum* cover is a specimen marked in Linnaeus' handwriting "maritima 6"; this is

Festuca maritima Linn., *Festuca* no. 6 of the first edition of the "Species Plantarum." Preceding the specific name, in an unknown handwriting, is the name *Festuca*. Sir James Smith added the name *Triticum hispanicum* Reich. This specimen, judged from an excellent photograph courteously supplied by Mr. S. Savage, is unquestionably the type of *Festuca maritima* Linn., and is that species as it is currently interpreted by modern botanists. Linnaeus' annotations show that he did confuse this *Festuca maritima* (Sp. Pl. 75. 1753, and ed. 2, 110. 1762) with *Triticum maritimum* (Sp. Pl. ed. 2, 128. 1762), but probably this confusion occurred after the publication of the second edition of the work, as the first paragraph and diagnosis of *T. maritimum* is *Cutanda maritima* (Linn.) Benth. which was based on the former name. *Triticum maritimum* Linn. Mant. **2:** 325. 1771. "cum flores *omnino* spicati," showing it to be different from *Triticum maritimum* of Sp. Pl. ed. 2. 1762, is invalid. I agree with Mrs. Agnes Chase, to whom my data were submitted, that *Triticum hispanicum* Willd. Sp. Pl. **1:** 479. 1797, based on *Triticum maritimum* Linn. Mant. **2:** 325. 1771, with the diagnosis of *Festuca maritima* Linn. quoted, must be *Festuca maritima* Linn., and that the earlier *Triticum hispanicum* Reich. (1779) and *Triticum hispanicum* Houtt. (1782) represent the same species. In the "Mantissa" **2:** 325. 1771, Linnaeus, who in the meantime had apparently transferred the specimen from the *Festuca* to the *Triticum* cover in his herbarium, entered the species under *Festuca* as: "maritim. TRITICUM calycibus sexfloris" etc., excluding the Scheuchzer reference in the first edition of the "Species Plantarum."

Ischaemum Linnaeus

Ischaemum muticum Linn. Sp. Pl. 1049. 1753; Hack. in DC. Monog. Phan. **6:** 212. 1889.

Agrostis javanica* Houtt. Nat. Hist. II. **13: Aanwyz. Plaat. [2]. *t. 90. f. 5.* 1782; Panzer, Pflanzensyst. **12:** Verz. Kupfertaf. [2]. *t. 90. f. 5.* 1785.

There is no indication that *Agrostis javanica* Houtt. was a new binomial. In Houttuyn's text **13:** 225 it appears following number 19, *Agrostis mexicana* Linn. merely indicated as "*Javaansche,*" and in Panzer's text **12:** 299 as "eines javanischen Grases." Kunth, Enum. **1:** 512. 1833 cites "Agrostis javanica Burm. *herb.*" as a synonym of *Ischaemum muticum* Linn., and the "Index Kewensis" entry is "Burm. ex Kunth, Enum. Pl. i. 512 = *Ischaemum muticum.*" The Burman specimen at Geneva shows no evidence that it was from Houttuyn. The species is a very common and characteristic one occurring along the

seashore from India through Malaysia to tropical Australia, New Caledonia, Micronesia and western Polynesia.

Ischaemum indicum (Houtt.) comb. nov.

Phleum indicum* Houtt. Nat. Hist. II. **13: 198 *t. 90. f. 2.* 1782; Panzer, Pflanzensyst. **12**: 259. *t. 90. f. 2.* 1785.

Ischaemum ciliare Retz. Obs. **6**: 36. 1791; Hack. in DC. Monog. Phan. **6**: 225. 1889.

Houttuyn's material was from Java and his species was clearly indicated as a new one as indicated by *mihi* following the short Latin diagnosis. Houttuyn's illustration is a reasonably good one for this widely distributed grass, currently known as *Ischaemum ciliare* Retz., which is common in Java. More definitely Houttuyn's species seems to be the same as *Ischaemum ciliare* Retz. var. *genuinum* Hack., *3. malacophyllum* (Hochst.) Hack. in DC. Monog. Phan. **6**: 226. 1889.

Miscanthus Andersson

Miscanthus japonicus (Houtt.) Anders. Oefv. Vet. Akad. Förhandl. Stockh. **1855**: 165. 1856; Hack. in DC. Monog. Phan. **6**: 107. 1889.

Saccharum japonicum* Houtt. Nat. Hist. II. **13: Aanwyz. Plaat. [1]. *t. 89. f. 1.* 1782; Panzer, Pflanzensyst. **12**: Verzeich. Kupfertaf. [3]. *t. 89. f. 1.* 1785; Thunb. Trans. Linn. Soc. **2**: 328. 1794.

In his text, page 146, Houttuyn gives a cursory description, following *Saccharum officinarum* Linn., of a Japanese form that he did not there name; he published the binomial *Saccharum japonicum* only in the explanation of the plates, as did Panzer. In Panzer's work the description appears in **12**: 195. Andersson based *Miscanthus japonicus* on *Saccharum japonicum* Thunb. (1794), but Houttuyn actually published the latter binomial six years earlier. His specimen was received from Thunberg.

Perotis Aiton

Perotis indica (Linn.) O. Ktze. Rev. Gen. Pl. 787. 1891.

Anthoxanthum indicum Linn. Sp. Pl. 28. 1753.

Perotis latifolia Ait. Hort. Kew. **1**: 85. 1789.

Alopecurus bengalensis* Houtt. Nat. Hist. II. **13: 206. *t. 90. f. 4.* 1782; Panzer, Pflanzensyst. **12**: 272. *t. 90. f. 4.* 1785.

Alopecurus bengalensis Houtt. was clearly indicated as a new species as evidenced by the addition of *mihi* following the short Latin diagnosis. The illustration seems clearly to represent the common Indo-Malaysian *Perotis indica* (Linn.) O. Ktze.

Stipa Linnaeus

Stipa sp.

Aristida avenacea* Guettard ex Houtt. Nat. Hist. II. **13: 375. 1782; Panzer, Pflanzensyst. **12**: 512. 1785.

Houttuyn gives the reference as "Guett. *Mem. des Sciences & Arts* Tom I—p. 19 T. 1" which was repeated by Panzer; this was published in 1768. Here Guettard gives a long description of this grass, illustrated by two plates. His data were based on plants grown in France from seeds originating in the Ukraine. Although he provided a short Latin diagnosis and considered the species to be undescribed, he published no binomial, speaking of the grass as the "Tirsa" of the Cossacks. The binomial and its authority dates from Houttuyn's use of it in 1782. Mrs. Agnes Chase, to whom copies of the descriptions and illustrations were sent, reports that she was unable to place *Aristida avenacea* Guettard, to her satisfaction, among the known European species of *Stipa* and *Oryzopsis*, but suggests that possibly *Stipa tortilis* Desv. might be the species intended. The Guettard publication is Mém. Sci. Arts **1**: 19. *t. 1, 2*. 1768, item 3631 of Pritzel's "Thesaurus."

Cyperaceae

Carex Linnaeus

Carex cyperoides Murr. Syst. Veg. ed. 13, 703. 1774 (*cyperoideus*); Christm. Pflanzensyst. **12**: 664. 1785; Kükenth. Pflanzenr. **38(IV.20)**: 191. *f. 31 G-H*. 1909.

Carex cyperoidea* Houtt. Nat. Hist. II. **13: 517. 1782.

The slight change in the specific name by Houttuyn was probably due to an error in transcription.

Cyperus Linnaeus

***Cyperus javanicus** Houtt. Nat. Hist. II. **13**: Aanwyz. Plaat. [1]. *t. 88. f. 1.* 1782; Panzer, Pflanzensyst. **12**: Verzeich. Kupfertaf. [3]. *t. 88. f. 1.* 1785.

Cyperus pennatus Lam. Illustr. **1**: 144. 1791; Kükenth. Pflanzenr. **101 (IV.20)**: 476. *f. 53A-G*. 1936, *cum syn.*

Following *Cyperus difformis* Linn., Houttuyn, **13**: 68, gives a cursory description of this form without a binomial, but in the description of the plate actually published *Cyperus javanicus*. In Panzer's work it appears also without a binomial, **12**: 92. The illustration is an excellent one for this widely distributed plant which is a characteristic and abundant one growing near the sea throughout the Indo-Malaysian and Polynesian regions. Kükenthal cites over 20 synonyms. Its most common name in

standard literature is *Mariscus albescens* Gaudich. For *Cyperus javanicus* Kükenth. Repert. Sp. Nov. **29:** 194. 1931, Pflanzenreich **101(IV. 20):** 319. 1936, which is no longer valid for the species Kükenthal described, I propose **Cyperus Kükenthalii** nom. nov.

Eriophorum Linnaeus

Eriophorum virginicum Linn. Sp. Pl. **52:** 1753; Panzer, Pflanzensyst. **12:** 162. 1785; Britt. & Br. Ill. Fl. N. States Canada **1:** 273. *f. 643.* 1896, ed. 2, **1:** 326. *f. 800.* 1913.

Eriophorum virginianum* Houtt. Nat. Hist. II. **13: 127. 1782.

There is no evidence that Houttuyn deliberately changed the form of the specific name; Panzer three years later accepted the form as published by Linnaeus.

Scleria Bergius

Scleria zeylanica Poir. in Lam. Encycl. **7:** 3. 1806; Trimen, Fl. Ceyl. **5:** 97. 1900.

Juncus zeilanicus* Houtt. Nat. Hist. II. **13: Aanwyz. Plaat. [2]. *t. 93. f. 1.* 1782; Panzer, Pflanzensyst. **12:** Verzeich. Kupfertaf. [4]. *t. 93. f. 1.* 1785 (*zeylonicus*).

Houttuyn provided a cursory description of *Juncus zeilanicus* in the text, op. cit. 463, following *J. bulbosus* Linn., as did Panzer, **12:** 612, but the binomial appears only in the explanations of the plates in both works. The description clearly appertains to *Scleria,* for Houttuyn speaks of the pearl-like round seed. From the illustration it seems clear that *Scleria zeylanica* Poir. is the species represented, although Poiret's specific name was published without reference to Houttuyn's earlier one. Buchenau, in his monographic treatment of the Juncaceae, Pflanzenr. **25(IV.36):** 263. 1906, cites "*J. zeylanicus* Houttuyn, Linne's Pflanzen-System XII. (?) 62, *t. 39. f. 1;* t. E. Mey. Synops. Juncor. (1822) 59, 66," among the excluded species, but does not indicate the group to which it belongs.

ARACEAE

Acorus Linnaeus

Acorus Calamus Linn. Sp. Pl. 324. 1753.

Acorus verus* Houtt. Nat. Hist. II. **8: 379. 1777.

This is clearly referable to *Acorus Calamus* Linn. The binomial was not indicated as a new one, and there is no formal description or Latin diagnosis. The form Houttuyn named is the common one of the Old World tropics. Christmann, Pflanzensyst. **6:** 354–356. 1780, recognized only *A. Calamus* Linn.

Homalomena Schott

Homalomena cordata Schott, Melet. **1**: 20. 1832; Engl. & Krause, Pflanzenr. **55(IV.23 Da.)**: 57. *f. 35*. 1912, *cum syn.*

Dracontium cordatum Houtt. Nat. Hist. II. **11**: 200. *t. 71. f. 2*. 1779; Panzer, Pflanzensyst. **10**: 151. *t. 71. f. 2*. 1783; non Aubl. 1775.

Houttuyn clearly indicated his species as a new one, it being based on Javan material. The species has been more or less confused with *Homalomena aromatica* (Roxb.) Schott, which is an Indian species, while the present one is known only from Java. Some botanists would doubtless consider that Houttuyn's specific name, being invalid in *Dracontium*, would hence not be available for transfer to *Homalomena*, yet this is permissible under the present rules of nomenclature by considering Schott's binomial as a new name.

Bromeliaceae

Aechmea Ruiz & Pavon

Aechmea lingulata (Linn.) Baker, Jour. Bot. **17**: 164. 1879.

Bromelia lingulata Linn. Sp. Pl. 285. 1753; Christm. Pflanzensyst. **6**: 299. 1780.

Bromelia lingularia* Houtt. Pflanzensyst. II. **8: 319. 1777.

Houttuyn's specific name *lingularia* was doubtless due to an inadvertent error on his part in transcribing the binomial.

Liliaceae

Eucomis L'Héritier

Eucomis comosa (Houtt.) comb. nov.

Asphodelus comosus Houtt. Nat. Hist. II. **12**: 336. *t. 83*. 1780; Panzer, Pflanzensyst. **11**: 381. *t. 83*. 1784.

Eucomis punctata L'Hér. Sert. Angl. 11. *t. 18*. 1788; Baker in Thiselton-Dyer, Fl. Cap. **6**: 475. 1897.

Fritillaria punctata Gmel. Syst. Nat. **2**: 545. 1791.

Ornithogalum punctatum Thunb. Prodr. Pl. Cap. 62. 1794.

Basilaea punctata Mirb. Hist. Nat. Pl. **8**: 339. 1804.

Houttuyn's species was described from a plant originating in South Africa, flowering in Leiden. He did not indicate it as a new species, yet the short Latin diagnosis is followed by his name. The "Index Kewensis" entry is to "Houtt. Plantenk. XII. 336. t. 83" and the species is correctly reduced to *Eucomis punctata* L'Hér.; Houttuyn's specific name is the oldest one and should be adopted.

Fritillaria Linnaeus

Fritillaria imperialis Linn. Sp. Pl. 303. 1753; Houtt. Nat. Hist. II. **12**: 247. 1780.

******Fritillaria corona imperialis* Panzer, Pflanzensyst. **11**: 276. 1784.

Panzer did not indicate his binomial as a new name. Whether or not its publication was deliberate or accidental cannot be determined. In any case the specific name is a direct translation of the French common name *couronne imperiale* cited in the text.

Hosta Trattinick

Hosta lancifolia (Thunb.) Engl. in Engl. & Prantl Nat. Pflanzenfam. **2**(5): 40. 1888; Stearn, Gard. Chron. III. **90:** 48. 1931, *cum syn.*

Hemerocallis lancifolia Thunb. Trans. Linn. Soc. **2**: 335. 1794.

Aletris japonica Thunb. Nova Acta Soc. Sci. Upsal. **3**: 204, 208. 1780, Misc. Pap. Jap. Pl. Thunb. 18, 22. 1935 (facsimile reprint); Houtt. Nat. Hist. II. **12**: 413. *t. 84. f. 2.* 1780; Panzer, Pflanzensyst. **11**: 486. *t. 84. f. 2.* 1784; non *Hosta japonica* Tratt.

Hosta japonica Voss, Vilmor. Blumeng. **1**: 1076. 1895; L. H. Bail. Gent. Herb. **2**: 129. *f. 65.* 1930; non Tratt.

Houttuyn's specimen was received from Thunberg under the name he published, and I therefore interpret the *mihi* at the end of the Latin diagnosis to mean that Houttuyn was the author of the diagnosis but scarcely of the binomial. The "Index Kewensis" reference, by error, is actually to Panzer's work rather than to Houttuyn's, and the reduction to *Funkia obcordata* is an error. The figure cited in the L. H. Bailey reference is a photographic reproduction of Thunberg's type specimen; a cursory comparison of Houttuyn's figure with Bailey's illustration shows that both manifestly refer to the same species which one would suspect from the single source of the material on which both illustrations were based.

Lilium Linnaeus

Lilium candidum Linn. Sp. Pl. 302. 1753; Panzer, Pflanzensyst. **11**: 261. 1784.

******Lilium album* Houtt. Nat. Hist. II. **12**: 228. 1780.

In publishing the binomial *Lilium album,* which Houttuyn erroneously ascribed to Linnaeus, he inadvertently wrote "album" in place of "candidum," the names having a very similar connotation. There is no "*Lilium album*" other than Houttuyn's accidental publication of this binomial.

***Lilium japonicum** Thunb. in Houtt. Nat. Hist. II. **12**: 245. *t. 82. f. 2.* 1780; Panzer, Pflanzensyst. **11**: 275. *t. 82. f. 2.* 1784, *in nota;* Thunb. Fl. Jap. 133. 1784.

Houttuyn published this binomial four years before it appeared in

Thunberg's work. His material was received from Thunberg under this binomial.

Lilium pomponium Linn. Sp. Pl. 302. 1753; Houtt. Nat. Hist. II. **12:** 234. 1780.

Lilium pomponicum* Panzer, Pflanzensyst. **11: 266. 1784.

Panzer's slight change was in all probability due to an error in transcribing the specific name.

Medeola Linnaeus

Medeola virginiana Linn. Sp. Pl. 339. 1753; Houtt. Nat. Hist. II. **8:** 416. 1777; Britt. & Br. Ill. Fl. N. States Canada **1:** 435, *f. 1042.* 1896, ed. 2, **1:** 523. *f. 1298.* 1913.

Medeola virginica* Christm. Pflanzenfam. **6: 389. 1790.

Christmann's use of the specific name *virginica* was doubtless due to an error in transcription on his part.

Ornithogalum Linnaeus

Ornithogalum thyrsoides Jacq. Hort. Vind. **3:** 17. *t. 28.* 1776; Baker in Thiselton-Dyer, Fl. Cap. **6:** 499. 1897.

Ornithogalum dubium Houtt. Nat. Hist. II. **12:** 309. *t. 82. f. 3.* 1780; Panzer, Pflanzensyst. **11:** 347. *t. 82. f. 3.* 1784, *in nota.*

Baker definitely placed Houttuyn's species as a synonym of *Ornithogalum thyrsoides* Jacq. var. *aureum* (Curt.) Baker, op. cit. 500. Houttuyn's type was from the Cape of Good Hope region.

AMARYLLIDACEAE

Agave Linnaeus

***Agave sobolifera** Houtt. Nat. Hist. II. **8:** 374. 1777.

Aloe americana sobolifera Herm. Hort. Acad. Lugd.-Bat. Cat. 16. *t.* 1687.

Houttuyn's binomial was based on Hermann's detailed description and rather good illustration, the latter's data being based on a plant flowering in Leiden. If *A. sobolifera* Salm-Dyck, Hort. Dyck. 307, 309. 1834 be distinct, then it needs a new name. Christmann and Panzer did not recognize Houttuyn's species.

Nerine Herbert

Nerine sarniensis (Linn.) Herb. App. [Bot. Reg.] 19. 1821; Baker in Thiselton-Dyer, Fl. Cap. **6:** 209. 1896.

Amaryllis sarniensis Linn. Sp. Pl. 293. 1753.

Amaryllis dubia Houtt. Nat. Hist. II. **12:** 181. *t. 82. f. 1.* 1780; Panzer, Pflanzensyst. **11:** 198. *t. 82. f. 1.* 1784; non Linn.

This was indicated by Houttuyn as new, his type being a specimen from the Cape of Good Hope. It has nothing to do with the earlier *Amaryllis dubia* Linn. which is a *Hippeastrum*.

Polianthes Linnaeus

Polianthes tuberosa Linn. Sp. Pl. 316. 1753.

Crinum angustifolium* Houtt. Nat. Hist. II. **12: 165. *t. 81. f. 3.* 1780; Panzer, Pflanzensyst. **11:** 181. *t. 81. f. 3.* 1784.

Houttuyn's material was from Java, received under the name *mohanks*. His description and illustration clearly apply to the common *Polianthes tuberosa*, a native of tropical America, but introduced into the Old World tropics at an early date in European colonial history for cultivation as an ornamental plant. *Crinum angustifolium* Linn. f. (1781) and *C. angustifolium* R. Br. (1810) represent entirely different species.

IRIDACEAE

Antholyza Linnaeus

Antholyza revoluta Burm. f. Prodr. Fl. Cap. 1. 1768; Baker in Thiselton-Dyer, Fl. Cap. **6:** 169. 1896.

Gladiolus recurvus sensu Houtt. Nat. Hist. II. **12:** 49. *t. 79. f. 1.* 1780; Panzer, Pflanzensyst. **11:** 59. *t. 79. f. 1.* 1784; non Linn.

Houttuyn did not describe *Gladiolus recurvus* as new but one notes various references to it in literature as such; he thought his plant represented the Linnaean species. It should be cited *sensu* Houttuyn, non Linn.

Gladiolus Linnaeus

Gladiolus liliaceus Houtt. Nat. Hist. II. **12:** 55. *t. 79. f. 2.* 1780; Panzer, Pflanzensyst. **11:** 65. *t. 79. f. 2.* 1784.

The entry in "Index Kewensis" is "*liliaceus*, Houtt. Handleid. xii. 55 = angustus, gracilis." Houttuyn's figure does not conform to the published illustrations of either *Gladiolus angustus* Linn. or *G. gracilis* Jacq. Manifestly only a single species is represented, not a mixture of two separate ones. It is not accounted for by Baker in his treatment of the Iridaceae of South Africa, Thiselton-Dyer, Fl. Cap. **6:** 7–171. 1896. While it clearly belongs in the group with terete or slender leaves, I am not able, from my limited knowledge of the genus, to refer it definitely to any of the generally recognized species. Houttuyn's material was from the Cape of Good Hope.

Ixia Linnaeus

Ixia campanulata Houtt. Nat. Hist. II. **12:** 42. *t. 78. f. 4.* 1780; Panzer Pflanzensyst. **11:** 49. *t. 78. f. 4.* 1784; N. E. Br. Kew Bull. **1929:** 133. 1929.

Ixia speciosa Andr. Bot. Repos. **3:** *t. 186.* 1802; Baker in Thiselton-Dyer, Fl. Cap. **6:** 80. 1896.

In the preliminary draft of this paper I had accepted Baker's interpretation of *Ixia campanulata* Houtt. (Fl. Cap. **6:** 80. 1896) although with little confidence that he was correct, as his description is distinctly not good for the form Houttuyn illustrated. Baker described the perianth-tube as not longer than the spathes; Houttuyn's figure shows the spathes to be only about one-half as long as the perianth-tube. I am indebted to Miss W. F. Barker who called my attention to N. E. Brown's note, Kew Bull. **1929:** 133. 1929, in which he states: "But as I find *I. campanulata* to be identical with *Ixia speciosa* Andr., which was not published until 1801, the name **I. campanulata** Houtt. must supersede *I. speciosa.* The plant Baker (Fl. Cap. vi. 80) has wrongly identified with *I. campanulata* Houtt. must be given a new name, and all references and synonyms quoted by him under *I. campanulata* excluded. I propose for it the name **Ixia dispar** N. E. Br.—" Mr. Brown further states: "The type of Houttuyn's figure and description, published in 1780, is in Burmann's herbarium, and upon the sheet is written in pencil the name '*Ixia crateroides* Ker' in Salisbury's handwriting." But Dr. Charles Baehni, who looked up the specimen for me states that the sheet in the Burman herbarium is labelled in Burman's handwriting "*Ixia campanulata* Houtt., there being no evidence that it is a Houttuyn plant; it also carries Brown's determination label and *Ixia crateroides* Ker in Salisbury's handwriting.

Ixia maculata Linn. Sp. Pl. ed. 2, 1664. 1763; Baker in Thiselton-Dyer, Fl. Cap. **6:** 81 1896.

Ixia abbreviata Houtt. Nat. Hist. II. **12:** 41. *t. 78. f. 3.* 1780; Panzer, Pflanzensyst. **11:** 48. *t. 78. f. 3.* 1784.

This is the currently accepted reduction of Houttuyn's species, and is undoubtedly the correct disposition of it, as his figure agrees excellently with those of other authors representing the Linnaean species.

Ixia paniculata De la Roche, Descr. Pl. Nov. 25. *t. 1.* 1776; Baker in Thiselton-Dyer, Fl. Cap. **6:** 85. 1896.

Houttuynia capensis Houtt. Nat. Hist. II. **12:** 448. *t. 85. f. 3.* 1780; Panzer, Pflanzensyst. **11:** 523. *t. 85. f. 3.* 1784.

In the "Botanical Magazine" **17:** t. 618. 1803 Ker-Gawler illustrated and described a plant as *Tritonia capensis* which he based nomenclaturally on *Houttuynia capensis* Houtt. The plant he illustrated is *Acidanthera capensis* Benth.; Baker in Thiselton-Dyer, Fl. Cap. **6:** 133. 1896. As a result of Ker-Gawler's misinterpretation of Houttuyn's species, the genus *Houttuynia* Houtt. is erroneously placed as a synonym of *Acidanthera* Hochstetter, although it seems manifestly to appertain to *Ixia*. *Houttuynia* Houtt. (1780) has priority over *Houttuynia* Thunb. (1784), but as the latter name is in general use for a very different group of plants in the Saururaceae it seems desirable to conserve the saururaceous *Houttuynia* Thunb. (1784) with *Polypara* Lour. (1780), *Anemia* Nutt. (1838) and *Aneuropsis* Hook. (1838) as synonyms. Were *Houttuynia* Houtt. (1780) actually synonymous with *Acidanthera* Hochst. (1844), the latter, to be valid, would need to be conserved. Such action is no longer necessary with the present disposition of *Houttuynia* Houtt. as a synonym of *Ixia* Linn. Bentham, Gen. Pl. **3:** 706. 1883, sub *Acidanthera* states: "Houttuynia Houtt. Handleit. (sic!) Pfl. Kund. xii. 448. t. 85. f. 3, ab auctoribus ad *Tritoniam capensem* refertur, sed icon spatham brevem exhibit Tritoniae nec Acidantherae et forma perianthii male cum *T. capense* convenit." Not being able to solve the problem of the identity of *Houttuynia capensis* Houtt. to my satisfaction an appeal was made to Dr. R. H. Compton at Kirstenbosch. He states that Miss W. F. Barker who investigated the matter reports that in her opinion the "Botanical Magazine" plates 618 and 1531 (*Tritonia capensis* Ker-Gawl. = *Acidanthera capensis* Benth.) do not represent the same species as that figured by Houttuyn. And that Houttuyn's illustration is a much better match for *Ixia paniculata* De la Roche, a species that occurs in the Cape Peninsula, and which has a regular flower with very short bracts. She lists the following illustrations as representing the same species that Houttuyn named and figured as *Houttuynia capensis* = *Ixia paniculata* De la Roche, Descr. Pl. Nov. 25. *t. 1.* 1766; *Ixia longiflora* Solander, Bot. Mag. **7:** *t. 256.* 1794; *Ixia longiflora* Solander; Redouté, Lil. **1:** *t. 34.* 1802; *Tritonia longiflora* Ker, Bot. Mag. **37:** *t. 1502.* 1813; *Gladiolus longiflorus* Thunb.; Jacq. Coll. Suppl. *t. 5. f. 1.* 1796 and *Gladioli longiflori varietas* Jacq. Ic. **2:** *t. 263.* 1786–93. Miss Barker's findings were confirmed by Miss G. J. Lewis. The specific name "*capensis*" may be retained for the *Acidanthera* (*A. capensis* Benth.) by considering its use by Ker-Gawler (as *Tritonia capensis*, 1803) as a new name and excluding the cited synonym *Houttuynia capensis* Houtt. Unless such action be taken, then *Acidan-*

thera capensis Benth. would have to be renamed. There are two synonyms, *Tritonia rosea* Ait. and *Gladiolus roseus* Jacq., both older than *Tritonia capensis* Ker = *Acidanthera capensis* Benth., but the specific name *rosea* is invalidated in *Acidanthera* by the very different *A. rosea* Schinz (1895).

Micranthus Persoon

Micranthus alopecuroides (Linn.) Eckl. Topog. Verzeich. 43. 1827.

Gladiolus alopecuroides Linn. Cent. II. Pl. 5. 1756, Amoen. Acad. **4**: 301. 1759.
Ixia triticea Burm. f. Prodr. Fl. Cap. 1. 1768.
Phalangium spicatum Houtt. Nat. Hist. II. **12**: 115. *t. 80. f. 2.* 1780; Panzer, Pflanzensyst. **11**: 129. *t. 80. f. 2.* 1784.
Ixia plantaginea Ait. Hort. Kew. **1**: 59. 1789.
Micranthus plantagineus Eckl. Topog. Verzeich. 43. 1827; Baker in Thiselton-Dyer, Fl. Cap. **6**: 97. 1896.

Baker, Fl. Cap. **6**: 97, 98. 1896, placed *Gladiolus alopecuroides* Linn. "ex parte" under both *Micranthus plantagineus* Eckl. and *M. fistulosus* Eckl. The Linnaean description was based on a single specimen received from Burman, still extant in Linnaeus' herbarium. A photograph of the sheet, kindly supplied by Mr. S. Savage, shows two specimens, but apparently representing a single species. On the sheet Linnaeus wrote "*Gladiolus alopecuroides* A" (i.e. a species published in the Systema Naturae, ed. 10, actually however, three years earlier in Cent. II. Pl. 5), and to the right of the left hand specimen "Sp. 190" (i.e. Sparmann). Sir James Smith added "*Ixia plantaginea* Wild. 23." The specimens seem clearly to represent the same species as that illustrated by Redouté, Lil. **4**: 198. *t. 198.* 1808 as *Ixia plantaginea* Ait. I had thought it possible that *Gladiolus spicatus* Linn. Sp. Pl. 37. 1753 might be involved in this synonymy. It was based wholly on a reference to Royen, Fl. Leyd. Prodr. 19. 1740, which in turn was a seven word description of an African plant. Baker curiously cites the species (Sp. Pl. ed. 2, 54. 1762) as a synonym of both *Micranthus fistulosus* Eckl. and *Watsonia punctata* Ker, but the 1762 description is exactly the same as that of 1753. The specimen in the Linnaean herbarium, which was there in the 1753 enumeration and marked "spicatus" by Linnaeus himself, cannot possibly be the type as it was collected by Gerber and was apparently of Russian origin. From a photograph of this specimen I judge it to be a true *Gladiolus,* perhaps not distinguishable from *G. communis* Linn.; cf. Reichenbach, Ic. Fl. Germ. 9: *t. 349.* 1847 which very strongly resembles the Linnaean specimen. Royen's specimen may have been a *Micranthus;* one cannot say with certainty from the description alone.

Tritonia Ker-Gawler

Tritonia lacerata (Burm. f.) Klatt, Abh. Naturf. Ges. Halle **25:** 358 1882.

Gladiolus laceratus Burm. f. Prodr. Fl. Cap. 2. 1768; Houtt. Nat. Hist. II. **12:** 55. 1780.
Gladiolus crispus Linn. f. Suppl. 94. 1781.
Gladiolus lacerus* Panzer, Pflanzensyst. **11: 64. 1784.
Tritonia crispa Ker-Gawl. Bot. Mag. **17:** *t. 678.* 1803; Baker in Thiselton-Dyer, Fl. Cap. **6:** 122. 1896.

Panzer's specific name was probably due to a *lapsus calami* on his part, for there is no indication that he intended to publish a new one.

Watsonia Miller

Watsonia humilis Mill. Gard. Dict. ed. 8, no. 2. 1768; Baker in Thiselton-Dyer, Fl. Cap. **6:** 102. 1896.

Antholyza carophyllacea Burm. f. Prodr. Fl. Cap. 1. 1768; Houtt. Nat. Hist. II. **12:** 63. *t. 79. f. 3.* 1780.
Antholyza caryophyllea* Panzer, Pflanzensyst. **11: 76. 1784.

Baker apparently followed Thunberg, Fl. Cap. 50. 1823, in accrediting the binomial *Antholyza caryophyllacea* to Houttuyn; the latter merely accepted Burman's species. Panzer, as the authority for *A. caryophyllea,* merely replaces Vahl, Enum. **2:** 123. 1806.

ORCHIDACEAE

Dendrobium Swartz

Dendrobium moniliforme (Linn.) Sw. Nov. Act. Soc. Sci. Upsala **6:** 85. 1799.

Epidendrum moniliforme Linn. Sp. Pl. 954. 1753; Houtt. Nat. Hist. II. **11:** 169. 1779.
Epidendrum moniliferum* Panzer, Pflanzensyst. **10: 122. 1783.
Epidendrum Monile Thunb. Fl. Jap. 30. 1784.
Dendrobium Monile Kränzl. Pflanzenr. **45(IV.50.II.B.21):** 50. *f.* 2. 1910.

The Linnaean species was based wholly on *Fu-Ran,* Kaempfer, Amoen. 864. fig., 1712 and *Dendrobium moniliforme* (Linn.) Sw. should be interpreted by the Linnaean and Kaempfer references; the Kaempfer illustration is a good one. Kränzlin, Pflanzenr. **45(IV.50.II.B.21):** 51. 1910 discusses *D. moniliforme* Sw. under *D. Monile* (Thunb.) Kränzl. I think the latter, at least as represented by Terasaki, Nippon Shokubutsu Zuhu *f. 652.* 1933 is the same as *D. moniliforme* (Linn.) Sw. Many of the illustrations published as *D. moniliforme* Sw. in European literature do not represent that species, but that is no valid reason for considering *Dendrobium moniliforme* Sw. to be a *nomen confusum.*

Panzer's use of *moniliferum* as the specific name was doubtless due to an error in transcription.

Massonia Thunberg

***Massonia depressa** Thunb. in Houtt. Nat. Hist. II. **12:** 424. *t. 85. f. 1.* 1780; Panzer, Pflanzensyst. **11:** 498. *t. 85. f. 1.* 1784.

Massonia latifolia Linn. f. Suppl. 193. 1781; Baker in Thiselton-Dyer, Fl. Cap. **6:** 416. 1897.

Currently the publication of the genus *Massonia* is credited to Thunberg in Linnaeus f. Suppl. 1781, but Houttuyn published the generic name and the binomial for Thunberg one year earlier.

Satyrium Swartz

Satyrium coriifolium Sw. Vet. Acad. Handl. Stockh. **21:** 216. 1800; Rolfe in Thiselton-Dyer, Fl. Cap. **5**(3)**:** 161, 323. 1912.

Orchis cornuta sensu Houtt. Nat. Hist. II. **12:** 456. *t. 86. f. 2.* 1780; Panzer, Pflanzensyst. **11:** 531. *t. 86. f. 2.* 1784; non Linn.

Houttuyn did not propose a new binomial but attempted to interpret the Linnaean species. The Cape of Good Hope plant that he figured is, however, *Satyrium coriifolium* Sw., not *Orchis cornuta* Linn. The citation should be *sensu* Houtt., non Linn.

MORACEAE

Artocarpus J. R. & G. Forster

***Artocarpus rotunda** (Houtt.) Panzer, Pflanzensyst. **10:** 380. 1783.

Rademachia (Radermachia) rotunda* Houtt. Nat. Hist. II. **11: 455. 1779.

Artocarpus rigida Blume, Bijdr. 482. 1825; King, Ann. Bot. Gard. Calcutta **2:** 8. *t. 3.* 1889; Koord. & Val. Meded. Depart. Landbouw **2:** 17. 1906 (Bijdr. Boomsoort. Java **11:** 17).

Artocarpus echinata Roxb. Hort. Beng. 66. 1814, *nomen nudum,* Fl. Ind. ed. 2, **3:** 527. 1832.

Artocarpus dimorphophylla Miq. Fl. Ind. Bot. Suppl. 417. 1862.

Houttuyn did not indicate his species as new and provided no Latin diagnosis; neither did Panzer indicate his binomial as a new one, both being thus overlooked by later botanists. From Houttuyn's description *Artocarpus rigida* Blume is clearly indicated, his material being from Java. This interpretation is further verified by the local name *mandelique* cited by him; Heyne gives it, after Backer, as *mandelika,* and Koorders and Valeton cite it as *mandaliké.*

PROTEACEAE

Leucadendron R. Brown

Leucadendron pedunculatum Meisn. in DC. Prodr. **14:** 216. 1856.

Protea linearis Houtt. Nat. Hist. II. **4**: 116. *t. 19. f. 2.* 1775; Christm. Pflanzensyst. **3**: 84. *t. 19. f. 2.* 1778.

Leucadendron lineare R. Br. ex Steud. Nomencl. ed. 2, **2**: 34. 1841; non Burm. f. 1768.

Leucadendron tortum R. Br. Trans. Linn. Soc. **10**: 56. 1810; Phillips & Hutch. in Thiselton-Dyer, Fl. Cap. **5**(1): 524. 1912; non *Protea torta* Thunb.

Houttuyn's type was from the Cape of Good Hope region, and his species has been placed as a doubtful synonym of *Leucadendron angustatum* R. Br., itself a species of doubtful status, and is so left by Phillips & Hutchinson, op. cit. 549. From Houttuyn's distinctly good figure I suspect that the species currently known as *Leucadendron tortum* R. Br. is the one represented. I fail to see how the latter name can be maintained for this particular species as it was based on *Protea torta* Thunb., in spite of the fact that Robert Brown cited the latter as a doubtful synonym; he was probably misled by Jacquin's erroneous interpretation of Thunberg's species. *Leucadendron fusciflorum* R. Br. Trans. Linn. Soc. **10**: 216. 1810; Phillips & Hutch. in Thiselton-Dyer, Fl. Cap. **5**(1): 527. 1912 is to be replaced by **Leucadendron tortum** (Thunb.) R. Br. I am by no means certain that the Meisner binomial that I have adopted for *Leucadendron tortum* sensu Phillips & Hutch., non (Thunb.) R. Br., is the oldest valid one for this particular species.

Protea Linnaeus

***Protea arborea** Houtt. Nat. Hist. II. **4**: 107. 1775.

Protea grandiflora Thunb. Prot. 56. 1781; Phillips & Stapf in Thiselton-Dyer, Fl. Cap. **5**(1): 580. 1912.

Houttuyn's overlooked binomial was based wholly on *Lepidocarpodendron folio saligno*, etc. Boerh. Ind. Alt. Hort. Lugd.-Bat. **2**: 183. *t. 183.* 1720, and was not indicated by him as new; it was not admitted by Christmann and Panzer. Phillips and Stapf cite Boerhaave's pre-Linnaean description and illustration as representing *Protea grandiflora* Thunb. and it is an excellent representation of that species. Houttuyn's specific name antedates Thunberg's by six years. *Protea arborea* Schultes (not Link as cited by some authors) Syst. Veg. Mant. **3**: 266. 1827 is a *nomen nudum*.

Serruria Salisbury

Serruria pedunculata (Lam.) R. Br. Trans. Linn. Soc. **10**: 119. 1810.

Protea pedunculata Lam. Ill. **1**: 240. 1791–97.

Protea sphaerocephala sensu Houtt. Nat. Hist. II. **4**: 99. *t. 19. f. 1.* 1775; Christm. Pflanzensyst. **3**: 72. *t. 19. f. 1.* 1778; non Linn.

Protea glomerata Andr. Bot. Repos. **4**: *t. 264.* 1803, non Linn.

Serruria artemisifolia Knight, Prot. 80. 1809; Philipps & Hutch. in Thiselton-Dyer, Fl. Cap. **5**: 675. 1912.

Houttuyn did not describe this as new but thought that the form he illustrated represented *Protea sphaerocephala* Linn. His binomial appears in botanical literature as an independently published one. The "Index Kewensis" entry reads "*sphaerocephala,* Houtt. Handleid. iv. 99. t. 19. f. 1. = Serruria hirsuta, pedunculata, scariosa," copied from Steudel, Nomencl. ed. 2, **2**: 401. 1841. But a single species is represented by the illustration.

LORANTHACEAE

Viscum Linnaeus

Viscum album Linn. Sp. Pl. 1023. 1753.

Viscum polycoccon* Houtt. Nat. Hist. II. **6: 336. 1776.

The cursory description apparently applies to a many fruited form of the European *Viscum album* Linn.

SANTALACEAE

Thesium Linnaeus

Thesium Linophyllon Linn. Sp. Pl. 207. 1753; Houtt. Nat. Hist. II. **7**: 719. 1777 (*linophyllum*); Hegi, Ill. Fl. Mittel-Europa **3**: 154. *f. 515*. 1910.

Thesium linifolium* Christm. Pflanzensyst. **5: 738. 1779.

Christmann's new binomial was doubtless due to an inadvertent error on his part in transcribing the specific name. *Thesium linifolium* Schrank, Reise 129. 1786, Baier. Fl. **1**: 506. 1789, another synonym, is antedated by nine years.

ARISTOLOCHIACEAE

Aristolochia *Linnaeus*

Aristolochia Clematitis Linn. Sp. Pl. 962. 1753; Hegi, Ill. Fl. Mittel-Europa **3**: 163. *f. 520*. 1910.

Aristolochia tenuis* Houtt. Nat. Hist. II. **6: 215. 1776.

There is no formal description nor any indication that *Aristolochia tenuis* was a new binomial; it was not accepted by Christmann and Panzer. From the data given it is reasonably safe to place *A. tenuis* Houtt. as a synonym of *A. Clematitis* Linn.

POLYGONACEAE

Polygonum Linnaeus

Polygonum chinense Linn. Sp. Pl. 363. 1753.

Rumex umbellatus Houtt. Nat. Hist. II. **8**: 414. *t. 47. f. 3.* 1777; Christm. Pflanzensyst. **6**: 388. *t. 47. f. 3.* 1780.

This reduction was indicated in "Index Kewensis," following Meisner's correct disposition of Houttuyn's species which Houttuyn himself had indicated at the end of the explanation of the plates **8**: [4]. 1777. Houttuyn's specimen was from Japan. He did not indicate *Rumex umbellatus* as new and supplied no Latin diagnosis.

Polygonum cuspidatum Sieb. & Zucc. Abh. Akad. Muench. **4**(2): 208. 1846 (Fl. Jap. Fam. Nat. **2**: 84.); Nakai, Fl. Korea. **2**: 173. 1911; Merr. Rhodora **40**: 290. 1938 (Contr. Gray Herb. **122**: 290).

Reynoutria japonica Houtt. Nat. Hist. II. **8**: 640. *t. 51. f. 1.* 1777; Christm. Pflanzensyst. **6**: 628. *t. 51. f. 1.* 1780; Ohki, Bot. Mag. Tokyo **40**: 49. 1926; Danser, Bull. Jard. Bot. Buitenz. III. **8**: 26. 1926; non *Polygonum japonicum* Meisn.

Polygonum pictum Sieb. Jaarb. Nederl. Maatsch. Aanm. Tuinb. **1848**: 44. 1848, *nomen nudum.*

Polygonum Sieboldii Reinw. ex De Vriese op. cit. **1849**: 31. 1850, *in syn.*; L. H. Bailey Cycl. Am. Hort. **3**: 1393. *f. 1880.* 1901.

Polygonum Zuccarinii Small, Mem. Dept. Bot. Columbia Univ. **1**: 158. *t. 66.* 1895.

Polygonum Reynoutria Makino, Bot. Mag. Tokyo **15**: 84. 1901; Somuku-Dzusetsu ed. 3, **1**: 75. *t. 75.* 1910.

Pleuropterus Zuccarinii Small in Britt. & Brown Illus. Fl. N. States Canada ed. 2, **1**: 676. *f. 1655.* 1913.

Pleuropterus cuspidatus H. Gross in Loesen. Beih. Bot. Centralbl. **37**(2): 114. 1919.

Pleuropterus cuspidatus Moldenke, Torreya **34**: 7. 1934.

This was described by Houttuyn as a new genus and species. The genus was listed in "Index Kewensis" as one of uncertain status. It does not appear in Bentham & Hooker f. "Genera Plantarum" nor in Engler & Prantl, "Die Natürlichen Pflanzenfamilien." In 1901 Makino recognized it as being identical with the very common *Polygonum cuspidatum* Sieb. & Zucc. Danser* in 1926 reproduced Houttuyn's original description and illustration. Since 1895 the species has acquired at least four bibliographic synonyms, although under present rules Siebold and Zuccarini's specific name is valid in *Polygonum*, the "earlier" *P. cuspidatum* Willd. appearing only in synonymy, and hence not validly published. Relatively new synonyms are *Polygonum Reynoutria* Makino (1901), *Polygonum Zuccarinii* Small (1895), *Pleuropterus Zuccarinii* Small (1913), *Pleuropterus cuspidatus* H. Gross (1919), and *P. cuspidatus* Moldenke (1934). The oldest valid specific name in *Polygonum*

*Danser, B. H. Die systematische Stellung der Houttuyn'schen Gattungen Reynoutria und Truellum. Bull. Jard. Bot. Buitenz. III. **8**: 25-31. *f. 1-2.* 1926.

is *P. cuspidatum* Sieb. & Zucc.; in *Reynoutria*, if one wishes to segregate smaller genera from the collective group *Polygonum*, *R. japonica* Houtt. *Pleuropterus* Turcz. (1848) is a synonym of *Reynoutria* Houtt. (1777). For notes on the validity of the specific name *cuspidatum* in *Polygonum*, see Moldenke, *l. c.*, and Rehder, Jour. Arnold Arb. **17**: 316. 1936.

Polygonum multiflorum Thunb. Fl. Jap. 169. 1784.

Polygonum chinense sensu Houtt. Nat. Hist. II. **8**: 479. *t. 49. f. 3.* 1777; Christmann, Pflanzensyst. **6**: 453. *t. 49. f. 3.* 1780, *quoad illus.;* non Linn.

Strictly the Houttuyn entry goes with *Polygonum chinense* Linn. Following the short cursory description he discusses two plants, one the "Javaansch" form (*P. chinensis* Linn.), the other the "Japansch" form, his illustration being based on the latter; this is clearly *P. multiflorum* Thunb.

Polygonum senticosum (Meisn.) Fr. & Sav. Enum. Pl. Jap. **1**: 401. 1875; Steward, Contr. Gray Herb. **88**: 82. 1930.

Truellum Houtt. Nat. Hist. II. **8**: 427. *t. 48. f. 1.* 1777.

Truellum japonicum Houtt. op. cit. Aanwyz. Plaat. [2]; Christmann, Pflanzensyst. **6**: 401. *t. 48. f. 1.* 1780, non *Polygonum japonicum,* Meisn.

Persicaria senticosa H. Gross, Beih. Bot. Centralbl. **37**(2): 113. 1919.

Truellum senticosum Danser, Bull. Jard. Bot. Buitenz. III. **8**: 31. 1926, *in nota.*

Polygonum Truellum Koidz. Bot. Mag. Tokyo **40**: 334. 1926.

Persicaria Truellum Masam. Prel. Rep. Veg. Yakusima 71. 1929.

The genus *Truellum* was apparently overlooked by all botanists since Christmann's consideration of it in 1780 until the Japanese botanists (Koidzumi in 1926, Masamune in 1929) and Dr. Danser (in 1926) called attention to it. It does not appear in "Index Kewensis" until Suppl. 7(1929), and was not mentioned by Bentham and Hooker f., nor by Engler and Prantl. Danser reproduced Houttuyn's original description and illustration. The type was from Japan, the species being a common one in eastern Asia. As a name for generic segregates from *Polygonum*, *Truellum* replaces *Echinocaulon* Spach (1841) and *Chylocalyx* Hassk. (1842), but not *Persicaria* Linn. Perhaps the extremists would consider that in Christmann's note "welche zwar mit dem *Polygonatum (sic!) perfoliatum viele Aehnlichkeit hat" (p. 401), that here is another binomial that ought to be listed, although manifestly *Polygonum perfoliatum* Linn. was intended. At the end of the description of the plates 8: |4|. 1777, Houttuyn discusses *Truellum japonicum* in relation to *Polygonum perfoliatum* Linn.

Polygonum viviparum Linn. Sp. Pl. 360. 1753; Christm. Pflanzensyst. **6**: 439. 1780.

Polygonum proliferum* Houtt. Nat. Hist. II. **8: 461. 1777.

There is no indication that *P. proliferum* Houtt. was a new binomial, and no reason is given for his non-acceptance of the Linnaean specific name; the references are to several of those cited in the original description of *Polygonum viviparum* Linn. Three years later Christmann accepted the Linnaean binomial without listing *P. proliferum* Houtt. in the synonymy.

Rumex Linnaeus

Rumex japonicus** Houtt. Nat. Hist. II. **8**: 394. *t. 47. f. 2.* 1777; Christm. Pflanzensyst. **6**: 371. *t. 47. f. 2.* 1780, ***in nota, sine nomine.

Rumex japonicus Meisn. Ann. Mus. Bot. Lugd.-Bat. **2**: 56. 1865.

Houttuyn did not indicate this as new and provided no Latin diagnosis. His illustration is of the fruit only. From this, and the other data given, I take the species to be the same as the one described by Meisner in 1865 independently under the same specific name. This conclusion had already been reached by modern Japanese botanists; see Masamune, Mem. Fac. Sci. Agr. Taihoku Univ. **11**: Bot. **4**: 171. 1934 (Fl. Yakusim. 171).

AMARANTHACEAE

Alternanthera Forskål

Alternanthera sessilis (Linn.) R. Br. ex Schult. in Roem. & Schult. Syst. **5**: 554. 1819.

Gomphrena sessilis Linn. Sp. Pl. 225. 1753.
Illecebrum sessile Linn. Sp. Pl. ed. 2, 300. 1762.
Illecebrum indicum* Houtt. Nat. Hist. II. **7: 713. *t. 43. f. 3.* 1777; Christm. Pflanzensyst. **5**: 731. *t. 43. f. 3.* 1779.

Houttuyn did not indicate *Illecebrum indicum* as new except incidentally in the text. It seems clearly to be only a rather luxuriant form of the very common *Alternanthera sessilis* (L.) R. Br.

Amaranthus Linnaeus

Amaranthus inamoenus Willd. Hist. Amarant. 14. *t. 7. f. 14.* 1790, Sp. Pl. **4**: 386. 1805; Makino, Jour. Jap. Bot. **3**: 9. 1926 (f. *viridis*); Makino & Nemoto, Fl. Jap. ed. 2, 275. 1931 (f. *viridis*).

Amaranthus japonicus* Houtt. in Willd. Sp. Pl. **4: 386. 1805, *in syn.*
Amaranthus Mangostanus sensu Houtt. Nat. Hist. II. **11**: 254. *t. 72. f. 1.* 1779; Panzer, Pflanzensyst. **10**: 198. *t. 72. f. 1.* 1783; non Linn.
Amaranthus gangeticus Linn. var. *inamoenus* Moq. in DC. Prodr. **13**(2): 261. 1849.

The synonymy, as given above, is primarily bibliographic as I do not understand the exact relationship of the Japanese plant that Houttuyn illustrated with allied forms described by other authors; nor is it certain that the form Willdenow named as *A. inamoenus* is the same as the one Houttuyn had, for he states "v. v." indicating that he had seen a living plant. The "Index Kewensis" reference to *Amaranthus japonicus* is "Houtt. ex Steud. Nom. ed. 1, 36." Houttuyn did not publish the binomial accredited to him by Willdenow, speaking of it as the "Japanische Amaranth," while Panzer, to whose work the Willdenow reference applies, cites it as "Amaranthus Mangostanus, aus Japan."

Celosia Linnaeus

Celosia argentea Linn. Sp. Pl. 205. 1753.

**Celosia japonica* Houtt. Nat. Hist. II. 7: Aanwyz. Plaat. [2]. *t. 43. f. 1.* 1777; Christm. Pflanzensyst. 5: Verzeich. Kupfertaf. [2]. *t. 43. f. 1.* 1779.

Houttuyn gives a cursory description of the plant in his text, 7: 702, without a Latin name, as does Christmann, 5: 720, following *C. margaritacea* Linn. The binomial *Celosia japonica* appears in both works only in the explanation of the plates. The species is clearly the same as *C. argentea* Linn.

CARYOPHYLLACEAE

Cerastium Linnaeus

Cerastium viscosum Linn. Sp. Pl. 437. 1753; Houtt. Nat. Hist. II. 8: 682. 1777.

**Cerastium viscidum* Christm. Pflanzensyst. 6: 668. 1780.

Christmann's use of the specific name *viscidum* was undoubtedly due to a *lapsus calami* on his part.

Corrigiola Linnaeus

Corrigiola littoralis Linn. Sp. Pl. 271. 1753; Christm. Pflanzensyst. 6: 216. 1780.

**Corrigiola littorea* Houtt. Nat. Hist. II. 8: 237. 1777.

Houttuyn's slight change in the Linnaean binomial for this European species was doubtless an inadvertent one, which Christmann corrected three years later.

Delia Dumortier

Delia segetalis (Linn.) Dum. Fl. Belg. 110. 1827; Hegi, Ill. Fl. Mittel-Europa 3: 425. 1911.

Alsine segetalis Linn. Sp. Pl. 272. 1753; Houtt. Nat. Hist. II. **8**: 247. 1777.

Alsine segetum* Christm. Pflanzensyst. **6: 223. 1780.

Spergularia segetalis G. Don, Gen. Syst. **1**: 425. 1831; Link, Handb. **2**: 259. 1831; Fenzl in Ledeb. Fl. Ross. **2**: 166. 1844–46.

Christmann's new binomial was doubtless due to an inadvertent error in transcribing the specific name.

Dianthus Linnaeus

Dianthus fruticosus Linn. Sp. Pl. 413. 1753; Boiss. Fl. Orient. **1**: 499. 1867.

Dianthus frutescens* Houtt. Nat. Hist. II. **5: 109. 1775; Christm. Pflanzensyst. **6**: 572. 1780.

Houttuyn's new binomial was surely an unintentional one, being due to an error in transcribing the Linnaean one; the references are to the Linnaean species.

Tunica Scopoli

Tunica prolifera (Linn.) Scop. Fl. Carn. ed. 2, **1**: 299. 1772; Hegi, Fl. Mittel-Europa **3**: 315. 1910.

Dianthus prolifer Linn. Sp. Pl. 410. 1753.

Dianthus diminutus Linn. Sp. Pl. ed. 2, 587. 1762; Houtt. Nat. Hist. II. **8**: 583. 1777.

Caryophyllus diminutus* Christm. Pflanzensyst. **6: 563. 1780.

Caryophyllus diminutus is manifestly an inadvertent binomial, for Christmann described nineteen other species of the genus under *Dianthus;* he accidentally transcribed the pre-Linnaean generic name in this case, which Linnaeus had replaced by *Dianthus*.

RANUNCULACEAE

Clematis Linnaeus

Clematis florida Thunb. Fl. Jap. 240. 1784; Rehd. & Wils. in Sargent Pl. Wils. **1**: 325. 1913, *cum syn.*

Anemone japonica* Houtt. Nat. Hist. II. **9: 191. *t. 55. f. 1.* 1778, non *Clematis japonica* Thunb.

Anemone, oder *Anemonoides* Christm. Pflanzensyst. **7**: Verzeich. Kupfertaf. [2]. *t. 55. f. 1.* 1781.

Clematis japonica sensu Makino Bot. Mag. Tokyo **26**: 81. 1912, non Thunb.

Houttuyn gave no Latin diagnosis and did not indicate his species as new; it was not accepted by Christmann who reproduced the illustration and indicated the species in the explanation of the plates [2] as "Eine Japanische Anemone oder Anemonoides." Houttuyn's specimen was

from Japan, unquestionably received from Thunberg, as his illustration very closely approximates Thunberg's actual type of *Clematis florida*, represented by a photograph in the Arnold Arboretum herbarium. Makino erred (Bot. Mag. Tokyo **25**: 81. 1912) in recording the species as *Clematis japonica* Houtt., for Houttuyn did not publish this binomial, but rather *Anemone japonica*. Houttuyn's specific name is invalidated in *Clematis* by *C. japonica* Thunb. **Clematis ternata* Makino, l. c., overlooked by the compilers of the supplements to "Index Kewensis," is an unnecessary synonym of *Clematis japonica* Thunb. The species is not native of Japan, but was introduced from China. *Anemone japonica* Sieb. & Zucc. Fl. Jap. **1**: 15. *t. 5*. 1835 (*Atragene japonica* Thunb., *Clematis polypetala* DC., non *Anemone polypetala* Larrañaga, 1923) being no longer a valid name for the Japanese species, it is renamed **Anemone nipponica** nom. nov.

Coptis Salisbury

Coptis trifolia (Linn.) Salisb. Trans. Linn. Soc. **8**: 305. 1807.

Helleborus trifolius Linn. Sp. Pl. 558. 1753; Christm. Pflanzensyst. 7: 376. 1781.

Helleborus trifoliatus* Houtt. Nat. Hist. II. **9: 262. 1778.

Houttuyn's slight change in the form of the specific name was probably unintentional, as there is no indication that he intended to publish a new one.

Ranunculus Linnaeus

Ranunculus pyrenaeus Linn. Mant. **2**: 248. 1771; Houtt. Nat. Hist. II. **9**: 226. 1778; DC. Prodr. **1**: 31. 1824.

Ranunculus pyrenaicus* Christm. Pflanzensyst. **7: 333. 1781.

The slight change in the specific name was doubtless due to an error in transcription on Christmann's part.

LARDIZABALACEAE
Akebia Decaisne

Akebia quinata (Thunb.) Dcne. Arch. Mus. Paris **1**: 195. *t. 13a*. 1839, Ann. Sci. Nat. II. Bot. **12**: 107. 1839.

Rajania quinata* Thunb. ex Houtt. Nat. Hist. II. **11: 366. *t. 75. f. 1*. 1779; Panzer, Pflanzensyst. **10**: 287. *t. 75. f. 1*. 1783 (*Rainia*); Thunb. Fl. Jap. 148. 1784.

Houttuyn's publication of Thunberg's binomial antedates that of Thunberg himself by five years. His specimen was received from Thunberg.

MENISPERMACEAE

Stephania Loureiro

Stephania hernandifolia (Willd.) Walp. Repert. **1**: 96. 1842; Diels, Pflanzenr. **46(IV. 94)**: 279. 1910.

Cissampelos hernandifolia Willd. Sp. Pl. **4**: 861. 1806.
Menispermum glabrum sensu Houtt. Nat. Hist. II. **11**: 377. *t. 75. f. 2.* 1779, Panzer, Pflanzensyst. **10**: 298. *t. 75. f. 2.* 1783, *in nota;* non Burm. f.

The Javan specimen that Houttuyn illustrated clearly represents a *Stephania*, and undoubtedly *S. hernandifolia* (Willd.) Walp. as that species is currently interpreted. It is not at all *Menispermum glabrum* Burm. f., which has deeply cordate leaves, while Houttuyn's plant has broadly peltate ones. Doctor Baehni informs me that there are two sheets in Burman's herbarium, one with cordate leaves, labelled by Burman as *Menispermum glabrum* (this is the holotype), the other, also labelled *Menispermum glabrum*, is the *Stephania*, but there is no positive evidence that this came from Houttuyn's herbarium. *Menispermum glabrum* Burm. f. is placed as synonym of *Tinospora crispa* (Linn.) Diels (non Miers), but as *Menispermum crispum* Linn., the name-bringing synonym of the latter, was based entirely on *Funis felleus* Rumph. Herb. Amb. **5**: 82. *t. 44. f. 1.* 1747 it seems to be evident that Diels has misinterpreted the Linnaean species. Rumphius' distinctly good illustration shows a plant which I believe to represent *Tinospora Rumphii* Boerl., the form with broadly ovate, deeply cordate leaves, and one very different from the form that Diels illustrated. In any case the binomial is *Tinospora crispa* (Linn.) Miers, for a new combination with Diels as the authority is inadmissible.

While this paper was in proof I received, through the courtesy of Dr. B. P. G. Hochreutiner, a very excellent photograph of the holotype of *Menispermum glabrum* Burm. f. This species, not accounted for by Diels, is clearly the same as the misinterpreted *Tinospora crispa* (Linn.) Diels. The following adjustment in synonymy is made:

Tinospora glabra (Burm. f.) comb. nov.

Menispermum glabrum Burm. f. Fl. Ind. 216 (err. typ. 316). 1768.
Tinospora crispa Diels, Pflanzenr. **46(IV.94)**: 142. *f. 49.* 1910; non Miers, non *Menispermum crispum* Linn.

This form, which is common in Java and which extends, according to Diels, from India and Ceylon to Java, Borneo and the Aru Islands, has oblong to oblong-ovate, slightly cordate leaves and smooth stems, as contrasted to the broadly ovate, deeply cordate leaves and strikingly verrucose stems of *Tinospora crispa* (Linn.) Miers.

Menispermum crispum Linn. Sp. Pl. was based wholly on "Funis quadrangularis, *Rumph. amb. 5. p. 83 t. 44. f. 1.*," for Linnaeus had no specimen. He confused two entirely different plants in this citation. The "Funis quadrangularis" is *Cissus quadrangularis* Linn., the plant figured on *t. 44. f. 2;* Linnaeus' own reference is to *t. 44. f. 1,* which is *Funis felleus* Rumph. described on page 83. The statement that the species came from Bengal was copied from Rumphius' indication that *Funis quadrangularis* (*Cissus quadrangularis*) had been introduced into Java from Bengal; Linnaeus later actually cited *Funis quadrangularis* Rumph. (Mant. **1:** 39. 1767) in the original description of *Cissus quadrangularis* Linn. It is believed that Linnaeus' intention was clear, and that he had in mind the menispermaceous plant illustrated on plate 44 (figure 1), not the entirely different vitaceous one (figure 2). His descriptive phrase "Menispermum foliis cordatis exquisitis, caule quadrangulo crispo" clearly indicates this, for it applies to figure 1 (*Funis felleus*), not to figure 2 (*Funis quadrangularis*); for Rumphius' excellent figure of the former shows the strikingly verruculose stems, the protuberances *apparently* (not actually in nature) conforming, in the artist's arrangement of them, to the descriptive phrase "caule quadrangulo crispo"; the other plant illustrated on the same plate has smooth 4-angled stems, not at all "crispo." It is, I am reasonably confident, the "macabuhay" of the Philippines, and is, I believe, the form described by Boerlage as *Tinospora Rumphii.* If this be the case, then *Tinospora Rumphii* Boerl. becomes a synonym of the true *Tinospora crispa* (Linn.) Miers. *Tinospora cordifolia* (Willd.) Miers is another possibility for the Linnaean species. This extends from India and Ceylon to Burma and the Andaman Islands, but is not recorded from Malaysia. Rumphius notes that his *Funis felleus* was introduced into Amboina about 1690, but does not indicate its source.

MYRISTACACEAE

Horsfieldia Willdenow

Horsfieldia sylvestris (Houtt.) Warb. Nova Acta Acad. Leop.-Carol. Nat. Cur. **68:** 337. *t. 12. f. 1–6.* 1897.

Myristica sylvestris Houtt. Nat. Hist. II. **3:** 340. 1774; Christm. Pflanzensyst. **2:** 326. 1777.

This was clearly indicated by Houttuyn as a new species. Warburg's interpretation of it is doubtless correct, although his citation is to Christmann's consideration of it in 1777 rather than to Houttuyn's original description of 1774.

Myristica Linnaeus

Myristica fragrans Houtt. Nat. Hist. II. **3:** 333. 1774; Christm. Pflanzensyst. **2:** 322. 1777; Warb. Nova Acta Acad. Leop.-Carol. Nat. Cur. **68:** 458. 1897.

Houttuyn described three species of *Myristica*, the first two still remaining in the genus, the third, now placed in the allied genus *Horsfieldia*. *Myristica fragrans* Houtt. is the common nutmeg. It was clearly indicated as new. Warburg cites a Houttuyn specimen in the Copenhagen herbarium. This, which I have had the privilege of examining, is a small specimen in Vahl's herbarium labelled on the back "*Myristica aromatica* ded. Dr. Houttuyn." *Myristica aromatica* Sw. is a synonym of *M. fragrans* Houtt.

Myristica fatua Houtt. Nat. Hist. II. **3:** 337. 1774; Christm. Pflanzensyst. **2:** 324. 1777; Warb. Nova Acta Acad. Leop.-Carol. Nat. Cur. **68:** 458. *t. 11. f. 1–7.* 1897.

It seems entirely safe to accept the current interpretation of this species as correct. Houttuyn clearly indicated it as new.

CRUCIFERAE

Arabis Linnaeus

Arabis virginica (Linn.) Trelease in Branner & Coville, Rep. Geol. Surv. Ark. **1884**(4): 165. 1891; Britt. & Br. Illus. Fl. N. States Canada **2:** 147. *f. 1771.* 1897, ed. 2, **2:** 179. *f. 2069.* 1913.

Cardamine virginica Linn. Sp. Pl. 656. 1753; Houtt. Nat. Hist. II. **9:** 667. 1778.

Cardamine virginiana* Panzer, Pflanzensyst. **8: 282. 1782.

The binomial published by Panzer was probably due to an error in transcription, as there is no evidence that he intended to propose a new name.

Didesmus Desvaux

Didesmus aegyptius (Linn.) Desv. Jour. de Bot. Appl. **3:** 160. *t. 25. f. 11.* 1814; Muschler, Man. Fl. Egypt **1:** 431. 1912.

Myagrum aegyptium Linn. Sp. Pl. 641. 1753; Houtt. Nat. Hist. II. **9:** 600. 1778.

Myagrum aegyptiacum* Panzer, Pflanzensyst. **8: 195. 1782.

Rapistrum aegyptium Coss. Bull. Soc. Bot. France **22:** 46. 1875.

Panzer's publication of the specific name *aegyptiacum* was probably due to a *lapsus calami* on his part. In "Index Kewensis" *Rapistrum aegyptium* is credited to Baillon, Hist. Pl. **3:** 197. 1872, but Baillon there failed to make the transfer.

RESEDACEAE

Reseda Linnaeus

Reseda undata Linn. Syst. ed. 10, 1046. 1759; Christm. Pflanzensyst. **7:** 29. 1781; Muell.-Arg. in DC. Prodr. **16**(2)**:** 558. 1868.

Reseda undulata* Houtt. Nat. Hist. II. **8: 728. 1777.

Houttuyn's binomial was probably an inadvertently published one, a *lapsus calami* for *R. undata* Linn. The Linnaean species is sometimes reduced to *R. alba* Linn. Sp. Pl. 449. 1753.

CRASSULACEAE

Cotyledon Linnaeus

Cotyledon Umbilicus Linn. Sp. Pl. 429. 1753.

Cotyledon Umbilicus Veneris* Houtt. Nat. Hist. II. **5: 119. 1775; Christm. Pflanzensyst. **3:** 600. 1778.

Houttuyn and Christmann are the only authors that I have noted using the specific name *Umbilicus Veneris;* it is an exact synonym of *C. Umbilicus* Linn., and the references are to the latter.

SAXIFRAGACEAE

Saxifraga Linnaeus

Saxifraga ajugifolia Linn. Cent. I. Pl. 11. 1755 (*ajugaefolia*); Amoen. Acad. **4:** 271. 1759; Houtt. Nat. Hist. II. **8:** 558. 1777; Engl. & Irmsch. Pflanzenr. **67(IV.117):** 315. 1916.

Saxifraga ajugoides* Christm. Pflanzensyst. **6: 531. 1780.

Christmann's publication of the specific name *ajugoides* was doubtless due to an error in transcription, *ajugifolia* being intended.

ROSACEAE

Cliffortia Linnaeus

Cliffortia strobilifera Murr. Syst. Veg. ed. 13, 749. 1774; Houtt. Nat. Hist. II. **6:** 381. 1776; Harv. Fl. Cap. **2:** 300. 1861–62.

Cliffortia conifera* Christm. Pflanzensyst. **4: 621. 1779.

There is no indication that *C. conifera* Christm. was a new name. It is suspected that it was merely a *lapsus calami* on Christmann's part, who inadvertently wrote "*conifera*" in place of *strobilifera.*

Kerria de Candolle

Kerria japonica (Linn.) DC. Trans. Linn. Soc. **12:** 157. 1817.

Rubus japonicus Linn. Mant. **2:** 245. 1771.

Corchorus japonicus* Houtt. Nat. Hist. II. **9: 146. *t. 54. f. 2.* 1778; Thunb. Fl. Jap. 227. 1784.

Houttuyn published *Corchorus japonicus* six years before Thunberg's binomial appeared; Christmann and Panzer did not recognize it.

LEGUMINOSAE

Acacia Linnaeus

Acacia Senegal (Linn.) Willd. Sp. Pl. **4**: 1077. 1805.

Mimosa Senegal Linn. Sp. Pl. 521. 1753; Christm. Pflanzensyst. **4**: 696. 1779.

Mimosa senegalensis* Houtt. Nat. Hist. II. **3: 614. 1774.

Houttuyn's new binomial, not indicated as such, may have been published inadvertently or deliberately. In any case it antedates *Mimosa senegalensis* Forsk. Fl. Aeg.-Arab. 176. 1775 by one year.

Alysicarpus Necker

Alysicarpus vaginalis (Linn.) DC. Prodr. **2**: 353. 1825; Prain ex King, Jour. As. Soc. Bengal **66**(2): 132. 1927.

Hedysarum vaginale Linn. Sp. Pl. 746. 1753.

Lotus monophyllus* Houtt. Nat. Hist. II. **10: 314. *t. 65. f. 4.* 1779, Panzer, Pflanzensyst. **8**: 759. *t. 65. f. 4.* 1782, *in nota.*

Houttuyn's specimens were from the East Indies. He did not indicate his binomial as a new one and provided no Latin diagnosis for the species. His cursory description and excellent illustration clearly represent *Alysicarpus vaginalis* (Linn.) DC., a form, as Prain has pointed out, that differs from *A. nummularifolius* auct. (non *Hedysarum nummularifolium* Linn.) by its erect habit and lax racemes. The differences are further discussed by me, Philip. Jour. Sci. **5**: Bot. 92. 1910, where *Hedysarum nummularifolium* Linn. was interpreted from Petiver's illustration as representing *A. nummularifolius* (Linn.) DC. However, the *Hedysarum*, *Fl. Zeyl. no. 288*, of which Linnaeus had seen a specimen, is an *Indigofera, I. nummularifolia* (Linn.) Livera in Alston, Handb. Fl. Ceyl. **6**: Suppl. 72. 1931 (*Indigofera echinata* Willd. Sp. Pl. **3**: 1222. 1803), and although Linnaeus manifestly took his specific name from the Petiver reference, *Onobrychis maderaspat. nummulariae folio* Petiver, Gaz. 41. *t. 26. f. 4.* 1702–04, he saw no actual specimen of this. It seems logical to interpret the species from the "Flora Zeylanica" reference, for this was based on a still extant specimen which Linnaeus saw and described. In my earlier somewhat extensive discussion of this species, Philip. Jour. Sci. **5**: Bot. 92. 1910, I interpreted *Alysicarpus nummularifolius* (Linn.) DC. as typified by the Petiver reference, excluding *Fl. Zeyl. 288.*

Aspalathus Linnaeus

***Aspalathus pedunculata** Houtt. Nat. Hist. II. **5:** 475. *t. 28. f. 2.* 1775; Christm. Pflanzensyst. **4:** 220. *t. 28. f. 2.* 1779.

? *Aspalathus divaricata* Thunb. Prodr. Pl. Cap. 128. 1800; Harv. Fl. Cap. **2:** 138. 1861.

Houttuyn's species was based on material from South Africa. The binomial is not indicated as new, neither is there any Latin diagnosis. It is, however, much earlier than *A. pedunculata* L'Hér. Sert. Angl. 13. *t. 26.* 1788, Bot. Mag. **10:** *t. 344.* 1796, Harv. Fl. Cap. **2:** 140. 1861, which should be replaced by *A. squamosa* Thunb. Dr. R. H. Compton states that certain identification from Houttuyn's description and illustration is difficult, but that very likely it is a poor representation of *Aspalathus divaricata* Thunb. Prodr. Pl. Cap. 128. 1800; Harvey, Fl. Cap. **2:** 138. 1861. If this suggested reduction be correct, Thunberg's specific name would be replaced by Houttuyn's.

Cynometra Linnaeus

Cynometra ramiflora Linn. Sp. Pl. 382. 1753.

Limonia diphylla* Houtt. Nat. Hist. II. **2: 440. *t. 9. f. 2.* 1774; Christm. Pflanzensyst. **1:** 615. *t. 9. f. 2.* 1777; M. Roem. Fam. Nat. Reg. Veg. Syn. Monogr. **1:** 39. 1846 (Syn. Hesper. 39).

Houttuyn's figure, as to the leaves, represents the characteristic form of *Cynometra cauliflora* Linn. with a single pair of leaflets, the one illustrated by Rumphius, Herb. Amb. **1:** 167. *t. 63,* as *Cynomorium silvestre;* this form was included by Linnaeus in his original concept of the species but the Linnaean type should probably be interpreted as the Ceylon form. I do not recognize the solitary, long-pedicelled, conspicuously bracteate flower which Houttuyn's artist represents as *attached* to the tip of the leafy branch; it certainly does not belong with the leaf specimen. Houttuyn gives the Javanese name of his plant as *crandang;* but this local name seems properly to belong with *Dialium Indum* Linn., a totally different species from the one that Houttuyn illustrated. *Limonia diphylla* M. Roem. was published independently, the entire description reading "Folia binata (conjugata v. bifoliolata). In Java. Fructus magnitudine ovi columbini." Its basis was probably Houttuyn's or Christmann's *Limonia diphylla* for Houttuyn says regarding the fruit "niet grooter dan een Duiven-Ey."

Desmodium Desvaux

Desmodium motorium (Houtt.) comb. nov.

Hedysarum motorium* Houtt. Nat. Hist. II. **10: 246. 1779; Panzer, Pflanzensyst. **8**: 666. 1782, *in nota*.
Hedysarum gyrans Linn. f. Suppl. 332. 1781.
Desmodium gyrans DC. Prodr. **2**: 326. 1825.
Codariocalyx gyrans Hassk. Flora **25**(2): Beibl. **2**: 49. 1842; Schindl. Repert. Sp. Nov. **20**: 281. 1924.

Houttuyn's description was based on specimens grown at Leiden, shown to him by Van Royen in September 1778. His specific name was selected in reference to the peculiar motion of the small lateral leaflets, for the same reason that Linnaeus proposed the descriptive name *gyrans* two years later. The latter's description was based on material grown at Upsala from seeds sent by Forster in 1778. Panzer saw the species in cultivation in the Vienna botanical garden in 1777. Doubtless all of the specimens grown in European botanical gardens in 1777–81 were derived from seeds from one single source.

Lathyrus Linnaeus

Lathyrus japonicus Willd. Sp. Pl. 3. 1092. 1803; Fernald, Rhodora **34**: 178. 1932.

Pisum maritimum Linn. Sp. Pl. 727. 1753, non *Lathyrus maritimus* Bigel.
Lathyrus pisiformis sensu Houtt. Nat. Hist. II. **10**: 197. *t. 65. f. 1.* 1779: Panzer, Pflanzensyst. **8**: 608. *t. 65. f. 1.* 1782; non Linn.

The nomenclature of this common and widely distributed strand plant has recently been discussed by Fernald.* Willdenow's binomial was based on Houttuyn's description and illustration, his reference, however, being to the "Pflanzensystem" rather than to the "Natuurlyke historie." *Lathyrus pisiformis* Houtt. appears in literature as an independently published binomial, but Houttuyn merely attempted to interpret the Linnaean species, illustrating a Japanese plant that he thought represented it. It should be cited as *Lathyrus pisiformis* sensu Houtt. non Linn.

Lotononis de Candolle

Lotononis umbellata (Linn.) Benth. Hook. Lond. Jour. Bot. **2**: 602. 1843; Harv. Fl. Cap. **2**: 55. 1861; Dümmer, Trans. Roy. Soc. S. Afr. **3**: 299. 1913.

Ononis umbellata Linn. Mant. **2**: 266. 1771.
Lotus capensis* Houtt. Nat. Hist. II. **10: 311. *t. 65. f. 3.* 1779; Panzer, Pflanzensyst. **8**: 758. *t. 65. f. 3.* 1782, *in nota*.

Houttuyn failed to indicate *Lotus capensis* as a new species and gave

***Fernald, M. L.** Lathyrus japonicus versus L. maritimus. Rhodora **34**: 177-187. 1932.

no Latin diagnosis. The illustration represents *Lotononis umbellata* (Linn.) Benth., this identification being confirmed by Dr. R. H. Compton. *Ononis umbellata* Linn. is cited by Harvey as a doubtful synonym of *Lotononis umbellata* Benth., but Bentham was apparently correct in his interpretation of the Linnaean species. Mr. J. E. Dandy examined the specimen in the Linnaean herbarium, which is in flower and in young fruit, and reports that it is identical with specimens currently accepted as representing *Lotononis umbellata* (Linn.) Benth. On the sheet, which otherwise bears no information, Smith has added the letters "HB" = Herb. Banks. At the British Museum Mr. Dandy found a sheet in the Banksian herbarium that is an absolute match for the Linnaean specimen. This sheet bears the inscription "Prom. bon. spei. Desmaret." and was named by Solander (MSS.) as *Lotus capensis* Houtt. No information is available as to the dates of Desmaret's collection. Dümmer, who monographed the genus in 1913, cites six synonyms of *Lotononis umbellata* Benth. but does not include *Ononis umbellata* Linn. *Lotus capensis* Houtt. adds another synonym. *Lotononis* was originally published by de Candolle in 1825 as a section of *Ononis*. As a generic name (1836) it is antedated by *Amphinomia* DC. (1825) and *Leobordea* Delisle (1830), and if it is to be maintained it should be added to some future additional list of *nomina generica conservanda*.

Podalyria Lamarck

Podalyria calyptrata (Retz.) Willd. Sp. Pl. **2:** 504. 1799; Harv. Fl. Cap. **2:** 12. 1861.

Sophora calyptrata Retz. Obs. **1:** 36. 1779.
Sophora biflora Houtt. Nat. Hist. II. **5:** 8. *t. 24. f. 1.* 1775; Christm. Pflanzensyst. **3:** 501. *t. 24. f. 1.* 1778, non Linn.?

In spite of the fact that Houttuyn added the word *mihi* following his very short diagnosis, it is suspected that he intended to describe and illustrate *S. biflora* Linn. Syst. Nat. ed. 10, **2:** 1015. 1759. Willdenow placed Houttuyn's illustration under *P. calyptrata* Willd., his reference, however, being to Christmann's text. *Sophora biflora* Linn. seems to have originally been based on an actual specimen from Burman, doubtless the one still preserved in the Linnaean herbarium. Later, Sp. Pl. ed. 2, 534. 1762, he added various pre-Linnaean references, which resulted in Lamarck's statement, Encycl. **5:** 444. 1804, that Linnaeus had apparently placed several distinct species under *Sophora biflora* Linn.; and accordingly Lamarck based *Podalyria biflora* on Retzius' description of *Sophora biflora*, not on the original one of Linnaeus. A critical examination of Linnaeus's type seems to be called for here, for *Sophora*

biflora Linn. may actually be the same as *Sophora biflora* Houtt., in which case an adjustment in the synonymy would be necessary.

Psoralea Linnaeus

Psoralea ensifolia (Houtt.) comb. nov.

Anthyllis ensifolia* Houtt. Nat. Hist. II. **10: 120. *t. 62. f. 3.* 1779; Panzer, Pflanzensyst. **8**: 532. *t. 62. f. 3.* 1782.

Psoralea capitata Linn. f. Suppl. 339. 1781; Harvey, Fl. Cap. **2**: 151. 1861.

Psoralea multicaulis Jacq. Hort. Schönbr. **2**: *t. 230.* 1797.

Houttuyn's description was based on a specimen from South Africa, and was not indicated as new. Dr. R. H. Compton has identified it as representing *Psoralea capitata* Linn. f. The latter binomial must now be replaced by Houttuyn's earlier name.

Pueraria de Candolle

Pueraria Thunbergiana (Sieb. & Zucc.) Benth. Jour. Linn. Soc. Bot. **9**: 122. 1865; Rehder, Jour. Arnold Arb. **18**: 208. 1937.

Dolichos hirsutus Thunb. Trans. Linn. Soc. **2**: 339. 1784, non *Pueraria hirsuta* Kurz (1873).

Dolichos trilobus sensu Houtt. Nat. Hist. II. **10**: 153. *t. 64. f. 1.* 1779; Panzer, Pflanzensyst. **8**: 560. *t. 64. f. 1.* 1782; non Linn.

Pueraria triloba Makino in Iinuma, Somoku-Dzusetsu, ed. 3, **3**: 954. *t. 22.* 1912.

Houttuyn merely attempted to interpret the Linnaean species, but illustrated an entirely different Japanese plant. If one wishes to insist that *Dolichos trilobus* Houtt. was actually published as a new binomial, then it was invalid when published. It should be cited *Dolichos trilobus* sensu Houtt., non Linn.

Sutherlandia R. Brown

Sutherlandia frutescens (Linn.) R. Br. in Ait. Hort. Kew. ed. 2, **4**: 327. 1812; Harv. Fl. Cap. **2**: 212. 1861–62.

Colutea frutescens Linn. Sp. Pl. 723. 1753; Christm. Pflanzensyst. **4**: 260. 1779.

Colutea fruticosa* Houtt. Nat. Hist. II. **5: 517. 1775.

The publication of *Colutea fruticosa* Houtt. was probably due to a *lapsus calami* on his part, *C. frutescens* doubtless being intended.

Wisteria Nuttall

Wisteria floribunda (Willd.) DC. Prodr. **2**: 390. 1825; Rehd. & Wils. in Sargent, Pl. Wils. **2**: 510. 1916, *cum syn.* (*Wistaria*).

Glycine floribunda Willd. Sp. Pl. **3**: 1066. 1800.
Dolichos japonicus Spreng. Syst. Veg. **3**: 252. 1826.
Wisteria brachybotrys Sieb. & Zucc. Fl. Jap. **1**: 92. *t. 45.* 1839.
Dolichos polystachyos sensu Houtt. Nat. Hist. II. **10**: 156. *t. 64. f. 2.* 1779; Panzer, Pflanzensyst. **8**: 563. *t. 64. f. 2.* 1782 (*polystachios*); Thunb. Fl. Jap. 281. 1784 (*polystachyos*); non *Dolichos polystachios* Linn. = *Phaseolus polystachyus* B.S.P.

Houttuyn, Panzer, and Thunberg all attempted to interpret the Linnaean species and did not propose a new binomial. The plant Houttuyn and Thunberg had and which the former illustrated is *Wisteria floribunda* (Willd.) DC. Willdenow's and Sprengel's binomials were based wholly on the Thunberg and Houttuyn references.

Zornia Gmelin

Zornia myriadena Benth. in Mart. Fl. Bras. **15**(1): 85. 1859.

Ornithopus tetraphyllus Linn. Syst. Nat. ed. 10, **2**: 1168. 1759; Panzer, Pflanzensyst. **8**: 636. 1782.
Ornithopus quadriphyllus* Houtt. Nat. Hist. II. **10: 225. 1779.
Myriadenus tetraphyllus DC. Prodr. **2**: 316. 1825.
Zornia Sloanei Griseb. Fl. Brit. West Ind. 709. 1864.
Zornia tetraphylla Fawc. & Rendle, Fl. Jamaic. **2**: 31. 1920, non Michx.

Houttuyn's use of the hybrid specific name *quadriphyllus* was doubtless due to a *lapsus calami* on his part for there was no indication that he contemplated publishing a new name. The two forms, of course, have the same meaning, but the original Linnaean name is wholly Greek and Houttuyn's inadvertent substitute is half Latin and half Greek. Fawcett and Rendle's new name *Zornia tetraphylla* is invalidated by the much earlier *Z. tetraphylla* Michx. If this synonymy be correct, *Z. myriadena* Benth. in Mart. Fl. Bras. **15**(1): 85. 1859 is the oldest valid specific name. The Linnaean binomial was based on Sloane's Jamaica reference, exactly *Zornia Sloanei* Griseb. and *Myriadenus tetraphyllus* DC. In spite of the fact that Bentham says "excl. syn. Sloane" and "nec in Jamaica," his binomial I judge to have been merely a new one for *Myriadenus tetraphyllus,* the specific name being invalid in *Zornia.* Hence the binomial is to be interpreted by its name-bringing synonym; and this would be the Jamaican form in spite of the fact that Bentham excluded it. *Zornia tetraphylla* Michx. was based on *Z. bracteata* Gmel. (*Anonymos bracteata* Walt.), not on *Ornithopus tetraphyllus* Linn.

GERANIACEAE

Pelargonium L'Héritier

Pelargonium Chelidonium (Houtt.) DC. Prodr. **1**: 650. 1824; Knuth, Pflanzenr. **53(IV.129)**: 334. 1912.

Geranium Chelidonium Houtt. Nat. Hist. II. **10**: 8. *t. 61. f. 1.* 1779; Panzer, Pflanzensyst. **8**: 398. *t. 61. f. 1.* 1782.

Knuth cites the Houttuyn reference as "Lin. Pfl. Syst. X. 8 p. 398. tab. 61. f 1" thus confusing the Houttuyn with the Panzer citation. The "Index Kewensis" entry to the volume, page, and illustration is correct. Houttuyn's type was from South Africa.

Pelargonium sp.

Geranium hybridum Linn. Mant. **1**: 97. 1767; Houtt. Nat. Hist. II. **5**: 370. 1775.

Geranium spurium* Christm. Pflanzensyst. **4: Regist. [38]. 1779, descr. p. 124, *s.n.*

The Linnaean species is apparently not accounted for in Knuth's monograph of the Geraniaceae, Pflanzenr. **53(IV.129)**: 1–640. 1912. The overlooked *G. spurium* Christm. was based on *G. hybridum* Linn. for Christmann cites the Linnaean description, Murray, Syst. Veg. ed. 13, 511. 1774, as no. 3 "Unächter oder Bastard-Storchschnabel." The specific name *spurium* appears only in the Register p. [38] at the end of the volume.

LINACEAE

Linum Linnaeus

***Linum capense** Houtt. Nat. Hist. II. 8: Aanwyz. Plaat. [1]. *t. 46. f. 1.* 1777; Christm. Pflanzensyst. **6**: 263. *t. 46. f. 1.* 1780; sub *L. quadrifolium* Linn.

This is actually named in the description of the plate thus: "Een Plantje dat ik, wegens de Vrugtmaakende deelen, *Linum capense* noem." In the text II. 8: 286. 1777, a cursory description appears following *Linum quadrifolium* Linn. The illustration shows a simple, slender, leafless plant, natural size according to Houttuyn, bearing five flowers. It may be a form of *Linum thesioides* Bartl. Linn. **7**: 540. 1832, in which case Houttuyn's binomial would replace the latter, or it may be referable to *Linum quadrifolium* Linn. Christmann suggested the latter identification; for manifestly, as Christmann noted, Houttuyn had an old plant from which the leaves had fallen.

RUTACEAE

Calodendrum Thunberg

Calodendrum capense Thunb. Nov. Gen. 43. 1782, Prodr. Pl. Cap. 44, 1794, Fl. Cap. ed. Schultes, 197. 1823; Sonder, Fl. Cap. **1**: 371. 1859–60.

Dictamnus capensis Linn. f. Suppl. 232. 1781.

Pallasia Houtt. Nat. Hist. II. **4**: 382. *t. 22*. 1775.
Pallasia capensis Christm. Pflanzensyst. **3**: 318. 1778.

Houttuyn described and illustrated the genus *Pallasia* in 1775 but published no specific name; the latter was provided by Christmann in 1778. *Pallasia* Houttuyn is the oldest name for this genus but *Calodendrum* Thunb. is conserved. The "Index Kewensis" entry for the binomial is "[Christm. in] Houtt. Pfl. Syst. iii. 318;" it should be as cited in the synonymy above. The three binomials listed above were published independently of each other, all three authors curiously selecting the same specific name.

Citrus Linnaeus

Citrus aurantifolia (Christm.) Swingle, Jour. Washington Acad. Sci. **3**: 465. 1913; Merr. Interpret. Herb. Amb. 296. 1917.

Limonia aurantifolia* Christm. Pflanzensyst. **1: 618. 1777; M. Roem. Fam. Nat. Reg. Veg. Syn. Monogr. **1**: 39. 1846 (Syn. Hesper. 39).
Limonia acidissima* Houtt. Nat. Hist. II. **2: 444. 1774, non Linn.

Limonia acidissima Houtt. was clearly indicated by him as a new species, but his specific name was invalidated by *Limonia acidissima* Linn. To it he referred first *Limonellus* Rumph. Herb. Amb. **2**: 107. *t. 29*. 1741, followed by *Limo ferus, papeda, tuberosus,* and *aurarius* Rumph., not all of which represent the same species. Essentially it seems safe to interpret the species from the first reference which undoubtedly represents the common lime, usually known as *Citrus acida* Roxb. *Limonia aurantifolia* Christm. is a new name for *L. acidissima* Houtt. (non Linn.), but it is not indicated as such except by reference to Houttuyn's description, and hence has very generally been overlooked by botanists until Swingle called attention to it. The "Index Kewensis" reference is to *Limonia aurantifolia* M. Roem., but although Roemer does not cite the source of his binomial he undoubtedly took it from the Surinam reference of Christmann.

Feronia Correa

Feronia Limonia (Linn.) Swingle, Jour. Washington Acad. Sci. **4**: 328. 1914.

Schinus Limonia Linn. Sp. Pl. 389. 1753.
Limonia acidissima Linn. Sp. Pl. ed. 2, 554. 1762; Hook. f. Fl. Brit. Ind. **1**: 507. 1875.
Limonia pinnatifolia* Houtt. Nat. Hist. II. **2: 441. 1774; Christm. Pflanzensyst. **1**: 616. 1777.

The form Houttuyn described is clearly the Linnaean species; it was not proposed as a new species, nor is there any indication that the specific name was a new one, or any explanation of the change in the name.

Ruta Linnaeus

Ruta chalepensis Linn. Mant. **1**: 69. 1767; Pereira, Fl. Portugal 378. 1913.

Ruta ulyssiponensis* Houtt. Nat. Hist. II. **5: 55. 1775.

As Pereira distinguishes the two Portugal species, *R. chalepensis* Linn. and *R. montana* Linn., Houttuyn's species seems to be referable to the former. *Ruta ulyssiponensis* Houtt. was based on Loefling's observations on plants noted in the protestant cemetery in Lisbon, and Houttuyn separated it from *R. chalepensis* Linn. Christmann did not recognize it.

POLYGALACEAE

Polygala Linnaeus

Polygala empetrifolia Houtt. Nat. Hist. II. **5:** 433. *t. 28. f. 1.* 1775; Christm. Pflanzensyst. **4:** 181. *t. 28. f. 1.* 1779, ***in nota.***

Polygala teretifolia Linn. f. Suppl. 316. 1781; Thunb. Prodr. Pl. Cap. 120. 1800; Harv. Fl. Cap. **1**: 83. 1859; Chodat, Mém. Soc. Phys. Hist. Nat. Genève **31**(2): 418. *t. 31. f. 24–25.* 1893.

Houttuyn's specific name is clearly the oldest available one for this characteristic South African species. He did not indicate the binomial as new and provided no Latin diagnosis. The entry and reduction in "Index Kewensis" is correct. Chodat does not mention Houttuyn's species in his "Monographia Polygalacearum" published in 1891–93.

Polygala japonica Houtt. Nat. Hist. II. **10:** 89. *t. 62. f. 1.* 1779; Panzer, Pflanzensyst. **8:** 488. *t. 62. f. 1.* 1782; Chodat, Mém. Soc. Phys. Hist. Nat. Genève **31**(2): 353. 1893.

Houttuyn did not indicate this as a new species, and provided no Latin diagnosis of it. While it is currently retained as specifically distinct from *P. sibirica* Linn., it is probably better placed as a synonym of the Linnaean species.

EUPHORBIACEAE

Euphorbia Linnaeus

Euphorbia nodosa** Houtt. Nat. Hist. II. **8:** 748. *t. 52. f. 2.* 1777; Christm. Pflanzensyst. **7:** 52. *t. 52. f. 2.* 1781, ***in nota.

Euphorbia corrigioloides Boiss. Cent. Euphorb. 11. 1860; DC. Prodr. **15**(2): 32. 1862; Hook. f. Fl. Brit. Ind. **5:** 251. 1887.

The plant Houttuyn described and illustrated seems clearly to be a small-leaved form of *E. corrigioloides* Boiss. Houttuyn's overlooked binomial, having 83 years' priority, is accepted. *Euphorbia nodosa* N. E. Brown in Thiselton-Dyer, Fl. Trop. Afr. **6**(1): 548. 1911 is renamed **Euphorbia Nebrownii** nom. nov.

Leidesia Mueller-Arg.

Leidesia procumbens (Linn.) Prain, Ann. Bot. **27**: 400. 1913; Pax, Pflanzenr. **63(IV.147.VII)**: 284. *f. 44*. 1914.

Mercurialis procumbens Linn. Sp. Pl. 1036. 1753.
Croton ricinocarpos Linn. Sp. Pl. ed. 2, 1427. 1763; Christm. Pflanzensyst. **4**: 526. 1779.
Croton ricinokarpos* Houtt. Nat. Hist. II. **6: 260. 1776.
Leidesia capensis Muell.-Arg. in DC. Prodr. **15**(2): 793. 1866; Prain in Thiselton-Dyer, Fl. Cap. **5**(2): 463. 1920.

Although Prain in 1920 abandoned the specific name *procumbens* in favor of *capensis* he states that it is *Mercurialis procumbens* Linn. (1753). Clearly the oldest name should be retained.

CALLITRICHACEAE

Callitriche Linnaeus

Callitriche autumnalis Linn. Fl. Suec. ed. 2, 2. 1755; Christm. Pflanzensyst. **5**: 49. 1779.

Stellaria autumnalis* Houtt. Nat. Hist. II. **7: 66. 1777.

Houttuyn's hitherto overlooked binomial was manifestly due to an inadvertent error on his part in transcribing the generic name, *Callitriche* being the one intended. The error was corrected two years later by Christmann.

ANACARDIACEAE

Lannea A. Richard

Lannea coromandelica (Houtt.) comb. nov.

Dialium coromandelicum Houtt. Nat. Hist. II. **2**: 39. *t. 5. f. 2.* 1774; Christm. Pflanzensyst. **1**: 208. *t. 5. f. 2.* 1777, *in nota.*
Haberlia grandis Dennst. Schlüss. Hort. Malabar. 30. 1818.
Odina Wodier Roxb. Hort. Beng. 29. 1814, *nomen nudum,* Fl. Ind. ed. 2, **2**: 293. 1832; Hook. f. Fl. Brit. Ind. **2**: 29. 1876; Lecomte, Fl. Gén. Indo-Chine **2**: 34. 1908.
Calesium grande O. Ktze. Rev. Gen. Pl. 151. 1891.
Lannea grandis Engl. in Engl. & Prantl, Nat. Pflanzenfam. Nachtr. 213. 1897.
Kalesiam Rheede, Hort. Malabar. **4**: 67. *t. 32.* 1683.

Houttuyn's species was not indicated by him as new and no Latin diagnosis was supplied. The description and the illustration, based on a Coromandel specimen from Burman, clearly represent no *Dialium*. I am indebted to Mr. C. E. C. Fischer of the Royal Botanic Gardens, Kew, who suggested to me the probability that *Lannea* was the genus represented. As he states what Houttuyn described in connection with the inflorescences as the "kleine rondagtige Blaadjes," are the young fruits.

Most of our material representing this common species, which extends from northwestern India to Ceylon and eastward to Indo-China and Hainan, has leaves with 7 to 9 leaflets, although some of the specimens have but five as Houttuyn describes and illustrates them. His illustration is, on the whole, better than is that of Rheede which is the whole basis of *Haberlia grandis* Dennst. Dr. Hochreutiner informs me that there is no specimen in Burman's herbarium at Geneva.

MALVACEAE

Malvastrum A. Gray

Malvastrum coromandelianum (Linn.) Garcke, Bonpl. **5**: 297. 1857.

Malva coromandeliana Linn. Sp. Pl. 687. 1753; Houtt. Nat. Hist. II. **10**: 54. 1779.

Malva coromandelica* Panzer, Pflanzensyst. **8: 448. 1782.

Malvastrum tricuspidatum A. Gray, Pl. Wright. 16. 1852.

The publication of the form *Malva coromandelica* was probably due to a *lapsus calami* on the part of Panzer.

STERCULIACEAE

Melochia Linnaeus

Melochia umbellata (Houtt.) Stapf, Kew Bull. **1913**: 317. 1913.

Visenia umbellata Houtt. Nat. Hist. II. **8**: 309. *t. 40. f. 3.* 1777; Christm. Pflanzensyst. **6**: 287. *t. 46. f. 3.* 1780.

Visenia umbellata Houtt. was proposed as a new genus and species, but there is no Latin diagnosis and no clear indication that they were new. The synonymy has been adjusted by Stapf, Kew Bull. **1913**: 317. 1913, this widely distributed Indo-Malaysian species being more commonly known as *Malachra indica* A. Gray and as *M. arborea* Blanco.

DILLENIACEAE

Tetracera Linnaeus

Tetracera indica (Houtt.) Merr. Interpret. Herb. Amb. 367. 1917, *in nota.*

Assa Houtt. Nat. Hist. II. **5**: 275. *t. 26. f. 1.* 1775.

Assa indica Houtt. ex Christm. Pflanzensyst. **4**: 40. *t. 26. f. 1.* 1779.

Assa exotica J. F. Gmel. Syst. Nat. **2**: 839. 1791.

Tetracera Assa DC. Syst. **1**: 402. 1818.

Houttuyn's material was from the Malaysian region. He proposed the new genus *Assa* but published no binomial for the species; a specific name was supplied by Christmann four years later, who, however, ascribes it to Houttuyn. The "Index Kewensis" entry is "Christm. &

Panz. in Houtt. Pflanz. Syst. iv. 40." All the synonyms cited above are based on Houttuyn's original description and illustration. It is *Ay-assa* Rumph. Herb. Amb. Auct. **7:** 20. 1755.

GUTTIFERAE

Calophyllum Linnaeus

Calophyllum sp. ?

Rheedia javanica Burm. f. Fl. Ind. 118. 1768; Christm. Pflanzensyst. **2:** 4. 1777.

Rheedia umbellata* Houtt. Nat. Hist. II. **3: 3. 1774.

Houttuyn's hitherto overlooked binomial was proposed as a new one for *Rheedia javanica* Burm. f. but was not so indicated by him. In my paper on Burman's species, Philip. Jour. Sci. **19:** 366. 1921, I placed it as *Garcinia* sp., but if Burman was correct in indicating his plant as representing Polyandria, Monogynia, this would be an impossible reduction; Dr. Hochreutiner informs me that there is no Burman specimen under *Garcinia* in the Delessert Herbarium at Geneva. *Calophyllum* would be a possibility because it has a 1-celled ovary and many stamens, but the description of the inflorescences "Pedunculi ex alis foliorum saepius terni ad medium quadrifidi" does not conform to *Calophyllum* characters nor does the term "umbellis pedunculatis" apply. Burman states "Foliatura and umbellis ab Americana differt, confer f. 4. t. 358. *Plukn. phyt.* quae ejusdem videtur generis," but Plukenet's *t. 358. f. 4.* is a rather crude illustration of some non-guttiferous plant with opposite *trifoliate*, rather coarsely toothed leaflets.

Hypericum Linnaeus

Hypericum aegypticum Linn. Sp. Pl. 784. 1753.

Hypericum aegyptium* Murr. Syst. Veg. ed. 13, 583. 1774; Houtt. Nat. Hist. II. **5: 572. 1775; Christm. Pflanzensyst. **4:** 313. 1779.

Hypericum aegyptiacum* Spreng. Syst. **3: 334. 1826, *in syn.*

Martia polyandra Spreng. op. cit. 333.

Houttuyn merely followed Murray in accepting the specific name *aegyptium* rather than the original form *aegypticum*.

Rheedia Linnaeus

Rheedia lateriflora Linn. Sp. Pl. 1193. 1753; Houtt. Nat. Hist. II. **3:** 2. 1774; Christm. Pflanzensyst. **2:** 4. 1777.

Rheedia americana* Christm. Pflanzensyst. **2: 4. 1777.

The publication of *Rheedia americana* by Christmann was doubtless due to an error on his part. The center head is "Amerikanische Rheedie.

Rheedia Americana" and this binomial appears in his index. *Rheedia lateriflora* Linn. appears as a lateral heading but is not indexed. The erroneous "Index Kewensis" entry "Rheedia americana, Hort. ex Steud. Nom. ed. II. ii. 446" was copied from Steudel, Nomencl. ed. 2, **2:** 446. 1841 "americana Hort. lateriflora." In ed. 1, 686. 1821 it appears as "R. americana Houtt." The author is Christmann.

FLACOURTIACEAE

Flacourtia L'Héritier

Flacourtia indica (Burm. f.) Merr. Interpret. Herb. Amb. 377. 1917, Enum. Philip. Fl. Pl. **3:** 112. 1923.

Gmelina indica Burm. f. Fl. Ind. 132. *t. 39. f. 5.* 1768; Houtt. Nat. Hist. II. **3:** 122. 1774.

Gmelina javanica* Christm. Pflanzensyst. **2: 134. 1777.

Christmann's binomial is not indicated as a new one and there is no explanation of the change in name. The material was from Java rather than from India. In any case it adds another synonym to the already ample list, including *Flacourtia sepiaria* Roxb. and *F. ramontchi* L'Hérit.

Samyda Linnaeus

Samyda serrulata Linn. Sp. Pl. ed. 2, 558. 1762; Houtt. Nat. Hist. II. **5:** 100. 1775; DC. Prodr. **2:** 47. 1825.

Samyda denticulata* Christm. Pflanzensyst. **3: 584. 1773.

Christmann's specific name was probably due to a *lapsus calami* on his part as the references he gives are to *S. serrulata* Linn. *Samyda denticulata* Poir. Dict. Sci. Nat. **47:** 159. 1816–30, was an independent publication, but is also a synonym of *S. serrulata* Linn.

LYTHRACEAE

Rotala Linnaeus

Rotala verticillaris Linn. Mant. **2:** 175. 1771; Houtt. Nat. Hist. II. **7:** 204. 1777; Koehne, Pflanzenr. **17(IV.216):** 30. 1903.

Rotala verticillata* Christm. Pflanzensyst. **5: 195. 1779.

Christmann's perhaps inadvertent use of the form *verticillata* is forty years earlier than that by Roemer & Schultes, cited by Koehne.

COMBRETACEAE

Terminalia Linnaeus

Terminalia Chebula Retz. Obs. **5:** 31. 1789; Roxb. Pl. Coromandel **2:** 52. *t. 197.* 1798; C. B. Clarke in Hook. f. Fl. Brit. Ind. **2:** 446. 1878.

Myrobalanifera citrina Houtt. Nat. Hist. II. **2**: 486. *t. 10. f. 2.* 1774; Christm. Pflanzensyst. **1**: 667. *t. 10. f. 2.* 1777, *in nota*; non *Terminalia citrina* (Gaertn.) Roxb.

Myrobalanifera is a generic name apparently overlooked by all botanists since Houttuyn's and Christmann's time up to 1929 when it was listed, but not reduced, in the seventh supplement to "Index Kewensis." The species, clearly indicated by Houttuyn as new and provided with a brief Latin diagnosis, is manifestly a form of *Terminalia Chebula* Retz., and is not the same as *T. citrina* (Gaertn.) Roxb., the latter binomial dating from 1800. Although Houttuyn's binomial is older than any that appertain to this particular group, his specific name is invalid in *Terminalia* thus fortunately permitting the retention of the well known *Terminalia Chebula* Retz. for this particular species.

ARALIACEAE

Panax Linnaeus

Panax trifolius Linn. Sp. Pl. 1059. 1753; Houtt. Nat. Hist. II. **11**: 419. 1779; Britt. & Brown, Ill. Fl. N. States Canada **2**: 507. *f. 2631.* 1897, ed. 2, **2**: 619. *f. 3094.* 1913.

Panax trifoliatum* Panzer, Pflanzensyst. **10: 335. 1783.

Panzer's binomial was probably due to an error on his part in transcribing the name.

UMBELLIFERAE

Cnidium Cosson

Cnidium suffruticosum (Berg.) Cham. & Schlecht. Linnaea **1**: 387. 1826; Sonder, Fl. Cap. **2**: 552. 1861–62.

Conium suffruticosum Berg. Descr. Pl. Cap. 77. 1767.
Athamantha capensis Burm. f. Prodr. Fl. Cap. 7. 1768.
Conium rigens Linn. Mant. **2**: 352, 512. 1771; Houtt. Nat. Hist. II. **8**: 62. 1777.
Conium rigidum* Christm. Pflanzensyst. **6: 60. 1780.

Christmann's change of the specific name might have been deliberate but it is more apt to have been due to a *lapsus calami* on his part.

Ruthea Bolle

Ruthea gummifera (Linn.) Drude in Engl. & Prantl, Nat. Pflanzenfam. **3**(8): 179. 1898.

Bubon gummiferum Linn. Sp. Pl. 254. 1753.
Glia gummifera Sonder, Fl. Cap. **2**: 548. 1861–62.
Oenanthe capensis Houtt. Nat. Hist. II. **8**: 140. *t. 45. f. 2.* 1777; Christm. Pflanzensyst. **6**: 139. *t. 45. f. 2.* 1780.

Houttuyn's species is reduced in "Index Kewensis" to *Lichtensteinia pyrethrifolia* DC. which is cited by Sonder under both *Glia gummifera* Sonder and *Peucedanum ferulaceum* Thunb. Houttuyn's material was from the Cape of Good Hope region. Dr. R. H. Compton informs me that the illustration represents *Glia gummifera* Sonder.

Tordylium Linnaeus

Tordylium aegyptiacum (Linn.) Lam. Tabl. Encycl. **2:** 336. 1819.

Hasselquistia aegyptiaca Linn. Cent. I. Pl. 9. 1755, Amoen. Acad. **4:** 270. 1759, Sp. Pl. ed. 2, 355. 1762; Christm. Pflanzensyst. **6:** 33. 1780.

Hasselquistia orientalis* Linn. Mant. **2: 217. 1771; Houtt. Nat. Hist. II. **8:** 31. 1777.

A detailed description of *Hasselquistia orientalis* Linn. appears in the "Mantissa Plantarum," with reference to *H. aegyptiaca* Linn. Sp. Pl. ed. 2, 1762. The new specific name may have been deliberately substituted, but the probability is that *orientalis* was inadvertently written in place of *aegyptiaca*. In any case *Hasselquistia orientalis* Linn. has very generally been overlooked and does not appear in "Index Kewensis."

Torilis Adanson

Torilis japonicus (Houtt.) DC. Prodr. **4:** 219. 1830; Buwalda, Blumea **2:** 169. 1937; Merr. Rhodora **40:** 291. 1938 (Contr. Gray Herb. **122:** 291).

Caucalis japonicus Houtt. Nat. Hist. II. **8:** 42. *t. 45. f. 1.* 1777; Christm. Pflanzensyst. **6:** 45. *t. 45. f. 1.* 1780.

Tordylium Anthriscus Linn. Sp. Pl. 240. 1753.

Caucalis Anthriscus Huds. Fl. Angl. 99, 1762, ed. 2, 114. 1778; Britt. & Br. Ill. Fl. N. States Canada **2:** 54. *f. 2634.* 1897.

Torilis Anthriscus Gmel. Fl. Bad. **1:** 613. 1805; Britt. & Br. Ill. Fl. N. States Canada ed. 2, **2:** 626. *f. 3106.* 1913; Thellung in Hegi, Ill. Fl. Mittel-Eur. **5**(2)**:** 1051. 1926; non Bernh. 1800, nec Gaertn. 1788.

Houttuyn's species was not indicated as new and no Latin diagnosis was provided. The "Index Kewensis" entry is correct except that the reference to the illustration was not included. De Candolle cites a Houttuyn specimen in the Delessert Herbarium at Geneva. Linnaeus described both *Tordylium Anthriscus* and *Scandix Anthriscus*, the same specific name for somewhat similar species causing some confusion. The *Tordylium* is the species here considered but the specific name is invalidated in *Torilis* by both Bernhardi's and Gaertner's use of the same epithet for a different species. *Scandix Anthriscus* Linn. has nothing to do with the species here considered, and is *Chaerefolium Anthriscus* (Linn.) Schinz & Thellung (*Torilis Anthriscus* Gaertn.); Hegi, Ill. Fl.

Mittel-Europa **5**(*2*): 1030. *f. 2385*. 1926. Under the International Code Houttuyn's specific name is the correct one for this common and very widely distributed Eurasian species which occurs as an introduced and naturalized one in North America.

ERICACEAE

Erica Linnaeus

Erica pulchella Houtt. Nat. Hist. II. **4**: 504. *t. 23. f. 1*. 1775; Christm. Pflanzensyst. **3**: 427. *t. 23. f. 1*. 1778; Guthrie & Bolus in Thiselton-Dyer, Fl. Cap. **4**(1): 208. 1905.

This is a well known species with several synonyms, amply described by Guthrie and Bolus, l. c. Houttuyn's type was from the Cape of Good Hope region.

***Erica splendida** Houtt. Nat. Hist. II. **4**: 519. *t. 23. f. 3*. 1775; Christm. Pflanzensyst. **3**: 444. *t. 23. f. 3*. 1778, *in nota*.

Houttuyn gave no Latin diagnosis and no indication that he proposed this as new except incidentally in the text. His specimen was from the Cape of Good Hope, and I have not been able to place it to my satisfaction among the 90 species known from that region. In facies, from Houttuyn's figure, it much resembles *Erica regerminans* as illustrated by Andrews (non Linn.) = *E. viridipurpurea* Linn., but the anthers as shown in Houttuyn's figure do not conform to those of the Linnaean species. The entry in Index Londinensis **3**: 83. 1930 to *Erica splendida* Mackay, Houttuyn, etc. is wrong, for *Erica splendida* Mackay ex Loud. Hort. Brit. 146. 1830, a *nomen nudum*, has nothing to do with *E. splendida* Houtt. Dr. R. H. Compton states that in spite of a considerable amount of effort he and his associates at Kirstenbosch have not been able to make a satisfactory identification of *Erica splendida* Houtt.

Rhododendron Linnaeus

Rhododendron viscosum (Linn.) Torr. Fl. North. & Mid. U. S. 424. 1824.

Azalea viscosa Linn. Sp. Pl. 151. 1753; Houtt. Nat. Hist. II. **4**: 188. 1775; Britt. & Brown, Ill. Fl. N. States Canada ed. *2*, **2**: 679. *f. 3219*. 1913.

Azalea viscida* Christm. Pflanzensyst. **3: 156. 1778.

Christmann's use of the specific name *viscida* was doubtless due to an error in transcription on his part.

PRIMULACEAE

Lysimachia Linnaeus

Lysimachia quadrifolia Linn. Sp. Pl. 147. 1753; Britt. & Br. Ill. Fl.

N. States Canada **2:** 588. *f. 2813*. 1897, ed. *2*, **2:** 711. *f. 3289*. 1913.

Anagallis flava* Houtt. Nat. Hist. II. **7: 514. 1777.

Houttuyn's species was based wholly on *Anagallis caule singulari* . . . Gronov. Fl. Virgin. ed. *2*, 26. 1762 which in turn was based on a Clayton specimen. Mr. J. E. Dandy states that the species is not ticked in the British Museum copy of Gronovius. The description appears in the first edition of Gronovius' work as *Galium caule singulari* . . . 16. 1739, corrected to *Anagallis* on page 138. It seems clearly to refer to *Lysimachia quadrifolia* Linn., a common species extending from New Brunswick southward to Georgia and Alabama. This most commonly has its leaves in whorls of four, but sometimes a specimen with as many as seven leaves in a whorl are found; Gronovius' description calls for a form with leaves in whorls of five or six. Christmann did not include Houttuyn's species.

OLEACEAE

Jasminum Linnaeus

Jasminum oblongum Burm. f. Fl. Ind. 6. *t. 3. f. 2*. 1768; Houtt. Nat. Hist. II. **4:** 23. 1775; Merr. Philip. Jour. Sci. **19:** 372. 1921.

Jasminum javanicum* Garcin. ex Burm. f. l. c. in syn; Christm. Pflanzensyst. **3: 14. 1778.

Houttuyn's short description is based wholly on Burman's original description and illustration. Christmann, however, abandoned Burman's specific name and accepted *J. javanicum* which had been cited by Burman as a synonym. The illustration clearly does not represent a *Jasminum*, but I am unable to suggest what genus may be represented.

GENTIANACEAE

Gentiana Linnaeus

Gentiana quinquefolia Linn. Sp. Pl. 230. 1753; Houtt. Nat. Hist. II. **7:** 827. 1777.

Gentiana quinqueflora* Christm. Pflanzensyst. **5: 864. 1779.

The publication of the specific name *quinqueflora* was manifestly due to a *lapsus calami* on Christmann's part.

Villarsia Ventenat

Villarsia capensis (Houtt.) comb. nov.

Renealmia capensis Houtt. Nat. Hist. II. **8:** 335. *t. 47. f. 1.* 1777; Christm. Pflanzensyst. II. **6:** 319. *t. 47. f. 1.* 1780.

Menyanthes ovata Linn. f. Suppl. 133. 1781.

Villarsia ovata Vent. Choix 9. *t. 9.* 1803; Hill & Prain in Thiselton-Dyer, Fl. Cap. **4:** 1119. 1909.

Houttuyn's new genus *Renealmia* is invalidated by *Renealmia* Linn. = *Tillandsia* Linn. of the Bromeliaceae; *Renealmia* Linn. f. (1781) is the generally accepted generic name for a zingiberaceous genus; *Renealmia* R. Br. (1810) is a synonym of the ericaceous *Libertia* Spreng. Houttuyn's specific name is clearly the oldest valid one for this South African species of *Villarsia*.

CONVOLVULACEAE

Merremia Dennstaedt

Merremia umbellata (Linn.) Hall. f. Bot. Jahrb. **16:** 552. 1892.

Convolvulus umbellatus Linn. Sp. Pl. 155. 1753.
Ipomoea cymosa R. & S. Syst. **4:** 241. 1819.
Ipomoea pilosa* Houtt. Nat. Hist. II. **7: 573. *t. 42. f. 2.* 1777; Christm. Pflanzensyst. **5:** 562. *t. 42. f. 2.* 1779, *in nota.*

Houttuyn's specimen was from the East Indies. I interpret the species as the very common *Merremia umbellata* Hall. f. The flowers, as drawn, represent them as they appear on old, rather poorly prepared specimens, after the corollas have partly closed.

Ipomoea Linnaeus

Ipomoea biflora (Linn.) Pers. Syn. **1:** 183. 1805.

Convolvulus biflorus Linn. Sp. Pl. ed. 2, 1668. 1763.
Convolvulus bifidus* Christm. Pflanzensyst. **5: 529. 1779.
Aniseia biflora Choisy in DC. Prodr. **9:** 431. 1845.

Christmann through a *lapsus calami* wrote *bifidus* instead of *biflorus*, for Houttuyn correctly indicated the Linnaean binomial and Christmann's literature references are to *Convolvulus biflorus* Linn. The exact status of *Ipomoea biflora* (Linn.) Pers. is somewhat doubtful. Linnaeus says that the plant was from China; there is no specimen in the Linnaean herbarium. Hemsley says that it is probably the same as *I. Hardwickii* (Spreng.) Hemsl. (*Aniseia calycina* Choisy).

HYDROPHYLLACEAE

Hydrolea Linnaeus

Hydrolea zeylanica (L.) Vahl, Symb. **2:** 46. 1791; Brand, Pflanzenr. **59(IV.251):** 174. 1918.

Nama zeylanica Linn. Sp. Pl. 226. 1753.
Steris javana Linn. Mant. **1:** 54. 1767; Houtt. Nat. Hist. II. **7:** 800. 1777.
Steris javanica* Christm. Pflanzensyst. **5: 831. 1779.

Christmann's slight change in the specific name was doubtless due to an inadvertent error on his part in transcribing it.

BORAGINACEAE

Ehretia Linnaeus

Ehretia tinifolia Linn. Syst. Nat. ed. 10. **2**: 936. 1759; Christm. Pflanzensyst. **1**: 309. 1777.

Ehretia tenuifolia* Houtt. Nat. Hist. II. **2: 130. 1774.

Ehretia tenuifolia Houtt. was an inadvertently published binomial apparently due to an error on the part of Houttuyn in transcribing the Linnaean binomial.

Plagiobotrys Fischer & Meyer

Plagiobotrys orientalis (Linn.) Johnston, Contr. Gray Herb. **81**: 80. 1928; Hultén, Kungl. Svensk. Vetensk. Handl. III. **8**(2): 78. 1930 (Fl. Kamtschatka).

Heliotropium orientale Linn. Sp. Pl. 131. 1753; Houtt. Nat. Hist. II. **7**: 419. 1777; Christm. Pflanzensyst. **5**: 402. 1779.

Lithospermum javanicum Spreng. Syst. Veg. **1**: 547. 1825.

Lithospermum plebejum Cham. & Schlecht. Linnaea **4**: 446. 1829.

This entry scarcely belongs in this paper for no new name was proposed by either Houttuyn or Christmann. The reason for including it is partly because of the "Index Kewensis" entry "orientale, *Linn. Sp. Pl.* 131; Houtt. *Handleid.* vii. 419 (sp. dub.). — Malaya." Steudel credited the binomial to Houttuyn. All Houttuyn did was to base a short cursory description on the original Linnaean diagnosis. Linnaeus merely said that his specimen was from "Asia" but Houttuyn said it was from Java — the Linnaean type is a Steller specimen from Kamtschatka. The species occurs in Kamtschatka and the Behring Sea region, and is to be eliminated from the Indo-Malaysian lists.

VERBENACEAE

Caryopteris Bunge

Caryopteris incana (Thunb.) Miq. Ann. Mus. Bot. Lugd.-Bat. **2**: 97. 1865 (Prol. Fl. Jap. 29).

Nepeta incana* Thunb. ex Houtt. Nat. Hist. II. **9: 307. *t. 56. f. 2.* 1778; Christm. Pflanzensyst. **7**: 429. *t. 56. f. 2.* 1781; Thunb. Fl. Jap. 244. 1784.

Houttuyn's specimen was received from Thunberg, the latter's binomial was published by both Houttuyn and by Christmann six and four years respectively before the "Flora Japonica" appeared. It seemed to be apparent that Thunberg's binomial was transmitted to Houttuyn with the specimens for Houttuyn states regarding it: "vondt de Heer Thunberg in Japan een Soort van dit Geslag, door hem *Grys* genaamd —"

Verbena Linnaeus

Verbena carolina Linn. Syst. ed. 10, 852. 1759; Houtt. Nat. Hist. II. **7:** 144. 1777; Schauer in DC. Prodr. **11:** 546. 1847 (*caroliniana*).

Verbena caroliniana* Murray, Syst. Veg. ed. 13, 62. 1774; Christm. Pflanzensyst. **5: 127. 1779; Willd. Sp. Pl. **1:** 119. 1797.

Christmann merely followed Murray in the use of the form *caroliniana* for the specific name, the latter antedating Willdenow's use of it by 23 years.

Labiatae

Dracocephalum Linnaeus

Dracocephalum thymiflorum Linn. Sp. Pl. 596. 1753; Christm. Pflanzensyst. **7:** 551. 1781.

Dracocephalum thymifolium* Houtt. Nat. Hist. II. **9: 412. 1778.

Houttuyn's binomial was not intended as a new one but was apparently due to a *lapsus calami* on his part in transcribing the specific name.

Lavandula Linnaeus

Lavandula multifida Linn. Sp. Pl. 572. 1753; Houtt. Nat. Hist. II. **5:** 282. 1775; Benth. in DC. Prodr. **12:** 147. 1848.

Lavandula multipartita* Christm. Pflanzensyst. **4: 43. 1779.

Christmann's new specific name for the Mediterranean species was undoubtedly due an error in transcription on his part.

Leonurus Linnaeus

***Leonurus japonicus** Houtt. Nat. Hist. II. **9:** 366. *t. 57. f. 1.* 1778; Christm. Pflanzensyst. **7:** 501. *t. 57. f. 1.* 1781, *in nota.*

Leonurus macranthus Maxim. Prim. Fl. Amur. 476. 1859.
Leonurus japonicus Miq. Ann. Bot. Lugd.-Bat. **2:** 112. 1865.

I believe the form illustrated and described by Houttuyn, briefly noted but illustrated by Christmann, to be the same as *L. macranthus* Maxim. rather than the more widely distributed *L. sibiricus* Linn. *L. japonicus* Miq. was published independently of *L. japonicus* Houtt. The latter has been overlooked by all botanists since 1781, and curiously was not mentioned by Willdenow, Sp. Pl. **3:** 114–117. 1800, although he does include a reference to Houttuyn's treatment of *L. sibiricus* Linn. Houttuyn did not clearly indicate his binomial as a new one.

Salvia Linnaeus

Salvia Disermas Linn. Sp. Pl. ed. 2, 36. 1762; Skan in Thiselton-Dyer, Fl. Cap. **5:** 319. 1910.

Salvia Bisermas* Houtt. Nat. Hist. II. **7: 168. 1777.
Salvia Difermas* Christm. Pflanzensyst. **5: 155. 1779.

The variant spellings of the specific name by both Houttuyn and Christmann may undoubtedly be placed in the category of typographical errors, for the Linnaean *Salvia Disermas* was unquestionably intended.

Teucrium Linnaeus

***Teucrium japonicum** Houtt. Nat. Hist. II. **9**: 282. *t. 56. f. 1.* 1778; Christm. Pflanzensyst. **7**: Verzeich, Kupfertaf. [2] *t. 56. f. 1.* 1781; Willd. Sp. Pl. **3**: 23. 1800; Makino & Nemoto Fl. Jap. ed. 2, 1039. 1931.

Houttuyn definitely published this binomial as new but did not indicate it as such and provided no Latin diagnosis. Christmann ignored it, except for his reproduction of Houttuyn's illustration and the name "Das Teucrium Virginicum aus Japan" in the explanation of the plate. Willdenow did not consult Houttuyn's original work but cites as a synonym of *Teucrium japonicum* that he described as new "Teucrium virginicum e Japonia Houttuyn. *Lin Pfl. Syst.* 7, p. 401, t. 56, f. 1." which he took from Christmann's work, not from Houttuyn's. The species is not considered in Christmann's text, but on p. 401 only the true *Teucrium virginicum* is described.

Teucrium Pseudochamaepitys Linn. Sp. Pl. 562. 1753; Christm. Pflanzensyst. **7**: 391. 1781 (*Pseudochamaepithys*); Benth. in DC. Prodr. **12**: 580. 1848.

Teucrium Pseudopitys* Houtt. Nat. Hist. II. **9: 274. 1778.
Teucrium mauritanum Linn. op. cit. 563; Houtt. op. cit. 275.
**Teucrium mauritanicum* Christm. op. cit. 392.

Both new names were undoubtedly due to inadvertent errors in transcription, one by Houttuyn, the other by Christmann. Bentham reduced *T. mauritanum* Linn. to *T. Pseudochamaepitys* Linn.

Trichostema Gronovius

***Trichostema setaceum** Houtt. Nat. Hist. II. **9**: 428. 1778; Merr. Rhodora **40**: 292. 1938 (Contr. Gray Herb. **122**: 292).

Trichostema lineare Walt. Fl. Carol. 164. 1788.
Trichostema lineare Nutt. Gen. **2**: 39. 1818; Britt. & Brown, Ill. Fl. N. States Canada **3**: 78. *f. 3074.* 1898, ed. *2*, **3**: 105. *f. 3574.* 1913.
Trichostema foliis setaceis Gronov. Fl. Virgin. ed. *2*, 90. 1762.

Houttuyn's hitherto overlooked binomial was based wholly on *Trichostema foliis setaceis* Gronov. Fl. Virgin. ed. 2, 90. 1762, which in turn

was based on *Clayton 41.* Mr. J. E. Dandy of the British Museum kindly looked up this specimen for me, and states that *Clayton 41* was determined by Mr. C. A. Weatherby in 1935 to represent *Trichostema lineare* Nutt.; Nuttall described the species as new independently of Walter's early description of the same species under the same specific name. Mr. Dandy courteously supplied me with a photograph of the fragmentary specimen. He also states that there is another unnumbered Clayton specimen representing *Trichostema var. foliis semper angustioribus* Gronov. Fl. Virgin. 64. 1739; it appears in the last two lines in the *Trichostema* entry. This is also named *T. lineare* Nutt. Houttuyn did not indicate his binomial as a new one; Christmann and Panzer did not recognize it. The species occurs in sandy fields and in dry pine barrens from Connecticut to Georgia and Alabama, mostly near the coast.

SCROPHULARIACEAE

Bramia Lamarck

Bramia Monnieri (Linn.) Pennell, Proc. Acad. Nat. Sci. Phila. **71**: 243. 1919.

Lysimachia Monnieri Linn. Cent. II. Pl. 9. 1756.
Gratiola Monniera Linn. Amoen. Acad. **4**: 306. 1759.
Ruellia articulata* Houtt. Nat. Hist. II. **9: Aanwyz. Plaat. [4]. *t. 59. f. 3.* 1778.
Herpestis Monnieria H. B. K. Nov. Gen. Sp. Pl. **2**: 294. 1817.

This form, well illustrated by Houttuyn, is discussed in his text, **9**: 579, without a binomial, following *Ruellia repens* Linn. He clearly did not intend the illustration to represent the Linnaean species. Panzer also discusses it in his text, **8**: 173. *t. 59. f. 3.* 1782, following *Ruellia repens* Linn., and in his explanation of the plate lists it as "Ruellia repens, aus Ostindien."

Diascia Link & Otto

Diascia capensis (Linn.) Britten, Jour. Bot. **47**: 45. 1909.

Anagallis capensis Linn. Sp. Pl. 149. 1753.
Hemimeris bonae-spei Linn. Pl. Rar. Afr. 8. 1760, Amoen. Acad. **6**: 83. 1763.
Paederota bonae-spei Linn. Sp. Pl. ed. 2, 20. 1762; Houtt. Nat. Hist. II. **7**: 107. 1777.
Paederota capitis bonae-spei* Christm. Pflanzensyst. **5: 87. 1779.
Diascia nemophiloides Benth. in DC. Prodr. **10**: 257. 1846; Hiern in Thiselton-Dyer Fl. Cap. **4**(2): 148. 1904.

The synonymy is that given by Britten, *l. c.*, with the addition of Christmann's binomial which has hitherto been overlooked.

Erinus Linnaeus

Erinus alpinus Linn. Sp. Pl. 630. 1753; Houtt. Nat. Hist. II. **9**: 537. 1778; Hegi, Fl. Mittel-Europa **6**(1): 70. 1913.

Erinus europaeus* Panzer, Pflanzensyst. **8: 123. 1782.

Panzer gives no reason for changing the specific name. The references are clearly to *E. alpinus* Linn.

Hemimeris Linnaeus f.

Hemimeris racemosa (Houtt.) comb. nov.

Paederota racemosa Houtt. Nat. Hist. II. **7**: 110. *t. 38. f. 1.* 1777; Christm. Pflanzensyst. **5**: 89. *t. 38. f. 1.* 1779.

Hemimeris montana Linn. f. Suppl. 280. 1781; Hiern in Thiselton-Dyer, Fl. Cap. **4**(2): 165. 1904; Grant, Ann. Missouri Bot. Gard. **25**: 446. *f. 2.* 1938, *cum syn.*

This change of name is unavoidable for this common South African species, as Houttuyn's specific name antedates that of the younger Linnaeus by four years. Houttuyn did not indicate his species as new and supplied no Latin diagnosis of it. His description and illustration unquestionably appertain to the species described by the younger Linnaeus as *Hemimeris montana*. Dr. Grant provided a greatly amplified description of the species in her monographic treatment of *Hemimeris* in 1938.

Ilysanthes Rafinesque

Ilysanthes hyssopioides (Linn.) Benth. in DC. Prodr. **10**: 419. 1846; Hook. f. Fl. Brit. Ind. **4**: 283. 1884.

Gratiola hyssopioides Linn. Mant. **2**: 174. 1771.

Gratiola hyssopifolia* Houtt. Nat. Hist. II. **7: 123. 1777; Christm. Pflanzensyst. **5**: 104. 1779.

Morgania hyssopioides Spreng. Syst. **2**: 803. 1825.

Bonnaya hyssopioides Benth. in Wall. List no. 3867. 1830; Scroph. Ind. 34. 1835.

Gratiola hyssopifolia Houtt. was apparently not intended as a new name, but should rather be explained as a probable *lapsus calami* on his part, which Christmann failed to note and correct.

Pedicularis Linnaeus

***Pedicularis labradorica** Wirsing, Eclog. Bot. [2] *t. 10.* 1778; Panzer, Pflanzensyst. **8**: 39. *t. 57c.* 1782; Fernald, Rhodora **33**: 193. 1931; Merr. Rhodora **40**: 292. *t. 495.* 1938 (Contr. Gray Herb. **122**: 292. *t. 495*).

Pedicularis euphrasioides Stephan in Willd. Sp. Pl. **3**: 204. 1801, Britt.

& Brown, Ill. Fl. N. States Canada **3:** 185. *f. 3332.* 1898, ed. *2,* **3:** *220. f. 3847.* 1913.

Pedicularis euphrasioides Stephan in Willd. Sp. Pl. **3:** 204. 1801, incl. *β labradorica* (Houtt.) Willd. l. c.

This species was not included by Houttuyn in his treatment of *Pedicularis,* Nat. Hist. II. **9:** 468–478. 1778. The "Index Kewensis" reference is erroneous and incomplete "[Panzer, in] Houtt. Pflanzensyst. VIII. 39 = *euphrasioides.*" Fernald, in calling attention to the older name for *P. euphrasioides* Stephan gives the citation to "Houttuyn, Pflanzensyst.," an error in citation starting with Willdenow who gives it as "*Houttuyn Lin. Pfl. Syst.* 8. p. 39. *t. 57c.*" Panzer interpolated two extra plates in volume eight of the "Pflanzensystem" which he numbered 57b and 57c, the second one being an excellent illustration of the species under consideration copied from Wirsing's "Eclogae botanicae" (1778), which he merely cites as "Ecl. bot." and as "Eclogis botanicis" without giving its author's name. Suspecting that this was Wirsing's work, and that he had actually named and described the species, I asked Mr. J. E. Dandy to check the reference in the British Museum library, and he reports that Wirsing published a formal description of *Pedicularis labradorica;* this was overlooked in the compilation of "Index Kewensis." There is a copy of Wirsing's work in the New York Botanical Garden library. Wirsing's overlooked original description of *Pedicularis labradorica,* Eclog. Bot. [4]. *t. 10.* 1778 was reprinted by me, and his illustration was reproduced, Rhodora **40:** 293. *t. 495.* 1938 (Contr. Gray Herb. **122:** 293).

BIGNONIACEAE

Crescentia Linnaeus

Crescentia cucurbitina Linn. Mant. **2:** 250. 1771.

Crescentia cucurbitifera* Houtt. Nat. Hist. II. **3: 118. 1774; Christm. Pflanzensyst. **2:** 130. 1777.

It is suspected that the use of the specific name *cucurbitifera* by both Houttuyn and by Christmann was due to an error in transcription, rather than to a deliberate change in form by Houttuyn.

ACANTHACEAE

Acanthus Linnaeus

Acanthus arboreus Forsk. Fl. Aegypt.-Arab. 115. 1775; Houtt. Nat. Hist. II. **9:** 591. 1778.

Acanthus arborescens* Panzer, Pflanzensyst. **8: 185. 1782.

Panzer's change of the specific name was probably due to a *lapsus calami* on his part.

RUBIACEAE

Oldenlandia Linnaeus

Oldenlandia biflora Linn. Sp. Pl. 119. 1753; Trimen, Fl. Ceyl. **2:** 317. 1894.

Oldenlandia paniculata Linn. Sp. Pl. ed. 2, 1667. 1763.

Ludwigia (*Ludwighia*) *trifolia* Burm. f. Fl. Ind. 37. 1768; Merr. Philip. Jour. Sci. **19:** 388. 1921.

Ludwigia trifoliata* Houtt. Nat. Hist. II. **7: 341. 1777.

Houttuyn may not have intended to publish a new specific name although he actually did so in accepting Burman's species and adding an additional syllable in the specific name; Christmann does not recognize it. In my bibliographical study of Burman's new species* I was unable to place *Ludwigia trifolia* Burm. f. from the description alone, having to be content with the statement that no *Ludwigia* was represented. Through the courtesy of Dr. B. P. G. Hochreutiner, I have been privileged to examine Burman's type, preserved in the Delessert Herbarium at Geneva. The Javan specimen of *doedoek* labelled by Burman as *Ludwigia trifolia* proves to be the same as the common and widely distributed *Oldenlandia biflora* Linn. Advantage is taken of this opportunity to clarify the situation as to *Oldenlandia paniculata* Linn. (1763), the generally accepted binomial for this species. It was based wholly on an actual specimen in the Linnaean herbarium in spite of Trimen's statement (Fl. Ceyl. **2:** 317. 1894 sub *O. biflora* Linn.): "*O. paniculata*, L., is moreover quite doubtful; it is entirely based on a figure of Burman in Thes. Zeyl. t. 71. f. 2. which is apparently a *Mollugo* (certainly not an *Oldenlandia*.)" There is no literature reference in the original description of 1763; the Burman citation was added by Linnaeus in Syst. Nat. ed. 12, **2:** 126. 1767, which was doubtless the source on which Trimen's erroneous statement was based, but even here the first reference is to Sp. Pl. ed. 2, 1667. 1763.

Ophiorrhiza Linnaeus

Ophiorrhiza Mungos Linn. Sp. Pl. 150. 1753; Houtt. Nat. Hist. II. **7:** 518. 1777.

Ophiorrhiza ostindica* Christm. Pflanzensyst. **5: 503. 1779.

Christmann's peculiar hybrid specific name was apparently due to a *lapsus calami* on his part. Doubtless he intended to use the Linnaean binomial, but what he published was a hybrid translation of "Oostindische" from his common name "Oostindische Schlangenwurz."

***Merrill, E. D.** A review of the new species of plants proposed by N. L. Burman in his Flora Indica. Philip. Jour. Sci. **21:** 329-388. 1921.

Pavetta Linnaeus

Pavetta capensis (Houtt.) Bremek. Repert. Sp. Nov. **37**: 166. 1934, *cum syn.*

Crinita capensis Houtt. Nat. Hist. II. **7**: 362. *t. 40. f. 1.* 1777; Christm. Pflanzensyst. **5**: 357. *t. 40. f. 1.* 1779.

Pavetta Caffra Linn. f. Suppl. 121. 1781; Sonder, Fl. Cap. **3**: 19. 1864.

Pavetta corymbosa Houtt. ex. Thunb. Fl. Cap. 535. 1813, *in syn.*

This South African species is commonly known as *Pavetta Caffra* Linn. f. *Crinita* was described by Houttuyn as a new genus. The specimen in the Rijks Herbarium, Leiden, that Bremekamp cites is apparently not Houttuyn's type, but is a sheet labelled in the handwriting of Adrian van Royen (1705–1779) with a citation to Houttuyn's publication, fide Dr. van Oostroom *in lit.* There is also a sheet in Burman's herbarium at Geneva labelled *Crinita capensis* but it is not certain that this was a Houttuyn specimen. The reduction of *C. capensis* Houtt. to *Pavetta Caffra* Linn. f., as indicated in "Index Kewensis" is correct, but Houttuyn's specific name is the oldest one.

Compositae

Berkheya Ehrhart

Berkheya aculeata (Houtt.) comb. nov.

Basteria aculeata Houtt. Nat. Hist. II. **6**: 158. *t. 34. f. 2.* 1776; Christm. Pflanzensyst. **4**: 437. *t. 34. f. 2.* 1779 (without specific name).

**Basteria capensis* Houtt. op. cit. Aanwyz. Plaat. [3]; Christm. op. cit. Verzeich. Kupfertaf. [5].

Gorteria spinosa Linn. f. Suppl. 381. 1781.

Rohria obovata Thunb. Prodr. Pl. Cap. 140. 1800.

Berkheya obovata Willd. Sp. Pl. **3**: 2269. 1804; Harv. Fl. Cap. **3**: 508. 1864–65.

Berkheya spinosa Druce, Rep. Bot. Exch. Club Brit. Isles **1916**: 609. 1917.

Houttuyn's genus and species were not clearly indicated as new and there is no Latin diagnosis of either the genus or the species. His material was from South Africa. Willdenow's reduction of it to his *Berkheya obovata* is apparently correct but Houttuyn's name is the oldest valid one for the species. *Basteria* Houtt. is invalidated by the earlier *Basteria* Mill.

Berkheya angustifolia (Houtt.) comb. nov.

Atractylis angustifolia Houtt. Nat. Hist. II. **10**: 518. *t. 67. f. 1.* 1779; Panzer, Pflanzensyst. **9**: 203. *t. 67. f. 1.* 1783.

Rohria lanceolata Thunb. Prodr. Pl. Cap. 140. 1800.

Berkheya lanceolata Willd. Sp. Pl. **3**: 2270. 1804; Harv. Fl. Cap. **3**: 506. 1864–65.

Houttuyn's type was from the Cape of Good Hope region. He did not indicate the species as new, nor did he provide it with a Latin diagnosis. Willdenow reduced it to Thunberg's species, but Houttuyn's name is the oldest valid one. The "Index Kewensis" entry is correct except that the illustration is not cited.

Berkheya cruciata (Houtt.) Willd. Sp. Pl. **3:** 2276. 1804.

Gorteria cruciata Houtt. Nat. Hist. II. **11:** 21. *t. 70. f. 1.* 1779; Panzer, Pflanzensyst. **10:** 103. *t. 70. f. 1.* 1783.

Rohria cruciata Thunb. Act. Soc. Nat. Hafn. **3:** 104. 1793, Fl. Cap. 619. 1823.

Stobaea cruciata Harv. Fl. Cap. **3:** 498. 1864–65.

The three synonyms cited are all based on Houttuyn's original description. The "Index Kewensis" entry "Houtt. Nat. Hist. ii t. 70; ex DC Prodr. VI. 506" is incomplete and inaccurate.

Brachylaena R. Brown

Brachylaena elliptica (Thunb.) Less. Syn. Comp. 208. 1832; Harv. Fl. Cap. **3:** 116. 1864–65.

Tarchonanthus ellipticus Thunb. Prodr. Pl. Cap. 145. 1800.

Tarchonanthus camphoratus Houtt. ex DC. Prodr. **5:** 430. 1836, *in syn.;* non Linn.

The "Houttuyn" binomial is recorded merely because it appears in the literature, in synonymy. Houttuyn, Nat. Hist. II. **6:** 34. 1776, and Christmann, Pflanzensyst. **4:** 344. 1779, considered *Tarchonanthus camphoratus* Linn. The specimen cited by De Candolle "Tarch. camphoratus Houtt.! in H. Deless. v. s." is the *Brachylaena* and if the specimen came from Houttuyn's collection, for which there is no direct evidence, it merely means that Houttuyn made an erroneous identification. The actual specimen, which I have examined, is in the Burman herbarium (herb. Delessert).

Conyza Linnaeus

Conyza pusilla Houtt. Nat. Hist. II. **10:** 618. *t. 69. f. 1.* 1779; Panzer, Pflanzensyst. **9:** 319. *t. 69. f. 1.* 1783, *in nota;* Harv. Fl. Cap. **3:** 113. 1864–65.

This was accepted by Harvey in the "Flora Capensis," with a short description compiled from de Candolle Prodr. **5:** 388. 1836, but indicated as unknown to him. De Candolle states "ad Cap. Bonae-Spei. Frustulum tantum vidi sed meo sensu distinctissimum. (v. s. in H. Delessert.);" but Doctor Hochreutiner informs me that he was unable to locate the specimen. Houttuyn did not indicate his species as a new one. Dr.

R. H. Compton states that there is no material at Kirstenbosch representing Houttuyn's species, and that he cannot suggest any alternative name.

Cotula Linnaeus

Cotula turbinata Linn. Sp. Pl. 892. 1753.

Cotula pumila Houtt. Nat. Hist. II. **10**: *772. t. 69. f. 4.* 1779; Panzer, Pflanzensyst. **9**: 499. *t. 69. f. 4.* 1783, *in nota.*

Cenia turbinata Pers. Syn. **2**: 463. 1807; Harv. Fl. Cap. **3**: 185. 1864–65.

Houttuyn's species was not indicated as new, nor is there a Latin diagnosis. It was reduced to *Cenia turbinata* Pers. in "Index Kewensis," the entry there being to "Handleid.x.772" without citing the figure. De Candolle, Prodr. **6**: 83. 1837, placed it as a doubtful synonym of *Cenia subheterocarpa* Less. It seems to be the same as the Linnaean species. Houttuyn's type was from the Cape of Good Hope.

Dichrocephala L'Héritier

Dichrocephala latifolia (Lam.) DC. in Guill. Archiv. Bot. **2**: 518. 1833, Prodr. **5**: 372. 1836; Harv. Fl. Cap. **3**: 115. 1864.

Grangea latifolia Lam. ex Poir. Encycl. Suppl. **2**: 826. 1812; Lam. Tabl. Encycl. **3**: *276. t. 699. f. 1.* 1823.

Ethulia paniculata Houtt. Nat. Hist. II. **10**: 551. *t. 67. f. 2.* 1779; Panzer, Pflanzensyst. **9**: 235. *t. 67. f. 2.* 1783.

Houttuyn's species was clearly indicated by him as new, and has been reduced to *Hibbia integrifolia* Less. I consider it to represent *Dichrocephala latifolia* DC. rather than Lessing's species. Houttuyn's description is much earlier than Lamarck's, but curiously *Dichrocephala paniculata* Miq., which was independently published, is apparently identical with *Ethulia paniculata* Houtt. = *Dichrocephala latifolia* (Lam.) DC. Miquel's use of this binomial seems to preclude the acceptance of Houttuyn's earlier specific name in *Dichrocephala.*

Eupatorium Linnaeus

***Eupatorium rugosum** Houtt. Nat. Hist. II. **10**: 558. 1779; Merr. Rhodora **40**: 293. 1938 (Contr. Gray Herb. **122**: 293).

Ageratum altissimum Linn. Sp. Pl. 839. 1753, ed. 2, 1176. 1763.

Eupatorium urticaefolium Reichard, Syst. Pl. **3**: 719. 1780; Panzer, Pflanzensyst. **9**: 245. 1783; Britt. & Br. Illus. Fl. N. States Canada ed. 2, **3**: 361. *f. 4169.* 1913.

Eupatorium ageratoides Linn. f. Suppl. 355. 1781; Britt. & Br. Illus. Fl. N. States Canada **3**: 312. *f. 3629.* 1898.

Eupatorium altissimum Murr. Syst. Veg. ed. 13, 614. 1774, non *E. altissimum* Linn. (1753).

Eupatorium rugosum Houtt. is a validly published new name for *Ageratum altissimum* Linn., but it is not indicated by Houttuyn as new. The Linnaean binomial and the pre-Linnaean synonyms of Gronovius and Cornut are cited in the footnote. *Eupatorium ageratoides* Linn. f. (1781) was based on *Eupatorium altissimum* Murr. (1774) which in turn was based on *Ageratum altissimum* Linn. (1753). *Eupatorium urticaefolium* Reichard (1780) was also a new name for the same Linnaean species *Ageratum altissimum* Linn. = *Eupatorium altissimum* Murr. = *E. rugosum* Houtt. The three new names proposed in 1779, 1780, and 1781 were attempts on the part of Houttuyn, Reichard, and Linnaeus f. to provide a valid specific name for this particular species; of these that of Houttuyn is the oldest. *Eupatorium rugosum* H. B. K., an Ecuadorian species, needs a new name.

Helichrysum Vaillant

Helichrysum aureum (Houtt.) comb. nov.

Gnaphalium aureum Houtt. Nat. Hist. II. **10**: 590. *t. 67. f. 3.* 1779; Panzer, Pflanzensyst. **9**: 291. *t. 67. f. 3.* 1783.

Xeranthemum fulgidum Linn. f. Suppl. 365. 1781; Jacq. Ic. Rar. **1**: *t. 173.* 1781–86.

Elichrysum fulgidum Willd. Sp. Pl. **3**: 1904. 1804.

Helichrysum fulgidum DC. Prodr. **6**: 187. 1837; Harv. Fl. Cap. **3**: 232. 1864–65.

Houttuyn's species is clearly indicated by him as new. The reduction follows Willdenow and is apparently correct. The "Index Kewensis" entry for the binomial is correct. Houttuyn's specific name is accepted as the oldest one for this South African species.

Helianthus Linnaeus

Helianthus decapetalus Linn. Sp. Pl. 905. 1753; Houtt. Nat. Hist. II. **11**: 10. 1779; Britt. & Br. Ill. Fl. N. States Canada **3**: 427. *f, 3913.* 1898, ed. 2, **3**: 484. *f. 4480.* 1913.

Helianthus dodecapetalus* Panzer, Pflanzensyst. **9: 557. 1783.

Panzer's new specific name was apparently an unintentional one due to an error in transcription.

Hieracium Linnaeus

Hieracium murorum Linn. Sp. Pl. 802. 1753; Zahn, Pflanzenr. **75(IV.280)**: 287. 1921.

Hieracium Myophoron* Houtt. Nat. Hist. II. **10: 406. 1779.

This is the pre-Linnaean *Hieracium Myophorum* Rupp. Fl. Jen. ed. 2, 163. 1726, the *Hieracium murorum* Linn. var. γ Linn. Fl. Suec. ed. 2,

273, 1755, which, according to Linnaeus, is merely a gall infested form of *H. murorum* Linn.

Lactuca Linnaeus

Lactuca denticulata (Houtt.) Maxim. Bull. Acad. Sci. St. Pétersb. **19:** 529. 1874, Mél. Biol. **9:** 359. 1874; Hemsl. Jour. Linn. Soc. Bot. **23:** 480. 1888.

Prenanthes denticulata Houtt. Nat. Hist. II. **10:** 385. *t. 66. f. 4.* 1779; Panzer, Pflanzensyst. **9:** 50. *t. 66. f. 4.* 1783.

The status of Houttuyn's species, which is very common in eastern Asia, is well understood. It was clearly indicated by him as new. Hemsley lists numerous synonyms.

Lactuca indica Linn. Mant. **2:** 278. 1771; Merr. Bot. Mag. Tokyo **51:** 194. *t. 3.* 1937.

Prenanthes laciniata Houtt. Nat. Hist. II. **10:** 381. *t. 66. f. 1.* 1779; Panzer, Pflanzensyst. **9:** 46. *t. 66. f. 1.* 1783.

Lactuca laciniata Makino, Bot. Mag. Tokyo **17:** 88. 1903 (based on *Prenanthes laciniata* Houtt.), non Roth, 1821.

Lactuca brevirostris Champ. Hook. Jour. Bot. Kew Gard. Miscel. **4:** 237 1852.

Lactuca squarrosa Miq. Ann. Mus. Bot. Lugd.-Bat. **2:** 189. 1861.

The status of the Linnaean species, with its sixteen synonyms, is discussed by me in Bot. Mag. Tokyo **51:** 192–196. *t. 3.* 1937. The illustration is a photographic reproduction of the holotype of *Lactuca indica* Linn. Houttuyn's species is the form with pinnately lobed leaves (*Lactuca squarrosa* Miq. var. *laciniata* Miq.); he clearly indicated his species as a new one. Hara, Bot. Mag. Tokyo **52:** 122. 1938, retains *Lactuca squarrosa* Miq. (1866) as the name for the Japanese form, stating that he can divide the *Lactuca indica* group into two forms, one extending from southern Korea, Honshu and Yezo to the Riu Kiu Islands and Formosa, with a slender rostrum to the achenes 1 mm. or more long, the other, *Lactuca indica* Linn. (*L. brevirostris* Champ.) which is common in China, Manchuria, and Korea with a rostrum only 0.7 mm. long. The Linnaean type is the southern form which is abundant in southern China, extending southward to Indo-China, the Philippines, Sumatra and Java. Three-tenths of a mm. in the length of the beak to the achene seems to be a very slight character on which to base a specific distinction, for there are apparently no other distinguishing characters that hold.

Lactuca lanceolata (Houtt.) Mak. Bot. Mag. Tokyo **27:** 257. 1913, *cum. syn.*

Prenanthes lanceolata Houtt. Nat. Hist. II. **10**: 383, *t. 66. f. 2.* 1779; Panzer, Pflanzensyst. **9**: 49. *t. 66. f. 2.* 1783.
Prenanthes integra Thunb. Fl. Jap. 300. 1784.
Youngia integra A. Gray, Mem. Am. Acad. II. **6**: 396. 1859.
Crepis integra Miq. Ann. Mus. Bot. Lugd.-Bat. **2**: 190. 1866.

Houttuyn's species was clearly indicated as new, and was based on a Japanese specimen, and very likely on a duplicate of the collection on which Thunberg later based his *Prenanthes integra*.

Osteospermum Linnaeus

Osteospermum polygaloides Linn. Sp. Pl. 924. 1753; Harv. Fl. Cap. **3**: 444. 1864–65.

Calendula rosmarinifolia Houtt. Nat. Hist. II. **11**: 84. *t. 70. f. 2.* 1779; Panzer, Pflanzensyst. **10**: 23. *t. 70. f. 2.* 1783, *in nota.*

This is the conventional reduction of Houttuyn's species, and is clearly the correct disposition of it. *Osteospermum polygaloides* Linn. was based on three pre-Linnaean references, Royen 1740, Vaillant 1720, and Plukenet 1700, the first two of these being apparently typified by *Chrysanthemum fruticosum polygoni foliis* Pluk. Alm. Bot. Mant. 47. *t. 382. f. 2.* 1700–1705. Plukenet's figure, as compared with Houttuyn's, differs chiefly in the relatively much shorter and broader leaves. In any case, Houttuyn's excellent illustration clearly represents the same species as *Osteospermum polygaloides* Linn. as represented in the Linnaean herbarium by two specimens so named by Linnaeus, of which I have an excellent photograph courteously supplied by Mr. S. Savage. Mr. B. Daydon Jackson notes that these specimens are not included in the three enumerations of the herbarium discussed by him, and that they were either added after 1767, or by some accident were not recorded by Linnaeus. Mr. Savage states that Linnaeus' annotated copy of Sp. Pl. ed. 1 has no MS additions under this species, but that the similar copy of ed. 2 has extensive additions and some modifications of the original description, clearly indicating that Linnaeus had an actual specimen before him sometime after 1763. The species is actually typified by the Plukenet reference, not by the specimens named by Linnaeus. Dr. Tycho Norlindh, who has nearly completed a revision of *Osteospermum;* confirms this reduction of *Calendula rosmarinifolia* Houtt.

Senecio Linnaeus

Senecio varicosus Linn. f. Dec. Pl. Hort. Ups. 9. *t. 5.* 1762; Houtt. Nat. Hist. II. **10**: 647. 1779. DC. Prodr. **6**: 433. 1837.

Senecio verrucosus* Panzer, Pflanzensyst. **9: 356. 1783.

Panzer's specific name was apparently due to an error in transcription on his part. The Linnaean type, still preserved, is said by him to have come from Egypt, but the species is not mentioned in any special treatments of the Egyptian flora that I have seen.

Vernonia Linnaeus

Vernonia capensis (Houtt.) Druce, Rep. Exch. Club Brit. Isles **1916:** 651. 1917.

Erigeron capense Houtt. Nat. Hist. II. **10:** 629. *t. 69. f. 2.* 1779; Panzer, Pflanzensyst. **9:** 333. *t. 69. f. 2.* 1783.

Conyza pinifolia Lam. Encycl. **2:** 86. 1786.

Vernonia pinifolia Less. Linnaea **4:** 257. 1829; Harv. Fl. Cap. **3:** 51. 1864.

Houttuyn's species was clearly indicated by him as new. His specific name is the oldest valid one for this South African species.

Youngia Cassini

Youngia japonica (Linn.) Babc. & Stebb. Carnegie Inst. Publ. **484:** 94. *f. 28, 29.* 1937 (Gen. Youngia).

Prenanthes japonica Linn. Mant. **1:** 107. 1767; Houtt. Nat. Hist. II. **10:** 384. *t. 66. f. 3.* 1779; Panzer, Pflanzensyst. **9:** 49. 1783 (*iapanica*).

Prenanthes lyrata* Houtt. Nat. Hist. II. **10: Aanwyz. Plaat. [3]. 1779; Panzer, Pflanzensyst. **9:** 50. *t. 66. f. 3.* 1783, *in nota;* Thunb. Fl. Jap. 303. 1784.

Crepis japonica Benth. Fl. Hongk. 194. 1861.

In the text Houttuyn used the Linnaean binomial but in the description of the plate he used *Prenanthes lyrata,* thus publishing this binomial, doubtless the name under which he received his specimen from Thunberg. The form illustrated is var. *genuina* (Hochr.) Babc. & Stebb. op. cit. 95.

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THE SPECIES OF SISYRINCHIUM IN URUGUAY, PARAGUAY AND BRAZIL

IVAN M. JOHNSTON

SOUTH AMERICA is evidently an evolutionary center for the Iridaceae and is probably the place of origin and the center of distribution for *Sisyrinchium;* within this genus a great variety of diverse forms has been developed in that continent. In the present paper I discuss the species found in Brazil, Paraguay, Uruguay and the low country of northern and northeastern Argentina. This is a natural region and most of the species I have treated are confined to it. In a subsequent paper I shall discuss the species of Argentina and those of southern Chile. No pretense is made that these treatments are complete or in any way beyond criticism. Very much more material from the areas must be studied and the types in Europe must be reexamined before a definitive monograph of this very difficult genus can be prepared. The South American species of *Sisyrinchium,* however, are in great need of immediate study. The published monographs of the genus are incomplete, vague, and full of obvious errors, and are almost useless for the identification of specimens.

The present paper is based on a study of the material from our area preserved in the Gray Herbarium (G), the U. S. National Herbarium (US), and the Field Museum in Chicago (FM). Invaluable in my study of the Brazilian species has been the large sending of specimens, from the herbarium of the Serviço de Botanica e Agronomis of São Paulo (S.B.S.P.), which I received through the courtesy of Mr. F. C. Hoehne. Of the Uruguayan species I have received many very interesting specimens from Dr. Bernardo Rosengurtt. Dr. Angel L. Cabrera kindly sent me a number of collections of *Sisyrinchium* from the Argentine.

KEY TO THE SPECIES

Filament-tube and lobes glabrous, devoid of hairs or glands; leaf-blades flattened; corolla yellow.

Leaves all cauline, well developed or more or less reduced and scale-like, scattered along the stems, the lower ones very reduced and not forming a basal cluster.....1. *S. vaginatum* and allies.

Leaves crowded at the base of the stem, forming a conspicuous cluster, stem-leaves apparently terminal or none.

Filaments completely united into a very slender elongate tube, the oblong anthers closely proximate; spathes borne on slender elongate naked peduncles.....2. *S. megapotamicum.*

Filaments united only below the middle, free and diverging above; the narrow elongate anthers separate, becoming curved or coiled at maturity; spathes sessile or short pedunculate.

Stems continued as the rhachis of an erect terminal distichous spike; the outer spathe-valves clasping the stem; the stem producing no leaf or leaf-like bract in or just below the inflorescence.

Leaves 1–1.5 mm. broad, margins serrulate; plant 15–25 cm. tall. 3. *S. avenaceum.*

Leaves 2–5 mm. broad; plant much coarser, 15–40 cm. tall.

Leaves and stems serrulate on margin; middle of the leaf-blade devoid of prominent veins, these crowded at the margins; leaf-margins thin, not thickened.....4. *S. Rosengurttii.*

Leaves and stems with entire margins; prominent veins equally distributed on the leaf-blade; leaf-margins somewhat thickened and rounded.....5. *S. eserrulatum.*

Stems apparently terminated by an erect leafy bract that appears to be a sterile continuation of the stem; the inflorescence apparently lateral.

Margins of leaves thickened; the stout strongly compressed spicate cluster of spathes surpassed by the two leaf-like bracts subtending it; outer spathe-valves (from keel to margin) 3–5 mm. broad; stems less than 2 dm. tall, usually surpassed by the leaves; corolla-lobes ca. 2 cm. long.....6. *S. nidulare.*

Margins of leaves thin, usually scarious; the cluster of spathes overtopping the leafy bracts or overtopped by only one of them; outer spathe-valves (keel to margin) ca. 2 mm. broad; stems 2–10 dm. or more tall, usually surpassing the leaves.

Plant coarse, stems and leaves 4–15 mm. broad; the epidermis smooth, without emergences; inflorescence repeatedly branched, congested or open.....7. *S. macrocephalum.*

Plant slender, stems and leaves 2–6 mm. broad; the epidermis usually bearing abundant microscopic conic or rounded emergences; inflorescence of one, or two unequal, rather regular, dense, erect, distichous spikes, 4–10 cm. long. 8. *S. Wettsteinii.*

Filament-tube bearing glands (particularly near the base) or hairs or both.

Spathes sessile or subsessile in bracteolate, crowded cymes or glomerules borne at the base of the stiff erect leaf which terminates the otherwise naked stem and appears to be its sterile continuation; inflorescence apparently lateral, its branches (when developed) curving.

Blades of the basal leaves (and the bract terminating the stem) distinctly terete.

Individual spathes 10–15 mm. long; Paraguay and Matto Grosso.

Leaf-blades 5–14 cm. long; leaf-sheathes ciliolate..9. *S. Fiebrigii.*

Leaf-blades very inconspicuous, acicular, 0.3–1 cm. long; leaf-sheathes not ciliolate.....10. *S. subnudum.*

Individual spathes 6–10 mm. long; Uruguay and eastern Brazil.

Valves of spathes and the subtending bracteoles acute, lanceolate, with narrow (0.2–0.5 mm. wide) scarious margins which are narrowed towards the apex; Paraná to Minas Geraes.

11. *S. Luzula.*

Valves of spathes and the subtending bracteoles obtuse or retuse, oblong to elliptic, with a very wide (0.8–1.5 mm.) scarious margin which continues broad and conspicuous to (or even beyond) the tip of the valve or bracteole; Uruguay to Paraná .....12. *S. scariosum.*

Blades of basal leaves (and the bract terminating the stem) not terete, compressed, linear-ensiform.

Staminal tube clothed its whole length with abundant, more or less reflexed, elongate yellow hairs, not glanduliferous.

Leaves 2–3 mm. broad; stems usually ancipitous; Paraguay.

13. *S. Hasslerianum.*

Leaves 1–2 mm. broad; stems terete; eastern Brazil.

14. *S. Hoehnei.*

Staminal tube without yellow hairs or these borne only near the summit, glanduliferous especially near the base.

Basal leaves usually equaling or even surpassing the conspicuously winged stem; the leafy bract subtending the spathes very elongate and conspicuous; spathe-valves lanceolate, acute, with narrow scarious margins.....15. *S. Sellowianum.*

Basal leaves usually much shorter than the terete or inconspicuously ancipitous stems; the leafy bract subtending the spathes short and not conspicuous; spathe-valves lance-oblong, obtusish, with broad conspicuous scarious margins.

Plant about 3 dm. tall; leaves about 3 mm. broad.

16. *S. fasciculatum.*

Plant 1–2 dm. tall; leaves 0.5–2 mm. broad.

Leaves 1–2 mm. broad; spathes 12–15 mm. long; plant not darkened in drying.....17. *S. Ostenianum.*

Leaves 0.5–0.8 mm. broad; spathes 6–9 mm. long; plants becoming dark in drying.....18. *S. Claritae.*

Spathes on evident naked peduncles, terminal on the stem or its branches; stems usually leaf-bearing and dichotomous; uppermost leaf rarely (except in nos. 21 and 22) much simulating a sterile continuation of the main stem.

Filaments united for only ½ to ⅔ of their length, the tube inflated towards the base, flask-shaped, the free tips of the filaments evident, ascending; plants weedy annuals.

Corolla small, less than 10 (usually ca. 6) mm. long, usually yellowish; spathe-valves very unequal, the outer one much surpassing

the inner; fruiting pedicels not surpassing the shorter valve and usually surpassed by it; ovary glabrous; plant usually darkened in drying; a tropical species extending into the temperate zone. 19. *S. micranthum.*

Corolla large, 10–15 mm. long, white or bluish; spathe-valves subequal; fruiting pedicels as long as the valves or distinctly surpassing them; ovary frequently glandular puberulent; plant not becoming dark in drying; Chile and Argentina north to Paraguay and Brazil.....20. *S. laxum.*

Filaments completely united or nearly so, the tube cylindric or only swollen (except in no. 26) below the middle.

Papery bracts inside the spathe protruding beyond the valves at maturity; inner valve distinctly longer than the outer, obtusish, very broad with conspicuous scarious margins; spathes 5–8 mm. long; peduncles usually densely clustered and varying conspicuously in length.

Leaves capillary, 0.2–0.5 mm. wide; Paraguay....21. *S. piliferum.*

Leaves linear, 0.7–2 mm. wide; Brazil.....22. *S. commutatum.*

Papery bracts inside the spathe remaining short and completely hidden; inner valve weakly if at all surpassing the outer, elongate, with narrow scarious margins; spathe (except in no. 25) 10–15 mm. long or more; spathes usually not densely clustered nor conspicuously unequal.

Corolla 2.5–6 mm. long; plants small, slender, less than 15 cm. tall; roots very slender, fibrous, apparently annual.

Staminal tube yellow-villous from base to top, glands inconspicuous or absent; leaves capillary, ca. 0.1 mm. thick; stems naked, scapose; plant spreading by very slender elongate subterranean rhizomes.....23. *S. setaceum.*

Staminal tube with stipitate glands near the base, otherwise glabrous except for a few hairs occasionally produced near the apex; stems bearing one or more leaves; leaves flattened, linear, 0.5–1.7 mm. broad; rhizomes absent.

Capsule obovoid or ellipsoid, distinctly elongate, becoming verrucose at maturity from the pressure of the swelling seed within; spathes with spathe-valves unequal, the outer twice the length of the inner and usually surpassing the fruiting pedicels; stems becoming repeatedly branched, producing many cauline leaves and many spathes, commonly 1–2 dm. long; plant usually darkened in drying.....24. *S. minus.*

Capsules globose or ellipsoid-globose, not becoming distinctly verrucose; spathes with subequal valves which are usually surpassed by the fruiting pedicels; stems usually simple and producing only a single cauline leaf and a single (apparently terminal) spathe, commonly less than 9 cm. long; plant usually not darkening in drying. 25. *S. minutiflorum.*

Corolla 7–13 mm. long; plants coarser and larger, 15–75 cm. tall, usually with coarse roots which are frequently more or less fleshy and perennial.

Corolla purplish to nearly white.....*26. S. platense.*

Corolla yellow.

Ovary and pedicels glandular puberulent; capsule subglobose, 2.5–5 mm. long; roots more or less fleshy and frequently conspicuously thickened; perennial..*27. S. pachyrhizum.*

Ovary and pedicels glabrous; capsule rather large, 6–8 mm. long, broadly ellipsoid or obovoid; roots fibrous, slender, possibly annual.....*28. S. foliosum.*

1. **Sisyrinchium vaginatum and allies.**

S. VAGINATUM Spreng. Syst. **1:** 166 (1825). — Montevideo, *Sellow.*

S. RESTIOIDES Spreng. Syst. **1:** 166 (1825). — Montevideo, *Sellow.*

S. MARCHIO (Vell.) Steud. Nomencl. ed. 2, **2:** 596 (1841). *Souza Marchio.* Vellozo, Fl. Flum. 273 (1825) and Icones **7:** tab. 1 (1827). — State of Rio Janeiro.

S. SULCATUM Gillies ex Hook. Icones **3:** tab. 218 (1840). — Maldonado, Uruguay, Gillies.

S. ALATUM Hook. Icones **3:** tab. 219 (1840). — Demerara, Brazil and Uruguay.

S. INCURVATUM Gardner ex Hook. Icones **6:** tab. 513 (1843). — Organ Mts., *Gardner 5890.*

S. GLAZIOVII Baker, Jour. Bot. **14:** 268 (1876), and Handb. Irid. 129 (1892). — Rio Janeiro, *Glaziou 6732.*

S. WEIRII Baker, Jour. Bot. **14:** 268 (1876), and Handb. Irid. 130 (1892). — Southern Brazil, *Weir 372.*

S. MANDONI Baker, Jour. Bot. **14:** 269 (1876), and Handb. Irid. 130 (1892). — Bolivia, *Mandon 1217.*

S. BALANSAE Baker, Handb. Irid. 133 (1892). — Paraguay, *Balansa 547* and *548.*

S. PARVIFOLIUM Baker, Bull. Herb. Boiss. II. **3:** 1104 (1903). — Paraguay, *Hassler 5938.*

S. DISTANTIFLORUM Kränzlin, Bot. Jahrb. **40:** 240 (1908). — Paraguay, *Fiebrig 248* and *Hassler 2121;* Bolivia, *Fiebrig 3302.*

S. ALATUM var. MINOR Rusby, Bull. N. Y. Bot. Garden **6:** 493 (1910). Northern Bolivia, *Williams 114.*

The names listed belong to a very natural group of plants containing an undetermined number of critical species. A consideration of this difficult complex is being reserved for a subsequent paper. The treatments of the group, by Klatt, Linnaea **31:** 77–80, 374–5 (1861–2) and

in Martius, Fl. Bras. **3**(1): 537–39 (1871), and Baker, Handb. Irid. 129–30 (1892), are not satisfactory.

2. **Sisyrinchium megapotamicum** Malme, Ark. Bot. **269, 9:** 16 (1935).

S. gracile Klotzsch ex Baker, Jour. Bot. **14:** 268 (1876), Handb. Irid. 123 (1892), not *S. gracile* Phil. (1858).

BRAZIL: Curityba, Paraná, 1928, *Hoehne, S.B.S.P. no. 23053* (G); Porto Alegre, Rio Grande do Sul, 1892, *Lindman 333* (G). ARGENTINA: El Socorro, Buenos Aires, 1926, *Parodi 7388* in pt. (G).

The species is based upon *Sellow 3863*, from southern Brazil. In gross habit the plant much resembles forms of *S. pachyrhizum*. From that plant, however, *S. megapotamicum* is quickly distinguished by having the staminal tube glabrous and glandless, the anthers larger and more elongate, the base of the stem more fibrous, and the roots very much more slender and not at all fleshy. The species is a very distinct one.

3. **Sisyrinchium avenaceum** Klatt, Linnaea **31:** 373 (1862), and in Martius, Fl. Bras. **3**(1): 537 (1871).

S. monostachyum Baker, Jour. Bot. **14:** 268 (1876), and Handb. Irid. 132 (1892).
S. aurantiacum Griseb. Abhandl. Ges. Wiss. Göttingen **24:** 327 (1879).
S. Clarazii Baker, Jour. Linn. Soc. Bot. **21:** 235 (1884).

URUGUAY: Agronomía, Paysandú, 1937, *Rosengurtt B. 2193* (G). ARGENTINA: Concepcion del Urúguay, Entre Rios, Sept. 1877, *Lorentz* (G); Alto de Lucero, Tandil, Buenos Aires, 1937, *Troncosa 1250* (G); Cerros y Laguna de Puán, 1928, *Scala 1086* and *1087* (G).

I have seen a photograph of *Sellow 2849*, the type of *S. avenaceum*. It consists of one plant, showing basal leaves and flowering stems, about 2.5 dm. tall, one or two detached flowering stems of the same, and a very coarse tuft of leaves. The coarse leaves, at least 8 dm. long and 2–3 mm. broad, belong to an unrecognized species. The flowering plant and the detached flowering stems are a close match for the material, collected at Concepcion de Uruguay by Lorentz, which Grisebach described as *S. aurantiacum*.

4. **Sisyrinchium Rosengurttii**, sp. nov.

Planta perennis 1.5–4 dm. alta; radicibus fasciculatis crassiusculis; foliis basalibus 5–25 cm. longis, 2.5–5 mm. latis, margine serrulatis; nervis marginem versus laminae congestis 1–2, alibi haud conspicuis; caule ancipite 1.5–3 mm. lato, quam foliis subduplo longiore, margine serrulato; inflorescentia spicata terminali simplici 3–5 cm. longa, rhachi eius recta productionem caulis formante; spathis sessilibus distichis 2–5;

valva exteriore carinata rhachim amplectente 1.5–2 cm. longa glumacea praesertim marginem versus purpurascente, apice plus minusve producta et herbacea (apice valvae infimae 0.5–5 cm. longo, ceterae breviore; valvis intimis angustis scariosis quam exterioribus paullo brevioribus; tepalis flavis 1 cm. longis 3 mm. latis 7-nervatis glaberrimis apice acutis apiculatis; filamentis glaberrimis 2.5–3 mm. longis, infra medium in tubum connatis, supra medium liberis ascendentibus; antheris angustis elongatis 2–2.3 mm. longis maturitate plus minusve curvatis vel spiralis; ovario ovoideo glaberrimo; capsula subglobosa 3–4 mm. crassa 4–5 mm. longa.

URUGUAY: Sierra Animas, Maldonado, rocky places, fl. yellow, Oct. 11, 1932, *Osten 22692* (TYPE, Gray Herb.); Sierra Animas, rocky slope, Nov. 5, 1931, *Osten 22393* (FM); Est. Palleros, Rio Negro, Cerro Largo, Dec. 1937, *ex Rosengurtt PE. 1509* (G); Est. Santa Elvira, Cerro Colorado, Florida, Nov. 1936, *ex Rosengurtt PE. 272* (G).

This species is evidently related to *S. avenaceum*, but differs from it in being larger and coarser in all its parts and in having a geographic range to the east of that species.

5. **Sisyrinchium eserrulatum**, sp. nov.

Planta ca. 3 dm. alta; radicibus ignotis; foliis basalibus 15–20 cm. longis 3–5 mm. latis planis, margine integerrimis parce incrassatis; nervis conspicuis saepe 5 regulariter (ca. 0.9 mm. distante) dispositis; caule ancipite 2 mm. lato quam foliis basalibus evidenter longiore; inflorescentia terminali simplice spicata 4–5 mm. longa, rhachi eius recta productionem caulis formante; spathis ca. 4 sessilibus distichis 12–15 mm. longis; valva exteriore carinata glumacea plus minusve purpurascente rhachim amplectente; valva spathae infimae cum apice ca. 3 mm. longo ornata, ceteris acutis; valvis intimis scariosis quam exterioribus paullo brevioribus; tepalis flavis ca. 10 mm. longis glaberrimis; antheris anguste elongatis 2–2.3 mm. longis maturitate curvatis vel spiralibus; filamentis glaberrimis ca. 3 mm. longis infra medium in tubum connatis, supra medium liberis ascendentibus; ovario glaberrimo obovoideo; capsulis (vix maturis) subglobosis 5 mm. crassis.

BRAZIL: Est. L. Gomez, northwest of Neu Württemberg, Rio Grande do Sul, 500 m. alt., Oct. 18, 1904, *Bornmüller 236* in pt. (TYPE, Gray Herb.).

Much resembling *S. Rosengurttii* in general appearance, but readily distinguished from that Uruguayan species by having the stems and leaves entire, rather than serrulate, the leaves with slightly thickened, rather than sharp margins, and the leaf-blades bearing veins, not crowded

at the margins, but equally distributed across its surface. The tips of the spathe-valves appear to be less well developed than in its relative. The type material of *S. eserrulatum* was mixed with specimens of *S. macrocephalum* and determined as "*S. iridifolium*."

6. **Sisyrinchium nidulare** (Hand.-Mazz.), comb. nov.

S. palmifolium var. *nidulare* Hand.-Mazz. Denkschr. Akad. Wiss. Wien **79**: 216 (1908).

BRAZIL: Curityba, Paraná, in campo, 1908, *Dusen 6815* (G); Curityba, 1915, *Dusen 17185* (G); Pinhaes near Curityba, in campo, 1908, *Dusen 7107* (G); Ypirangas, S. Paulo, 1912, *Brade 7271, S.B.S.P.* no. *7271* (G); Chapada do Paranan, Minas Geraes, *Martius* (photo.; FM).

A very well marked species having a low stature, thickened leaf-margins, broad, strongly two-ranked spikes with two large bracts, and very large corollas. The collection by Martius, cited above, is that referred to *S. marginatum* by Klatt in Martius, Fl. Bras. **3**(1): 540 (1871).

7. **Sisyrinchium macrocephalum** Graham, Edinb. N. Philos. Journ. 176 (Jan. 1833); Klatt, Linnaea **31**: 98, 380 (1861–2), and in Martius, Fl. Bras. **3**(1): 542 (1871).

Moraea alata Vahl, Enum. **2**: 154 (1805), not *S. alatum* Hook. (1840).

S. altissimum Tenore, Atti 3a. Riun. Soc. Bot. Ital. 504 (1841); Walpers, Ann. Bot. Syst. **3**: 610 (1852).

S. giganteum Tenore, Cat. Orto Bot. Napoli 96 (1845).

S. marginatum Klatt, Linnaea **31**: 83, 376 (1861–2) and Hamburg. Garten- u. Blumenzeitung **17**: 453 (Oct. 1861), and in Martius Fl. Bras. **3**(1): 539 (1871).

S. grande Baker, Bull. Herb. Boiss. II. **3**: 1106 (1903).

Uruguay and eastern Brazil (Rio Grande do Sul to Paraná) westward to Bolivia (Tarija to Cochabamba) and northern Argentina.

BRAZIL: Calmon, Paraná, 1910, *Dusen 9268* (G); Roca Nova, Paraná, 1909, *Dusen 8955* (US); Est. L. Gomez near Neu Württemberg, Rio Grande do Sul, 1904, *Bornmüller 236* in pt. (G). URUGUAY: Barra del Rio Santa Lucia, San Jose, *Osten 21642* (FM) and *Rosengurtt B. 1743* (G); Cerro Colorado, Florida, 1936, *Rosengurtt B. 733* (G); Cerro de las Cuentas, Cerro Largo, 1938, *Rosengurtt B. 2544* and *B. 2545* (G); Est. Palleros, Cerro Largo, 1937, *ex Rosengurtt PE. 1307* (G); Rio Negro, *Parker 853* (G). PARAGUAY: Rio Curuguaty, *Hassler 4586* (G); illegible, *Jorgensen 4533* and *4538* (US).

Apparently in response to various habitats, this plant varies in stature, in robustness, and in the size and form of the inflorescence. When well

developed it forms large clumps a meter or more high. The plants are the largest in the genus. When well developed the cymes are much forked, open, and nearly a decimeter in length. They may be variously simplified in branching, or may be shortened and congested into a very dense subsessile cluster. In some plants the cymes remain unbranched and form a more or less curving unilateral spike. When this is accompanied by a reduction in the number of spathes there may be only one or a very few spathes sessile at the summit of the stem. There are many transitions between all these forms of inflorescences. Since the species is reported from such diverse habitats as swamps, meadows, sand, and rocky hillsides these variations may well be ecological in origin.

Baker, Handb. Irid. 132 (1892) treats most of the above species as synonyms of *S. palmifolium* L. While this may be correct, I feel it is wise at present to place the Linnaean species among the doubtful ones, since the type must be reexamined and its precise identity established.

8. **Sisyrinchium Wettsteinii** Hand.-Mazz. Denkschr. Akad. Wiss. Wien **79:** 216, fig. 6 (1908).

BRAZIL: Turma 23, Paraná, locis subpaludosis in campo, 1914, *Jonsson 1204a* (FM); Curityba, Paraná, campo subuliginoso, 1908, *Dusen sine no.* (US); Alto da Serra, São Paulo, 1924, *Gehrt, S.B.S.P.* no. *14501* (G).

This species was based upon material collected between Pilar and Alto da Serra (*Wacket*) and on the upper slopes of Itatiaya (*Wettstein & Schiffner; Wawra 480*). Handel-Mazzetti stressed the microscopic protuberances on the epidermis. These do seem to achieve an unusual development in *S. Wettsteinii* but they do not always have the maximum development that Handel-Mazzetti describes. The species is evidently related to the more southern *S. macrocephalum*. Possibly it may be only a northern variety of that species characterized by a very slender habit, papillate epidermis, slightly smaller corollas, and a usually more erect and more simply and trimly organized inflorescence.

9. **Sisyrinchium Fiebrigii,** sp. nov.

Planta 3–8 dm. alta; radicibus perennibus gracilibus; foliis basalibus; lamina terete elongata (sed caulem haud superante) e vagina 5–14 cm. longa anguste scariosa haud ciliolata oriente; caulibus teretibus junciformibus apice bracteam 3–9 cm. longam rectam (cum lamina terete quam parte vaginata 0–3-plo longiore donatam) productioni caulis similem gerentibus; inflorescentia bracteolata e basi bracteae caulinae terminalis erumpente ergo per speciem laterale; spathis 1–5 congestis

sessilibus vel in ramulo usque ad 5 mm. longo curvato gestis ca. 15 mm. longis; valvis spathae lanceolatis infra medium 4–5 mm. latis, margine late scariosis (margine scarioso apicem versus valvae gradatim angustato); tepalis ad 6 mm. longis oblongis 3-nervatis (in sicco purpureis) apice obtusis apiculatis; filamentis fere ad apicem in tubum ca. 2 mm. longum connatis, apicibus liberis brevibus haud conspicuis ascendentibus; tubo basi glandulis adundantibus aglutinatis incrassato, alibi pilis brevibus flavis glanduliferis ornato; antheris latis ca. 0.4 mm. longis; ovario globoso pilis flavis brevibus glanduliferis vestito; capsula depresse globosa 4–5 mm. crassa.

PARAGUAY: Cordillera de Altos, Oct. 8, 1902, *Fiebrig 220* (TYPE, Gray Herb.).

Related to *S. laterale* Baker, a Bolivian species probably having a synonym in *S. pictum* Kränzl. The Bolivian species also has elongate terete leaf-blades. Its spathes are also similar to the species here described. Its longer (3–3.5 mm.) staminal tube, however, is shaggy villous its whole length with slender yellow hairs without glands. Towards the base of the tube these hairs are most abundant and there may be intermixed with some subsessile glands. There is no agglutinated mass of glands at the base of the tube as is found in *S. Fiebrigii*. The Bolivian and Paraguayan plants seem to be amply distinct.

10. **Sisyrinchium subnudum,** sp. nov.

Herba 2–3 dm. alta; radicibus gracilibus perennibus; foliis basalibus; vaginis 4–7 mm. longis margine ciliolatis apice laminam acicularem inconspicuam 3–10 mm. longam gerentibus; caulibus junciformibus teretibus apice bracteam 2–5 cm. longam rectam (saepe cum lamina terete quam parte vaginata 1–4-plo longiore donatam) productioni caulis persimilem gerentibus; inflorescentia e basi bracteae caulinae terminalis erumpente, ergo per speciem laterali; bracteolis conspicuis; spathis 1–3 congestis; valvis subaequalibus 10–12 mm. longis 2.5–4 mm. latis (infra medium latioribus) margine 0.5–0.9 mm. latis late scariosis, apice subacutis mucronatis; valvis intimis spathae scariosis maturitate conspicuis; ovario et pedicellis pilis flavescentibus glanduliferis sparse vestitis; tepalis flavis oblongis 3-nervatis 4-5 mm. longis ca. 1.5 mm. latis, apice obtusis ca. 0.8–1 mm. longe flagellato-acuminatis; filamentis in tubum 1.7–2.1 mm. longum connatis; tubo basim versus glandulis abundantissimis agglutinatis incrassato, alibi pilis flavis eglanduliferis vestito; antheris latis ca. 0.5 mm. longis subsessilibus; capsula maturitate ignota, ut videtur depresse globosa et ca. 3 mm. crassa.

BRAZIL: Corrego dos Moreiras, E.F.N.B., Matto Grosso, Sept. 1914,

Kuhlmann, S.B.S.P. no. *103* (G); Capão Bonito, Campo Grande, Matto Grosso, Sept. 6, 1936, *Archer & Gehrt, S.B.S.P.* no. *36372* (TYPE, Gray Herb.).

Evidently related to the Paraguayan *S. Fiebrigii,* but smaller in all parts and having non-ciliate leaf-sheaths and only rudimentary leaf-blades.

11. **Sisyrinchium Luzula** Klotzsch ex Klatt, Linnaea **31**: 89, 376 (1862–3) and in Martius, Fl. Bras. **3**(1): 542 (1871); Baker, Handb. Irid. 131 (1892).

BRAZIL: Ponta Grossa, Paraná, campo, 1928, *Hoehne, S.B.S.P.* no. *23226* (G); Curityba, Paraná, 1928, *Hoehne, S.B.S.P.* no. *23133* (G); Curityba, 1903, wet place, *Dusen 2247* (G; US. in pt.); Curityba, 1908, campo, *Dusen 6921* (US); Santo Angelo, São Paulo, campo, 1936, *Hoehne & Gehrt, S.B.S.P.* no. *36568* (G); Butantan, São Paulo, *Hoehne, S.B.S.P.* no. *2558* (São Paulo); Ypiranga, São Paulo, campo, 1921, *Brade 5621, S.B.S.P.* no. *7269* (G); São Ignatio, *Sellow c. 321* (FM, photo.); Minas Geraes, *Regnell 1227* and *1224* (US).

The species was originally based upon the following suite of specimens: 1) *Widgren 789* from Minas Geraes; 2) *Blanchet 3313;* 3) *Sellow B1325, c320* from S. Antonio da Monte; and 4) *Sellow c321* from S. Ignatio. Later Klatt added other collections, some of which are certainly referable to *S. Hoehnei* and *S. scariosa.* All the original specimens are probably representative of the species as here accepted. In the past, most of the species with terete stems and leaves and congested pseudo-lateral cymes, have at one time or another, been referred to *S. Luzula.* The real *S. Luzula* appears to be restricted to eastern Brazil from Paraná to Minas Geraes or Bahia.

12. **Sisyrinchium scariosum,** sp. nov.

Herba 1–7 dm. alta; radicibus gracilibus perennibus; foliis basalibus; vaginis 5–10 cm. longis saepe ciliolatis, apice plerumque laminam teretem gracilem gerentibus; laminis vaginarum superiorum non rariter 1–2 dm. longis quam caule brevioribus; caulibus junciformibus teretibus apice bracteam 2–10 cm. longam rectam (saepe cum lamina terete quam parte vaginata 1–8-plo longiore donatam) productioni caulis persimilem gerentibus; inflorescentia congesta e basi bracteae caulinae terminalis erumpentibus ergo per speciem laterali; bracteolis late scarioso-marginatis, carina ciliolata; spathis 1–8 spiculae Melicae sub-similibus 6–10 mm. longis sessilibus et glomeratis vel in ramulo inflorescentiae 1–6 mm. longo curvato gestis; valvis spathae exterioribus quam interioribus

evidenter longioribus 4–5 mm. latis; margine valvae latissime scariosa, apicem versus valvae haud angustata; tepalis trinerviis 5–7 mm. longis 1.8–2.3 mm. latis apice emarginatis flagellatis; filamentis fere ad apicem apicem in tubum ca. 2 mm. longum connatis, apicibus liberis brevibus; tubo basim versus glandulis numerosis agglutinatis incrassato, alibi pilis flavis glanduliferis satis ornato; antheris ca. 0.4 mm. longis; ovario globoso pilis brevibus flavis glanduliferis ornato; capsula depresse globosa 3–4.5 mm. crassa.

BRAZIL: Curityba, Paraná, wet places, 1903, *Dusen 2247* in pt. (US); Neu Württemberg, Rio Grande do Sul, 1904, fl. yellow, *Bornmüller 381* (G); Santo Amargo, Rio Grande do Sul, 1925, *Jürgens 167* (US); Porto Alegre, Rio Grande do Sul, 1902, *Malme 96* (G, US). URUGUAY: Arroyo de La Pantanosa, Rocha, wet place, 1938, *Rosengurtt B. 2452* (G); Cerro de las Cucutas, Cerro Negro, grassy rocky slopes, 1938, *Rosengurtt B. 2555* (G); Rio Negro y Palleros, Cerro Negro, grassy slopes, fl. yellow, 1937, *Rosengurtt B. 2366* (G); Cerro, Montevideo, fl. white, 1924, *Herter 625–76162* (G, US); Atlantida, Canelones, dunes, fl. pink, 1930, *Osten 22020* (FM); Sierra Animas, Maldonado, grassy and rocky places, fl. violaceous, Oct. 11, 1932, *Osten 22693* (TYPE, Gray Herb.).

A very well marked species that has been confused with the more northern *S. Luzula*. It is readily recognized by having spathes which are very much more broadly scarious-margined and very much less pointed. In age the scarious margin becomes weathered and much torn, and the spathes consequently ragged and not so neat and trim as are those of *S. Luzula*.

13. **Sisyrinchium Hasslerianum** Baker, Bull. Herb. Boiss. II. 3: 1106 (1903).

PARAGUAY: vicinity of the Rio Capibary, *Hassler 4376* (G); Cord. de Altos, *Fiebrig 220* (FM); Villarica, 1930, *Jorgensen 4262* (US, FM).

In this species the staminal tube, for its entire length, is covered with abundant coarse reflexed yellow hairs. The spathes and inflorescences are very similar to those of *S. scariosum*.

14. **Sisyrinchium Hoehnei**, sp. nov.

Planta perennis junciformis 3–9 dm. alta; foliis basalibus longe vaginatis; vaginis 5–10 cm. longis saepe laminiferis; lamina 0–45 cm. longa lineari compressa, facie 1–1.5 mm. lata 3–4-nervata, margine tenui integra; caulibus teretibus quam foliis basalibus conspicue longioribus, apice bracteam 1–6 cm. longam rectam (saepe cum lamina compressa

ornatam) productioni caulis similem gerentibus; inflorescentia e basi bracteae caulinae terminalis erumpente glomerata subsessili; ramulis 0–6 mm. longis curvatis, bracteolatis; spathis saepe numerosis congestis 5–8 mm. longis stramineis; valvis obtusiusculis mucronatis 2–3.5 mm. latis conspicue scarioso-marginatis, interiore quam exteriore (ad 2 mm.) longioribus, intimis scariosis valvis exterioribus aequilongis; bracteolis navicularibus (carina serrulata) quam valvis spathae evidenter brevioribus; ovario globoso saepe pilis brevibus flavis glanduliferis plus minusve vestitis; tepalis flavis ca. 5 mm. longis 2 mm. latis trinervatis apice acutis apiculatis; filamentis in tubum ca. 2 mm. longum gracilem pilis flavis reflexis eglanduliferis abundantibus dense vestitum connatis; antheris ca. 0.9 mm. longis oblongis subsessilibus; capsula depresse globosa 2.5–3.5 mm. crassa.

BRAZIL: Heitor Legrum, S. Paulo, Sept. 1921, *Brade, S.B.S.P.* no. *7281* (G); Rio do Peixe, S. Paulo, *Edwall, S.B.S.P.* no. *12551* (G); Rio Pardo, S. Paulo, Sept. 1826, *Riedel* (G); Curityba, Paraná, Oct. 1908, *Dusen 6788* (US); Curityba, Oct. 1914, *Dusen 15627* (US); Curityba, fl. yellow, Oct. 1928, *Hoehne, S.B.S.P.* no. *23057* (TYPE, Gray Herb.).

Evidently a Brazilian relative of the Paraguayan endemic, *S. Hasslerianum*. It differs from that species in having less well developed leaf-blades (these shorter, narrower and less numerous), in its slightly shorter spathe-valves which are much more broadly scarious-margined, and in its terete rather than narrowly ancipitous stems. A collection of *S. Hoehnei* from Curityba (*Dusen 6788*) has the sheathes of the basal leaves lacking lamina. The bract terminating the stem, however, is prolonged into the flattened blade characteristic of the species.

15. **Sisyrinchium Sellowianum** Klatt, Linnaea **31**: 375 (1862) and in Martius, Fl. Bras. **3**(1): 539, tab. 70 (1871); Baker, Handb. Irid. 131 (1892).

S. platycaule Baker, Handb. Irid. 132 (1892).

BRAZIL: Est. L. Gomez, near Neu Württemberg, Rio Grande do Sul, 1904, *Bornmüller 231* (G). PARAGUAY: vicinity of the Rio Alto Paraná, *Fiebrig 5434* (G, US).

The type of *S. Sellowianum* is given as "Brasilia meridionalis, Montevideo, leg. *Sellow* no. *1484* et *3922*." I suspect that the material was obtained during Sellow's travels in the state of Rio Grande do Sul. The staminal tube is about 2 mm. long. It is more or less conic or swollen below the middle and short-cylindric above. The thickened lower portion is densely glandular or stipitate-glandular, above the indument is similar but very much less abundant. The anthers, 0.5–0.8 mm. long,

are oblong and borne on the short free tips of the otherwise completely united filaments. These tips are short but evident, and are almost as long as the anthers. The type of *S. platycaule* was collected in Paraguay by Balansa (no. *555*). It may possibly be worthy of recognition, but it is evidently very closely related to *S. Sellowianum*.

16. **Sisyrinchium fasciculatum** Klatt, Linnaea **31**: 97, 380 (1861–2) and in Martius Fl. Bras. **3**(1): 541 (1871); Baker, Handb. Irid. 131 (1892).

The original description of the species was based upon collections cited, "Brasilia meridionalis, leg. Sellow, Herb. Reg. Berol. no. 2 et 112." Later, in the Flora Brasiliensis Klatt cited additional material as follows, "Habitat in Brasilia australiore, stationibus accuratio haud notatis: *Sello, Riedel;* in prov. Rio Grande do Sul; *Gaudichaud.*" I have seen no specimens referable to this species. Recently Malme, Ark. Bot. **26A** (3): 18 (1935), has reported two collections of the plant from Rio Grande do Sul (*Lindman 310, 383*).

The measurements given by Klatt call for a plant with stems "subpedalis, 1 lin. crassus" and leaves "4–7 poll. longa, 1½ lin. lata." These measurements indicate that his illustration of the species is twice natural size. Klatt gives the staminal tube as 1 line long and densely glandulose-pubescent. His illustration of the tube shows it to be narrowly cylindric and not at all thickened at the base.

17. **Sisyrinchium Ostenianum** Beauverd, Bull. Soc. Bot. Genève **14**: 162, fig. 8 (1922).

URUGUAY: Cerro, dept. Montevideo, Oct. 1926, *Herter 907–81163* (US); Rio San Jose, F. C. Raigón, dept. San Jose, 1935, *Rosengurtt B. 1818* (G).

The type was collected by Osten (no. *4306*) in 1901, near Molles, dept. Durazno, Uruguay. Beauverd did not mention the androecium in his description. Herter's collection, above cited, is slightly immature and has no flowers. Rosengurtt's collection is in prime condition, having both flowers and fruit. The staminal tube is almost 2 mm. long. The lower quarter is covered with agglutinated glands and is distinctly thickened. Near the summit, beneath the short crowded anthers, the tube bears a dense conspicuous mass of eglanduliferous reflexed yellow hairs. Between this apical mass of yellow hairs, and the basal glandular area, the tube is practically naked and glabrous.

18. **Sisyrinchium Claritae** Herter, Rev. Sudamer. Bot. **5**: 27 (1937).

Herba 8–13 cm. alta; radicibus gracilibus ut videtur perennibus; foliis

basalibus rigidis gracillimis angustissimis linearibus quam caule evidenter brevioribus 5–9 cm. longis 0.4–0.8 mm. latis compressis in facie 2–3-nervatis; caulibus gracillimis rectis subteretibus vix ancipitibus ca. 0.4–0.8 mm. crassis 7–12 cm. longis usque ad apicem nudis, apice bracteam 5–10 (rariter usque ad 20) mm. longam rectam productioni caulis similem gerentibus; inflorescentia e basi bracteae caulinae terminalis erumpentibus ergo per speciem laterali bracteolata; spathis 1–4 sessilibus congestis 6–9 mm. longis; valvis 3–4 mm. latis apice obtusis margine 0.5–1 mm. late scariosis; valva interiore quam exteriore paullo longiore; bracteis intimis spathae scariosis valvis aequilongis; pedicellis et ovario subgloboso sparse flavescenteque glandulifero-villosulis; tepalis ca 5 mm. longis elongatis ca. 1.5 mm. latis trinerviis acuminatis "flavis"; filamentis omnino connatis ca. 2 mm. longis; tubo filamentorum basim versus evidenter ampliato ad 1 mm. crasso dense glandulifero, deinde abrupte contracto sursum anguste cylindraceo ca. 0.3 mm. crasso, apicem versus pilis flavis reflexis eglanduliferis gerente, alibi subglabro; antheris oblongis ad 1 mm. longis subsessilibus; capsula subglobosa 2.5–3 mm. crassa.

BRAZIL: Quinta, near Rio Grande do Sul, 1892, *Lindman 819* (G, US). URUGUAY: Santa Teresa, Rocha, Nov. 1931, *Herter 1525–87667* (G, US).

The species was based upon material collected by Herter at Santa Teresa, dept. Rocha, (no. *87667*) and near Arequita, dept. Lavalleja (no. *1525a–81255*), Uruguay. It is evidently related to *S. Ostenianum*. The staminal structures in the two species are very similar. The species, however, differ conspicuously in gross habit. The present one is a very much more slender plant than *S. Ostenianum*, and is smaller in all of its parts. It becomes darkened in drying; its relative does not. Malme, Bot. Ark. **26A**(9): 18 (1935), has recently reported the Brazilian collection, cited above, as representing *S. Ostenianum*. The new description, provided above, covers many of the important details of structure not mentioned in the original description of the species.

19. **Sisyrinchium micranthum** Cav. Diss. **2**: 345, tab. 191, fig. 2 (1788).

S. iridifolium HBK. Nov. Gen. **1**: 324 (1816).

S. scabrum Schlecht. & Cham. Linnaea **6**: 57 (1831).

Ranging from northwestern Argentina and southern Brazil, northward to Venezuela, Colombia and central America.

BRAZIL: Gavia, Rio Janeiro, 1868, *Glaziou 3129* (US, FM); betw. Petropolis and Raiz da serra, Rio Janeiro, 1928, *Smith 1313* (G);

Campinas, S. Paulo, *Novaes 1193* (US); Serra da Cantareira, S. Paulo, *Loefgren & Edwall 3284*, in pt. (G); Ubaruba, Paraná 1929, *Hoehne, S.B.S.P.* no. *24325* (G); Blumenau, S. Catharina, 1888, *Ule 982* (US); Velha, S. Catharina, 1888, *Ule 981* (US); Neu Württemberg, Rio Grande do Sul, 1904, *Bornmüller 245* (G). ARGENTINA: Delta, Rio Carabelas across from Tiburón, Buenos Aires, Nov. 1925, *Scala* (G); El Candado, Catamarca, 1907, *Jorgensen 1219* in pt. (US); dept. Famailla, Tucuman, *Venturi 407, 1024* and *1417* (G, US); dept. Leales, Tucuman, *Venturi 1330* (US); dept. Tafi, Tucuman, *Venturi 3933, 3937, 3940,* and *6005* (G, US). PARAGUAY: Villarica, 1929, *Jorgensen 3873* (US); Asuncion, *Morong 63* (G).

This slender weedy annual, which commonly darkens in drying, is well illustrated, as *S. micranthum,* in the Botanical Magazine, **47:** tab. 2116 (1830). Klatt seems to have placed plants of this species chiefly under *S. scabrum* and *S. micranthum.* As far as can be determined Baker seems generally to have used the name *S. micranthum* in the correct sense. Most of the recent collections from northern South America have been determined as *S. iridifolium.*

20. **Sisyrinchium laxum** Otto ex Sims, Bot. Mag. **49:** tab. 2312 (1822); Link ex Sprengel, Syst. **1:** 167 (1825).

S. geniculatum Herbert, London Jour. Bot. **1:** 538 (1842), nomen.
S. uniflorum Gay ex Phil. Linnaea **29:** 631 (1857).
? S. Pearcei Phil. Linnaea **33:** 251 (1864–5).
S. valdivianum Phil. Anal. Univ. Chile **91:** 616 (1895).
S. Metae Herter, Rev. Sudamer. Bot. **5:** 28 (1937).

BRAZIL: Minas Geraes: Serra da Caparáo, 1929, *Mexia 4028* (G, US, FM). Rio Janeiro: Serro Frio, 1886, *Glaziou 16399* (FM); Theresopolis, 1872, *Glaziou 6451* (US, FM); Tejuca, *Gardner 217* (US). São Paulo: Butantan, 1917, *Hoehne, S.B.S.P.* no. *769* (G); Mogy das Cruses, 1912, *Brade 5618, S.B.S.P.* no. *7270* (G); Rio Grande, 1892, *Edwall 1967, S.B.S.P.* no. *12518* (G); Santo Amaro, 1913, *Brade 7220, S.B.S.P.* no. *7286* (G); S. Francisco dos Campos, 1896, *Loefgren 3584, S.B.S.P.* no. *12511* (G); Serra da Cantareira, 1895, *Loefgren & Eswall 3284, S.B.S.P.* no. *12522* (G). Paraná: Rio Negro, 1928, *Hoehne, S.B.S.P.* no. *23138* (G); Ponta Grossa, 1928, *Hoehne, S.B.S.P.* no. *23241* (G); Tibagy, 1935, *Reiss 168* (G); Pinhaes, 1908, *Dusen 7109* (G); Serrinha, 1914, *Dusen 1083a* (US); Turma 23, 1914, *Dusen 1336a* (US); Rio Grande do Sul: Salto Alegre near Neu Württemberg, 1904, Bornmüller *304* (G); Porto Alegre, 1921, *Lindman 385* (G); Viamo near Porto Alegre, 1936, *Archer 4327* (G). URUGUAY: Riachuelo, Colonia, 1936,

Cabrera 3927 (FM); Mercedes, Soriano, 1936–37, *ex Rosengurtt PE. 59* and *172* (G); Rio Yi y Arroyo Marincho, Flores, 1936, *ex Rosengurtt. PE. 452* (G); Cerro Colorado, Florida, 1936, *ex Rosengurtt PE. 208, 334* and *375* (G); Santa Lucia, Canelones, 1884, *Safford 115* (US); Cayago, Montevideo, 1934, *Rosengurtt B. 1722* (G); Cerro, Montevideo, *Herter 143–79608, 144–79607, 146–79426* and *146a–79662* (G); Punta Yeguas, Montevideo, 1926, *Herter 448–81394* (G); Rio Negro, Cerro Largo, 1937, *ex Rosengurtt PE. 1367, 1429, 1789, 1881, 2040* and *2095* (G); Cabo Santa Maria, Roca, 1938, *Rosengurtt B. 2472* (G). PARAGUAY: Cord. de Altos, 1902, *Fiebrig 253* (FM); Itape, 1931, *Jorgensen 4538* (US, FM). ARGENTINA: Tilcara, Jujuy, 1927, *Venturi 4886* (G); El Duraznito, Tucuman, 1921, *Venturi 1561* (US); prov. Cordoba, *Lossen 1141* (G); Yapeyú, Corrientes, 1936, *Parodi 12658* (G); Isla Santiago, Buenos Aires, *Cabrera 2000* and *3417* (G); Avellaneda, Buenos Aires, 1925, *Parodi 6716* (G); Elizalde, Buenos Aires, 1930, *Cabrera 1527* (G); Mouth of Rio Negro, *Wilkes Exped.* (G); Bariloche, Rio Negro, 1934, *Parodi 11463* (G); Corcovado, Chubut, 1901, *Illin 43* (G).

Of this weedy annual I have cited all the material which I have examined from Brazil, Uruguay, Argentina and Paraguay; I have not listed the material from Chile. The species is not known from other South American countries, but occurs as an adventive species in Europe. Klatt and Baker seem to have referred this widely distributed, generally temperate plant, to *S. iridifolium*, but that name undoubtedly belongs in the synonymy of *S. micranthum* Cav. Illustrations of the present plant, all as "*iridifolium*," may be found in the following works, Herbert, Bot. Reg. **8:** tab. 646 (1822); Lodd. Bot. Cab. **20:** tab. 1979 (1833) and Bettfreund, Fl. Argent. **3:** 217 (1901).

In my key I have given the characters which usually serve to distinguish *S. laxum* from its close relative, *S. micranthum*. Individually these characters are not always decisive, though collectively they will usually distinguish the northern and tropical *S. micranthum* from the more southern and temperate, *S. laxum*. There are plants which present embarrassing combinations of characters, but it will be noted that most of these come from northern Argentina and southern Brazil where the ranges of these two species overlap and hence in the very region where hybridization might be expected. Of these two related species, *S. laxum* is the most variable.

21. **Sisyrinchium piliferum** Klatt, Abhand. Naturf. Ges. Halle **12:** 379 (1882); Baker, Handb. Irid. 123 (1892).

S. capillare Baker, Bull. Herb. Boiss. II. **3:** 1106 (1902).

PARAGUAY: Rio Curuguaty, *Hassler 4588* (G, FM); Cord. de Altos, *Fiebrig 161* (G); betw. Rio Apa and Rio Aquidaban, *Fiebrig 4677* (G); Ititimi, *Balansa 533* (FM, photo.); Hiati, *Jorgensen 4260* (US, FM); Villarica, *Jorgensen 3771a* (US).

A species closely related to the Brazilian *S. commutatum* but smaller and more slender, having almost capillary leaves and stems. Klatt founded his species on *Balansa 553* from Paraguay and described its leaves as being "radicalibus e vagina lata et longa piliferi-teretibus cuspidatis." Baker, apparently translating Klatt's description, erroneously described the leaves as "thread-like fine-pilose." The leaves are in fact actually capillary, slightly compressed, and glabrous.

22. **Sisyrinchium commutatum** Klatt, Hamburg. Garten- u. Blumenzeitung **16:** 164 (April, 1860).

S. secundiflorum Klatt, Linnaea **31**: 91, 377 (1861–2), and in Martius Fl. Bras. **3**(1): 541, tab. 71, fig. 2 (1871); Baker, Handb. Irid. 123 (1892).

BRAZIL: Caldas, Minas Geraes, 1862, *Herchen I. 444* (US); Minas Geraes, 1845, *Widgren* (US); Itatiaya, *Ginzberger 266* and *267* (FM); Campinas, S. Paulo, *Novas 1192* (US); Corrego Alegre, S. Paulo, *Loefgren 3585, S.B.S.P.* no. *12519* (G); Santa Anna, S. Paulo, *Usteri, S.B.S.P.* no. *12514* (G); Itú, S. Paulo, *Russel 70, S.B.S.P.* no. *18686* (G); Ypiranga, S. Paulo, *Luederwaldt 286, S.B.S.P.* no. *12509* (G); Itapetiininga, S. Paulo, *Loefgren 344, S.B.S.P.* no. *12510* (G); Moóca, S. Paulo, *Brade 5623* and *5966, S.B.S.P.* nos. *7266* and *7267* (G); Atibaia, S. Paulo, *Duarte 129, S.B.S.P.* no. *12507* (G); Butantan, S. Paulo, *Hoehne, S.B.S.P.* no. *549* (G); Ave. Paulista, S. Paulo, *Usteri, S.B.S.P.* no. *12508* (G). Jaguariahyna, Paraná, 1911, *Dusen 13266* (US); Tibagny, Paraná, *Reiss 164* (G, FM).

The plant illustrated in the Flora Brasiliensis has a poorly developed inflorescence. The inflorescence may become compounded with branches as much as one decimeter long. The peduncles are usually 1–2 (rarely even 5) cm. long and are rather unequally developed in each cluster. The staminal tube is densely glandular towards the base. Towards the apex the tube may bear some reflexed hairs, or may be almost glabrous.

A year before Klatt published his well known revision of *Sisyrinchium*, in volume 31 of Linnaea (1861), he had published a much less critical review of the genus in the Hamburger Garten- und Blumenzeitung **16:** 159–169 (1860). In this earlier work Klatt proposed a single new species, *S. commutatum*, basing it upon material from Minas Geraes collected by Regnell (no. *444*) and Widgren (no. *788*). This species, how-

ever, was ignored in his monograph published the next year and was there replaced by *S. secundiflorum*. He based that latter name upon the same two collections from Minas Geraes supplemented by a collection of Sellow, no. *101*, (cited,— "a S. Paula ad meridiam") which he had recently examined. The two species, *S. commutatum* and *S. secundiflorum* are practically identical. The former name, being at least a year older, is the one to be accepted.

23. **Sisyrinchium setaceum** Klatt, Linnaea **31**: 85 (1861); and in Martius, Fl. Bras. **3**(1): 540, tab. 71, fig. 1 (1871); Baker, Handb. Irid. 122 (1892).

BRAZIL: Porto Alegre, Rio Grande do Sul, *Malme 60* (G, US); Pelotas, Rio Grande do Sul, *Archer 4287* (G). ARGENTINA: Col. Bonpland, *Lilliesköld* (FM).

This species is well illustrated in the Flora Brasiliensis. It has a small tuft of very slender capillary leaves and bears the solitary spathes terminal on the erect naked capillary scapose stems. The outer valve commonly has a slender prolonged tip, 20–30 mm. long. This outer valve terminates the stem and is the homologue of the leafy bract which terminates and appears to be a prolongation of the stem in such species as *S. Luzula*, *S. macrocephalum*, *S. Sellowianum*, etc. In *S. setaceum* this terminal foliar structure clearly functions as the outer spathe-valve. In the other species mentioned it is a bract that stands beside the cymose cluster of spathes.

24. **Sisyrinchium minus** Engelm. & Gray, Boston Jour. Nat. Hist. **5**: 265 (1845); Bicknell, Bull. Torr. Bot. Club **28**: 591 (1901).

S. Bermudianum var. *minus* (Engel. & Gray) Klatt, Linnaea **31**: 69 (1861).

S. geniculatum Herbert, Bot. Reg. **29**: Miscel. 84 (1843), nomen.

URUGUAY: Arroyo Negro, Paysandú, 1937, *Rosengurtt B. 2276* (G); Rio Yi y Arroyo Marincho; Flores, openings in woods near stream, 1936, *Rosengurtt B. 582* (G); Rio Santa Lucia, 25 de Agosto, San José, weed near stream, 1935, *Rosengurtt B. 1800* (G). ARGENTINA: Delta del Paraná, Paraná Guazu, Buenos Aires, 1914, *Scala 41* (G); Avellaneda, Buenos Aires, 1931, *Parodi 9910* (G); Villa Ortuzar, Buenos Aires, adventive, *Parodi 8964* (G); Baradero, Buenos Aires, *Burkart 8532* (FM).

This is a very distinct species which is readily recognized by its slender, leafy stems, annual root, and its small elongate verrucose capsules. The plants of Uruguay and Argentina are remarkably similar to those of

Texas. The species was based upon material collected by Lindheimer at the margin of pools in the prairie west of San Felipe, Texas. Whether the species is one of those occurring naturally in Texas and in temperate South America, or whether it is recently adventive in the south, has not been determined.

25. **Sisyrinchium minutiflorum** Klatt, Linnaea **31**: 71 (1861), and in Martius, Fl. Bras. **3**(1): 536 (1871); Baker, Handb. Irid. 125 (1892).

BRAZIL: Rio Grande do Sul, 1901, *Malme 146* (G). URUGUAY: Agronomía, Paysandú, 1937, *Rosengurtt B. 2216* (G); Cerro, Montevideo, 1924, *Herter 145a–76182* (G); Santa Lucia, Canelones, 1886, *Safford* (US).

This species was based upon a collection made by Sellow (no. *2913*) at an undetermined locality in southern Brazil or Uruguay. I have seen a photograph of the type.

I have seen a specimen of a small annual herb of Brazil which resembles both *S. minutiflorum* and *S. minus*. It appears to be related to both of these species and seems to be undescribed. The specimen was collected by Dusen (no. *9450*, US) near Desiro Ribas, Paraná, and has been determined as *S. bogotense*. The plants from Rio Grande do Sul mentioned by Malme, Ark. Bot. **26A**(3): 16 (1935), under the name *S. iridifolium*, probably represents the same species. The plant in question has weak stems which become decumbent and root at the nodes, or, when buried in the soil, act as rhizomes. The capsules and size of leaves suggest those of *S. minutiflorum* but the corolla and the spathes (while smaller and having much less unequal valves) most suggest *S. minus*.

26. **Sisyrinchium platense,** sp. nov.

Planta 1.5–7.5 dm. alta perennis; radicibus longiusculis pro planta crassis; caulibus strictis numerosis rectis vel geniculatis supra medium dichotome ramosis ancipitibus 1–2 usque ad 3 mm. latis margine non raro serrulatis; foliis basalibus gramineis 1–2.5 dm. longis 2–4 mm. latis ensiformibus 7–20-nervatis margine saepe serrulatis; foliis caulinis quam basalibus brevioribus 1–3 pedunculos spatharum suffulcientibus; spathis 2–10-floris 15–19 mm. longis; pedunculis gracilibus 2–8 cm. longis 0.5–0.8 mm. latis rectis ascendentibus; valvis spathae lanceolatis stramineis saepe plus minusve purpurascentibus subaequalibus; pedicellis erectis gracilibus cum pilis glanduliferis sparse vestitis; ovario pilis glanduliferis ornato: tepalis violaceis extus puberulentis 5–9-nervatis oblongis ca. 1 cm. longis 2–3.5 mm. latis apice abrupte 1–2 mm. longeque acuminatis;

filamentis connatis; tubo 1.5–2.5 mm. longo, infra medium plus minusve evidenter expanso (non rariter ad 1 mm. crasso), e basi usque ad medium vel paullo supra medium dense glandulifero, alibi glabro vel sparse glandulifero; antheris ca. 0.5 mm. longis sessilibus; capsulis (plus minus depresse) globosis 4–5 mm. diametro.

PARAGUAY: Mercedes, Soriano, 1936, *ex Rosengurtt PE. 102, 137* and *160* (G); San José, 1922, *Smith 88* (G); Santa Lucia, Canelones, *Safford* (US) and *Smith 50* (US); near Montevideo, 1886, *Safford 116* (US); Cerro, Montevideo, 1925, *Herter 147–79660* (G); Carretera, Km. 100, Minas, 1937, *Rosengurtt B. 2325* (G); Rio Negro, Est. Palleros, Cerro Largo, 1937, *ex Rosengurtt PE. 1234, 1289, 1294, 1628, 1656,* and *1949* (G); Rio Negro y Arroyo Palleros, Cerro Largo, 1936, *Rosengurtt B. 1721* (G). ARGENTINA (dept. Buenos Aires): Bañado de Flores, Nov. 10, 1927, *Parodi 8171* (TYPE, Gray Herb.); San Fernando, 1903, *Pennington 46* (G); Punta Lara, 1932, *Cabrera 2419* (G); Tolusa, 1937, *Cabrera 3412* (G); between Tolusa and Ensenada, 1930, *Cabrera 1553* (G); Villa Elisa, La Plata, 1935, *Burkart 7096* (G); road to Brandzen, 1937, *Rodrigo 1067* (G); Elizade, 1928, *Cabrera 462* (G).

This is the coarse, tufted, perennial species with blue or purple flowers which appears to be common on both sides of the estuary of the La Plata. It has been mistaken for various species, but most generally seems to have passed as "*S. chilense.*" The relatives of *S. platense* are *S. chilense,* endemic at low altitudes in central Chile, and *S. azureum* Phil., distributed in the high country of northwestern Argentina and adjacent Chile northward to Peru. The present species, *S. platense,* has a range well separated from those of the relatives mentioned and possesses a differently shaped capsule. The capsule is depressed globose, averaging distinctly shorter than the obovoid or obovoid-ellipsoid ones of *S. chilense* and *S. azureum.* The staminal tube of *S. platense* is short (1.5–2.5 mm.) and frequently very stout. It is commonly densely glandular from the base up to or even beyond the middle. The staminal tube of *S. chilense* is 3–4 mm. long and bears agglutinated glands only below the middle lower two-fifths) and frequently some scattered glands above. In *S. azureum* the tube is equally long but it bears only a relative few glands just above its base. These three plants, *S. platense, S. chilense* and *S. azureum* differ in geographical distribution, in intangibles of habit, in the staminal tubes, and in the size and shape of the capsules. All three merit specific recognition.

Under what is described as *S. platense* there appears to be a recognizable natural assemblage of forms. In Argentina and Uruguay, however, there seems to be some other forms which are closely related to it and

which may possibly represent undescribed varieties or distinct species. All of these have longer terminal tubes on which the glandular area occurs well below the middle.

Well to the north of the main range of *S. platense* occur plants collected by Jorgensen near Guayales, Formosa (no. *2301*, G, US), and near Villarica, Paraguay (no. *3872;* US, FM). The former has a staminal tube 4 mm. long and the latter 2.6–3 mm. long. In gross habit the plants much suggest the typical plant from the province of Buenos Aires.

In southern and western Uruguay there is a more marked relative or form of *S. platense*. These plants are small, averaging 15 (rarely 20–25) cm. high and have very narrow leaves, 0.5–1 mm. wide. The stems and leaves are very densely tufted and the roots are conspicuously thickened. In these respects it is more suggestive of *S. pachyrhizum* than *S. platense*. The staminal tube is 2–3.7 mm. long, but averages 3–3.5 mm. in length. The corolla-lobes are mostly less than 1 cm. long and in some of the collections are given as white or as purplish white. Of this small, slender-leaved, fleshy rooted, densely tufted, relatively smaller flowered plant I have seen collections from Agronomiá, Paysandú, *Rosengurtt B. 3168* (G); Mercedes, Soriano, *ex Rosengurtt PE. 112* (G); Montevideo, *Safford 117* (US); Cerro, Montevideo, *Herter 908–79418* (G); and Cerro de las Animas, Maldonado, *Rosengurtt B. 2432* (G).

Similar to the Uruguayan form just mentioned, but having broader leaves, larger corollas and a coarser habit, is a plant from the southern half of the province of Buenos Aires. The few plants having fruit indicate that it produces capsules 4–6 mm. broad, and hence larger than those of typical *S. platense*. I have seen material of this form from near Monte Veloz, *Cabrera 1898* (G); Los Nogales, Tandil, *Pastore 1159* (FM); Cerros al sur de Pigüe, *Scala 1089* (G); Cerros y Laguna de Puán, *Scala 1088* (G); and Cura-malal grande, *Scala 1085* (G).

27. **Sisyrinchium pachyrhizum** Baker, Jour. Bot. **14:** 269 (1876), and Handb. Irid. 129 (1892).

S. glandulosum Kränzlin, Bot. Jahrb. **40:** 241 (1908).

BRAZIL: without locality, *Sellow 3862* (FM, photo.). PARAGUAY: Cerros de Tobaty, 1900, *Hassler 6444* and *6445* (G); Chaco, along the Rio Paraguay, lat. 23° 25′, *Rojas 2353* (G); Cord. de Altos, 1902, *Fiebrig 254* (G, FM). ARGENTINA: Queb. del Rio Caraparí, Salta, 1937, *Cabrera 4205* (FM); El Puestito, Tucuman, 1928, *Venturi 7341* (G, US); Chañar Poza, Tucuman, 1917, *Venturi 437* (G, US); Ri Timbó, Tucuman, 1923, *Venturi 2229* (G, US); C. Pellegrini, Santiago

del Estero, 1927, *Venturi 5698* (G, US); Fontana, Chaco, 1937, *Meyer 464* (FM); Las Palmas, Chaco, 1897, *Jorgensen 2295* (G, US); Santa Ana, Corrientes, 1934, *Parodi 12057* (G); Reconquista, Santa Fe, 1933, *Burkart 5774* (FM); Victoria, Entre Rios, 1937, *Burkart 8654* (FM); Baradero, Buenos Aires, 1937, *Burkart 8528* (FM); Elizalde, Buenos Aires, *Cabrera 457* and *2841* (G); El Socorro, Buenos Aires, 1926, *Parodi 7388* in pt. (G).

Baker's species was based upon *Sellow 3862*, from "southern Brazil" and Kränzlin's species was based on *Hassler 2353* from Paraguay. I suspect that Sellow obtained his type material near the Uruguay River in western Rio Grande do Sul. Some forms of *S. platense* appear to simulate *S. pachyrhizum*. The present species, however, may usually be recognized by its yellow, slightly smaller (6–9 mm.) corollas, its longer (2.5–4.5 mm.) more slender staminal tube, its slightly smaller, frequently stramineous and rarely purplish-tinged spathe-valves, its more slender leaves, and its more densely tufted growth habit. The roots may be conspicuously, or only very moderately, thickened and fleshy.

28. **Sisyrinchium foliosum**, sp. nov.

Herba gracilis foliosa 15–35 cm. alta; radicibus fibrosis gracilibus haud carnosis; foliis gramineis flaccidis basalibus 1–3 dm. longis 1.5–2.5 mm. latis, quam caule saepe sublongioribus; caulibus nudis tantum folium terminale elongatum (inflorescentiam suffulcientem) proferentibus alatis 1–2 mm. latis; spathis 2–11 cm. longe pedunculatis ca. 2 cm. longis 1–5-floris; valvis subaequilongis vel exteriore longiore; ovario obovoideo glaberrimo spathas satis superante; corolla flava; tepalis 7–9 mm. longis 2–2.5 mm. latis 5-nervatis apice acutis attenuatis; filamentis connatis; tubo gracili ca. 2.6 mm. longo basim versus glandulis stipitatis dense obsito, alibi glaberrimo; antheris elongatis 1.2–1.5 mm. longis sessilibus; capsula late obovoidea 7–8 mm. longa ca. 6 mm. crassa.

BOLIVIA: Cord. de Altos, 1902, *Fiebrig 253a* (FM). ARGENTINA: Campo Formosa, Formosa, Oct. 1919, *Jorgensen 2299* (TYPE, Gray Herb.); Rio del Chamico, dept. Tafi, Tucuman, Sept. 1922, *Venturi 1901* (G, US); Siambon, dept. Tafi, Tucuman, Nov. 1925, *Venturi 3943* (G).

A very well marked species. From *S. pachyrhizum*, the other yellow-flowered species of this group found in northern Argentina, it is readily distinguished by its much weaker, perhaps annual, roots, its glabrous pedicels and ovary, its larger, longer capsules, and its much more elongated basal leaves. The species seem to be most closely related to *S. Lechleri Phil.* of southern Chile and Patagonia.

Unrecognized and Excluded Species

Sisyrinchium Burchellii Baker, Handb. Irid. 123 (1892).

Based upon *Burchell 5961* from Goyaz. The original description is inexcusably short and indefinite. The plant is described as having terete leafless stems 3–6.5 cm. tall, "ending in a single cluster, subtended by a small lanceolate bract." The spathe is 6 mm. long. The outer valve is oblong and has a "narrow white margin." This may possibly be a slender small form of *S. Luzula*.

Sisyrinchium congestum Klatt, Linnaea **31:** 98, 380 (1861–2), and in Martius, Fl. Bras. **3**(1)**:** 542 (1871); Baker, Handb. Irid. 132 (1892).

Type from southern Brazil, collected by Sellow (no. *2967*). According to Klatt *Sellow 1196* may also belong here. I have seen no material that I can associate with Klatt's description. Possibly a form of *S. commutatum* or perhaps even of *S. Wettsteinii* may be represented. This species has me completely puzzled.

Sisyrinchium Gilberti Kränzlin, Repert. Sp. Nov. **14:** 295 (1906).

Based on a specimen from the Rio Tapiraguay, Paraguay, *Hassler 4289*, and hence on one bearing the same number and data as the type of *S. hirsutum* Baker (cf. infra). The plant may be a form of *S. Hasslerianum* Baker or a nearly related species having broader leaves and stem.

Sisyrinchium hirsutum Baker, Bull. Herb. Boiss. II. **3:** 1106 (1905).

Based upon *Hassler 4289* from the Rio Tapiraguay, Paraguay. The data for this collection are the same as for that of the type of *S. Gilberti* Kränzlin. The description of *S. Gilberti* and *S. hirsutum* differ in many important details. Possibly this is the result of carelessness in the preparation of the diagnosis.

Sisyrinchium palmifolium L. Mant. **1:** 122 (1767).

Moraea palmifolia Thunb. Dis. Moraea 8 (1787).
Marica palmifolia Ker, Bot. Reg. **2:** sub tab. 229 (1817).
Glumosia palmifolia Herbert, Bot. Reg. **29:** Miscel. 85 (1843).

The original description given by Linnaeus is as follows, — "Palmifolium 2. SISYRINCHIUM foliis ensiformibus nervosis. Bermudiana palmae folio, radice bulbosa. *Plum. ic. 35. t. 46* ? *Habitat in* Brasilia. *D. Arduini.* Simillima *S. Bermudianae, sed* Caulis *bipedalis, etiam anceps.* Folia *duplo latiora nervis 5 a 6 exstantibus, complicata.* Glumae Floresque *numerosi in fasciculum terminalem, vix maiores Bermudianae.* Stylus *ultra medium trifidus.*"

It is to be noted that Linnaeus cites the plate of Plumier with a question mark. This plant is *Eleutherine bulbosa* (Mill.) Urban. Many authors have considered that the Linnaean name, *S. palmifolium*, should be associated with this Eleutherine. Klatt seems to have completely ignored the Linnaean binomial in his revision of the Iridaceae. Baker, Handb. Irid. 132 (1892), resurrected the name, *S. palmifolium* L., and applied it to the group of plants I have called *S. macrocephalum*, *S. nidulare* and *S. Wettsteinii*. This is probably correct, but a reexamination of the material from Arduino, preserved in the Linnaean Herbarium, is needed before the precise application of the name can be settled. Herbert, l. c., gave a few notes on the floral structure of the Linnaean type which seem to indicate that Baker properly applied the Linnaean binomial to the Brazilian group of species mentioned.

SISYRINCHIUM SPICATUM Seubert ex Klatt, Linnaea **31**: 377 (1862), and in Martius, Fl. Bras. **3**(1): 541 (1871).

This is *Orthrosanthus spicatus* (Seubert) Baker.

SISYRINCHIUM TRICHANTHUM Dusen, Arch. Mus. Nac. Rio Janeiro **13**: 67 (1903).

The type was collected by Dusen on the margin of the forest at about 2200 m. alt. on Mt. Itatiaya, Brazil. The description suggests a form of *S. Luzula*.

SISYRINCHIUM PUMILUM Larrañaga, Escritos **1**: 413 (1922).

SISYRINCHIUM RACEMOSUM Larrañaga, l. c. **2**: 210 (1923).

SISYRINCHIUM LATERIFLORUM Larrañaga, l. c. **2**: 211 (1923).

SISYRINCHIUM BIFLORUM Larrañaga, l. c. **2**: 211 (1923).

SISYRINCHIUM FLEXUOSUM Larrañaga, l. c. **2**: 211 (1923).

SISYRINCHIUM LANCEOLATUM Larrañaga, l. c. **2**: 211 (1923).

The above six Uruguayan species appear with short, very inadequate descriptions in the recently exhumed botanical works of Larrañaga. They should be discarded, since they never can be identified with precision. Any attempt to accept them can lead only to confusion and uncertainty in nomenclature.

SISYRINCHIUM AUREUM Vellozo, Icon. **9**: tab. 69 (1827) and Fl. Flum. ed. 2, 375 (1881).

SISYRINCHIUM COERULEUM Vellozo, Icon. **9**: tab. 66 (1827) and Fl. Flum. ed. 2, 374 (1881).

SISYRINCHIUM COMES (Vell.) Steudel, Nomencl. ed. 2, **2**: 596 (1841). *Souza Comes* Vellozo, Fl. Flum. 273 (1825) and Icon. **7**: tab. 2 (1827).

SISYRINCHIUM CRENATUM Vellozo, Icon. 9: tab. 67 (1827) and Fl. Flum. ed. 2, 375 (1881).

SISYRINCHIUM FLUMINENSE Vellozo, Icon. 9: tab. 68 (1827) and Fl. Flum. ed. 2, 375 (1881).

SISYRINCHIUM PROREGIA (Vell.) Steudel, Nomencl. ed. 2, 2: 596 (1841). *Souza Proregia* Vellozo, Fl. Flum. 274 (1825) and Icon. 7: tab. 3 (1827).

The above names apply to plants from the environs of Rio Janeiro or from beyond the coastal mountains in the state of Rio Janeiro. Most of the plants seem to be members of the Iridaceae, but none of them appear to belong to *Sisyrinchium*.

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THE BIOLOGY OF RUSTS OF THE GENUS UREDINOPSIS

J. H. FAULL

As PART of a contribution towards a monograph on *Uredinopsis* I have recently presented an account of its taxonomy and geographical distribution (4). The paper now offered is devoted, except for a short section on economic considerations, to topics on the biology of Uredinopsis rusts. These topics comprise (1) hosts, (2) life history studies, (3) developmental periods, (4) habits of spore production, (5) host restrictions.

I. HOSTS

Ferns and ferns only serve as hosts for the diploid generation of all known species of rusts belonging to the genus *Uredinopsis*. These are restricted to *Osmunda* of the family Osmundaceae and twelve genera of the family Polypodiaceae. The subfamilies and genera represented in the latter are as follows: WOODSIEAE — *Cystopteris, Matteuccia, Onoclea, Woodsia;* ASPIDIEAE — *Dryopteris;* ASPLENIEAE — *Athyrium, Blechnum, Woodwardia;* PTERIDEAE — *Adiantum, Cheilanthes, Pellaea, Pteridium.*

In view of the fact that *Uredinopsis*, partly because of its occurrence on ferns, is generally considered to be one of the most primitive of existing rust genera, the finding of a species on *Osmunda* would seem at first sight to be of peculiar interest, because the Osmundaceae on both historical and morphological grounds were evidently antecedent to the Polypodiaceae. But *Uredinopsis Osmundae*, the rust in question, exhibits some of the more specialized features of the genus and none that are uniquely generalized. Apparently it is less primitive than certain species on polypodiaceous hosts. Hence, there is no reason to believe that any particular phylogenetic significance attaches to the one known species of *Uredinopsis* on *Osmunda*.

Quite in contrast to the generally rather long-lived fronds of the ferns susceptible to Milesia rusts, those that serve as hosts for Uredinopsis rusts are strictly seasonal, dying at the end of their single growing period. This means that all their spore production must take place in the one season; there can be none in the following spring as is true for most species of *Milesia*. Compensation for this difference, however, is found in the

circumstance that many species of *Uredinopsis* are provided with uredial overwintering spores (*amphispores*) in addition to their ordinary urediospores, thus making possible the perpetuation of those species on their fern hosts alone without any intervening development of the haploid phase on alternate hosts.

Alternate hosts have been demonstrated for sixteen species of *Uredinopsis* and for many of these the experimentation has been satisfactorily complete. In every instance they have proved to be species of *Abies* and it is reasonable to assume that *Abies* is almost certainly the actual or potential alternate host for all species of *Uredinopsis*. So far two species only are known to occur outside the range of *Abies*, but quite possibly others may yet be added to the list — species at present undiscovered, or known species such *U. glabra*. Of the two species referred to, one of them, *U. macrosperma*, is almost cosmopolitan, following its fern hosts on the one hand to their northerly range and on the other hand reaching down through the tropics to the South Temperate Zone. Beyond the southern limits of *Abies* the growth habits of the fern hosts easily make possible an unbroken continuance of the diploid phase of the rust. The other, *U. Mayoriana*, is known from Colombia only, far removed from any existing species of *Abies*. Whether or not it originated there we do not know. But if it did *Abies* must at one time have grown in Colombia or an adjacent tropical area, or it is an evolution from the diploid phase of some other species of *Uredinopsis*, or, most improbable of all, it has an alternate host other than *Abies*. In his discussion of the same phenomenon pertaining to certain species of *Milesia*, Faull (2) expresses preference for the second hypothesis.

II. LIFE HISTORY STUDIES

The first successful studies of the life history of any rust fungus of the genus *Uredinopsis* were made by Fraser; the species studied was *U. mirabilis* (Peck) Magnus. Impressed by the prevalent field association of *Peridermium balsameum* Peck on *Abies balsamea* (L.) Mill. and *U. mirabilis* on *Onoclea sensibilis* L., Professor Fraser (5) made exploratory tests in the summer of 1911 to find out whether or not these might be the haploid and diploid phases, respectively, of the same species. He inoculated several pot-grown plants of *O. sensibilis* in a greenhouse with aeciospores of what appeared to be the appropriate *P. balsameum*. Infection resulted promptly; within 8 to 11 days the inoculated fronds bore mature uredia of *U. mirabilis*. The controls remained free from infection; but, as there was a possibility of contamination, a more exacting series of experiments (7) was carried out in the summer of 1913.

Overwintered teliospores of *U. mirabilis* were then used to inoculate pot-grown plants of *Abies balsamea*. Spermogonia were present 8 to 11 days later and aecia 16 to 18 days after inoculation. Some of the culturally produced aeciospores were sown next on *O. sensibilis* and various other ferns; infection resulted on *O. sensibilis* but the others proved to be immune. This work rounded out Fraser's study of the life history of *U. mirabilis;* and in addition to demonstrating its host relationships, the experiment gave clear indication according to Fraser that "*Uredinopsis mirabilis* is a distinct species." Meanwhile, in the intervening year, Fraser (6) tested four recognized species of *Uredinopsis* by inoculating *Abies balsamea* with their overwintered teliospores, as follows: (1) *U. Struthiopteridis* Störmer from *Matteuccia Struthiopteris* (L.) Todaro; (2) *U. Osmundae* Magnus from *Osmunda Claytoniana* L.; (3) *U. mirabilis* (Peck) Magnus from *Onoclea sensibilis* L.; (4) *U. Phegopteridis* Arthur from *Dryopteris Linnaeana* C. Chr. In each case infection resulted, the aecia being those of what apparently answered to Peck's *Peridermium balsameum*. Fraser also inoculated *Dryopteris Thelypteris* var. *pubescens* (Lawson) A. R. Prince with aeciospores of the "*Peridermium balsameum*" which field associations indicated to be those of *U. Atkinsonii*. A meager infection occurred on one of the three plants used for the experiment and none on the others.

Two other contributions on the life histories of Uredinopsis rusts quickly followed, one by Klebahn (12) on *U. Struthiopteridis* in Europe, and the other by Weir and Hubert (14) on *U. macrosperma* in western North America. Using telial material from *Matteuccia Struthiopteris*, Klebahn obtained abundant infection on *Abies alba* Mill. Then sowing the culturally produced aeciospores back to *M. Struthiopteris*, infection followed accompanied with a profuse crop of ordinary uredia. By other suitable experiments Klebahn correctly interpreted for the first time the nature of amphispores.

Weir and Hubert's investigation of the life history of *Uredinopsis macrosperma*, though fragmentary, was significant. The inoculum used consisted of aeciospores from second year needles of *Abies grandis* Lindl. and was collected at Priest River, Idaho in the neighborhood of bracken ferns heavily rusted with *U. macrosperma*. The cultures were conducted on two potted plants of *Pteridium aquilinum* var. *lanuginosum* (Bong.) Fernald in a greenhouse at Missoula, Montana. Infection resulted on one of the ferns and the urediospores proved to be those of *U. macrosperma*. Obviously their work should be repeated and extended, but the results of their experiment lead to the reasonable conclusion that *U. macrosperma* alternates between *Pteridium* and *Abies*. I have had the

opportunity of examining part of their unused inoculum and also uredia from the rusted fronds of their experimental fern. The former unquestionably corresponds to *Peridermium pseudo-balsameum* (D. & H.) Arthur & Kern and the latter to the uredial fructifications of *U. macrosperma.*

The remaining studies on the life histories of Uredinopsis rusts recorded in the literature we owe to the excellent work of Kamei (8, 9) in Japan. Beginning with telial materials he has cultured the following species as indicated: (1) *Uredinopsis Kameiana* Faull from *Pteridium aquilinum* var. *japonicum* Nakai to *Abies Mayriana* Miyabe & Kudô and then back to the fern host; (2) *U. Woodsiae* Kamei from *Woodsia polystichoides* var. *nudiuscula* Hook. to *Abies Mayriana;* (3) *U. Athyrii* Kamei to *Abies Mayriana;* (4) *U. hirosakiensis* Kamei & Hirat. f. from *Dryopteris Thelypteris* var. *pubescens* (Lawson) A. R. Prince to *Abies Mayriana;* (5) *U. intermedia* Kamei from *Athyrium thelypteroides* (Michx.) Desv. and *A. pterorachis* Christ to *Abies Mayriana;* (6) *U. ossaeiformis* Kamei from *Dryopteris dilatata* var. *oblonga* Takeda, and *D. monticola* (Mak.) C. Chr. to *Abies Mayriana, A. firma* Sieb. & Zucc. and *A. sachalinensis* (Schm.) Mast.; (7) *U. filicina* (Niessl) Magnus from *Dryopteris Phegopteris* (L.) C. Chr. to *Abies Mayriana.*

My own researches have been concerned with six species of *Uredinopsis,* namely, (1) *U. longimucronata* Faull from *Athyrium angustum* (Willd.) Presl, (2) *U. Osmundae* Magnus from *Osmunda cinnamomea* L., *O. Claytoniana* L. and *O. regalis* var. *spectabilis* (Willd.) A. Gray, (3) *U. mirabilis* (Peck) Magnus from *Onoclea sensibilis* L., (4) *U. Phegopteridis* Arthur from *Dryopteris Linnaeana* C. Chr., (5) *U. Struthiopteridis* Störmer from *Matteuccia Struthiopteris* (L.) Todaro, (6) *U. ceratophora* Faull from *Cystopteris bulbifera* (L.) Bernh. The experiments were conducted at the University of Toronto Field Laboratory of Forest Pathology at Bear Island, Lake Timagami, Timagami Forest Reserve, Ontario, and the work was completed at the Arnold Arboretum, Harvard University, Jamaica Plain, Massachusetts. In the former locality all of the rusts mentioned, except *U. ceratophora,* are readily obtainable in ample quantities on their respective fern hosts; and the coniferous host, *Abies balsamea,* abounds there. Teliosporic material of *U. ceratophora* was collected by Dr. Lillian M. Hunter at Bradford, Ontario, where it seems to be frequent.

Studies on each of the species began with the telial stage. Teliosporic material was collected in the fall; part of it was overwintered in net bags out of doors, and part, slightly moistened occasionally, in a refrigerator in the laboratory. At the time the new needles of *Abies* were expanding

overwintered fronds bearing teliospores were brought into the laboratory, and, so as to force spore germination, they were placed between folds of wet paper or laid on damp sphagnum moss in large loosely covered cans. Small test pieces were also kept under moist conditions in Petri dishes to afford greater ease of observation. Close watch was kept for the emergence of basidia and the first formation of basidiospores. As soon as basidiospores were freely appearing the material was ready for making inoculations. In setting up an experiment a portion of a frond carrying inoculum was either laid, abaxial surface down, directly on the foliage of a small branch of the host to be inoculated, or it was first prepared for easier handling and greater economy in use by laying it between two strips of galvanized wire netting, separated from the upper strip by a piece of wet absorbent paper. The chosen branch by way of its preparation was sprayed with water from an atomizer and so flexed that its lower face would come in juxtaposition with the basidial-bearing face of the piece of frond. A celluloid cylinder about six inches long by two inches in diameter (E. E. Hubert — Celluloid cylinders for inoculation chambers. Phytopath. **6:** 447–450. 1916) plugged at one end with wet sphagnum was then slipped over the branch and its adjustment completed by packing its proximal end around the branch in its axis with wet sphagnum. Whenever necessary the branch was propped to keep it as nearly as possible in a horizontal position until the tube was finally removed some days later. The experiment was visited daily as long as the tube was in use, and the sphagnum plugs were kept wet by the addition of water as needed. Similar technique was employed in subsequent inoculations of ferns except that in some instances the inoculum consisted of a suspension of spores in water which was sprayed on the fronds.

Summaries of the experiments are recorded below in Tables 1 to 22. The following data, where pertinent, constitute a part of each table:

(1) The cultures were made under properly controlled conditions.

(2) All controls (unless otherwise stated) remained free from infection.

(3) Infections on *Abies* resulted on needles of the current season only.

(4) Inoculations on *Abies* were made soon after the unfolding of the new needles.

(5) Detailed data of the experiments, in tabular form, are filed in the J. H. Faull Herbarium.

(6) Representative culture materials of the positive experiments are filed in the J. H. Faull Herbarium under the numbers indicated in the Tables.

1. **Uredinopsis Struthiopteridis** Störmer

Uredinopsis Struthiopteridis occurs in both hemispheres throughout the range of its fern host, *Matteuccia Struthiopteris* (L.) Todaro. In America Fraser (6) demonstrated by cultures that it can be carried over to *Abies balsamea.* Conversely, he secured infection on the fern host by sowing aeciospores from the balsam fir "collected beside ferns of *Onoclea Struthiopteris* that were badly rusted the previous season." Other sowings of aeciospores from the same source were made on *Onoclea sensibilis, Dryopteris Linnaeana* and *Osmunda Claytoniana;* but the results were negative. In Europe Klebahn (12) similarly demonstrated that *U. Struthiopteridis* can be cultured on *Abies alba.* Then, by using the culturally produced aeciospores as inoculum, he carried it back to the fern host. He also obtained infection of the fern by inoculating it with the amphispores of *U. Struthiopteridis.* Finally in Japan, Kamei (10) was successful in culturing *U. Struthiopteridis* on *Abies Mayriana.*

Summaries of my own experiments are recorded in Tables 1 and 2. They were fully confirmatory and at the same time they served the purpose of providing necessary comparative materials. As an important part of the work, culture tests were made on *Athyrium angustum* (Willd.) Presl, *Dryopteris Linnaeana* C. Chr., *Onoclea sensibilis* L. and *Osmunda Claytoniana* L. These were shown to be immune to *U. Struthiopteridis.*

TABLE 1.

CULTURES OF UREDINOPSIS STRUTHIOPTERIDIS FROM MATTEUCCIA STRUTHIOPTERIS TO ABIES BALSAMEA

1. *Fifty-four inoculation experiments* were made; forty-nine gave *positive* results.
2. The dates of inoculation ranged from June 20 to July 7.
3. Yellowing of the needles appeared 9 to 11 days after inoculation. *The average was 10 days.*
4. The spermogonia were first observed 10 to 15 days after inoculation. *The average was 12 days.*
5. The peridermia were first observed 19 to 24 days after inoculation. *The average was 21 days.*
6. The peridermia usually began to rupture the day following their first appearance.
7. The production of peridermia was practically completed within 30 days after inoculation. *The average was about 26 days.*
8. The number of infected needles with peridermia varied from 2 to 162. *The average was 37.*
9. J. H. Faull Herbarium nos. 7732–7743 and 8486.

TABLE 2.

CULTURES OF UREDINOPSIS STRUTHIOPTERIDIS FROM ABIES BALSAMEA TO VARIOUS FERNS, USING AS INOCULUM AECIOSPORES CULTURALLY PRODUCED IN THE EXPERIMENTS RECORDED IN TABLE 1.

A. *From Abies balsamea to Matteuccia Struthiopteris*

1. *Six inoculation experiments* were made; all gave *positive* results.
2. The dates of inoculation ranged from July 14 to July 28.
3. Mature uredia were first observed 10 to 11 days after inoculation.
4. The experiments were harvested 13 to 28 days after inoculation. *The average was 17 days.*
5. The approximate number of uredia present at the time of harvesting varied from 60 to 200. *The average was 138.*
6. J. H. Faull Herbarium nos. *7744–7747.*

B. *From Abies balsamea to Athyrium angustum*

1. *Six inoculation experiments* were made; all gave *negative* results.
2. The dates of inoculation ranged from July 18 to July 27.
3. The experiments were harvested about 30 days after inoculation.

C. *From Abies balsamea to Dryopteris Linnaeana*

1. *Six inoculation experiments* were made; all gave *negative* results.
2. The dates of inoculation ranged from July 15 to July 25.
3. The experiments were harvested about 31 days after inoculation.

D. *From Abies balsamea to Onoclea sensibilis*

1. *Six inoculation experiments* were made; all gave *negative* results.
2. The dates of inoculation ranged from July 15 to July 23.
3. The experiments were harvested about 32 days after inoculation.

E. *From Abies balsamea to Osmunda Claytoniana*

1. *Six inoculation experiments* were made; all gave *negative* results.
2. The dates of inoculation ranged from July 22 to July 24.
3. The experiments were harvested about 30 days after inoculation.

2. **Uredinopsis mirabilis** (Peck) Magnus

Uredinopsis mirabilis has been collected throughout almost the entire range of *Onoclea sensibilis* L. in North America, and is very common on that host. It has also been found on *O. sensibilis* forma *obtusilobata* (Schk.) Gilbert. It is of further interest to note that a collection was made on *O. sensibilis* in a garden near London, England, where presumably it has been introduced along with its host. *Onoclea sensibilis*

is recognized as occurring naturally in eastern Asia; but so far there are no records of the rust from that part of the world.

Fraser's demonstrations (5, 6, 7) that *U. mirabilis* alternates between *Abies balsamea* and *Onoclea sensibilis* were complete. He also made an important contribution by showing that *U. mirabilis* apparently does not infect *Athyrium angustum, Dryopteris Linnaeana, D. Thelypteris* var. *pubescens, Osmunda Claytoniana* nor *O. regalis* var. *spectabilis.*

My own culture experiments, summaries of which are recorded in Tables 3 and 4, entirely confirm Fraser's findings on the life history of *U. mirabilis.* They have likewise shown that it does not cause infection of *Athyrium angustum* (Willd.) Presl, *Dryopteris Linnaeana* C. Chr., *Matteuccia Struthiopteris* (L.) Todaro, *Osmunda Claytoniana* L.

TABLE 3.

CULTURES OF UREDINOPSIS MIRABILIS
FROM ONOCLEA SENSIBILIS TO ABIES BALSAMEA

1. *Forty-four inoculation experiments* were made; thirty-nine gave *positive* results.
2. The dates of inoculation ranged from June 19 to July 7.
3. Yellowing of the needles appeared 9 to 16 days after inoculation. *The average was 12 days.*
4. The spermogonia were first observed 10 to 15 days after inoculation. *The average was 12 days.*
5. The peridermia were first observed 21 to 28 days after inoculation. *The average was 23 days.*
6. The peridermia usually began to rupture the second day following their first appearance.
7. The production of peridermia was practically completed within 40 days after inoculation. *The average was 32 days.*
8. The number of infected needles with peridermia varied from 1 to 91. *The average was 27.*
9. J. H. Faull Herbarium nos. 7696–7706 and 8494–8496.

TABLE 4.

CULTURES OF UREDINOPSIS MIRABILIS
FROM ABIES BALSAMEA TO VARIOUS FERNS, USING AS INOCULUM AECIOSPORES CULTURALLY PRODUCED IN THE EXPERIMENTS RECORDED IN TABLE 3.

A. *From Abies balsamea to Onoclea sensibilis*

1. *Six inoculation experiments* were made; all gave *positive* results.
2. The dates of inoculation ranged from July 18 to July 31.
3. The uredia were first observed 8 to 9 days after inoculation.

4. The experiments were harvested 9 to 13 days after inoculation. *The average was 11 days.*
5. The approximate number of uredia present at the time of harvesting varied from 200 to 500. *The average was 350.*
6. J. H. Faull Herbarium nos. 7707–7712.

B. *From Abies balsamea to Athyrium angustum*

1. *Four inoculation experiments* were made; all gave *negative* results.
2. The dates of inoculation ranged from July 23 to July 29.
3. The experiments were harvested about 29 days after inoculation.

C. *From Abies balsamea to Dryopteris Linnaeana*

1. *Two inoculation experiments* were made; both gave *negative* results.
2. The dates of inoculation ranged from July 25 to July 29.
3. The experiments were harvested about 27 days after inoculation.

D. *From Abies balsamea to Matteuccia Struthiopteris*

1. *Five inoculation experiments* were made; all gave *negative* results.
2. The dates of inoculation ranged from July 18 to July 31.
3. The experiments were harvested about 29 days after inoculation.

E. *From Abies balsamea to Osmunda Claytoniana*

1. *Three inoculation experiments* were made; all gave *negative* results.
2. The dates of inoculation ranged from July 18 to July 25.
3. The experiments were harvested about 30 days after inoculation.

3. **Uredinopsis longimucronata** Faull.

Uredinopsis longimucronata has its diploid phase on *Athyrium angustum* (Willd.) Presl. Heretofore this rust has passed under the name *U. Atkinsonii* Magnus, a rust described from *Dryopteris Thelypteris* var. *pubescens* (Lawson) A. R. Prince. Faull (3), however, has decided that *U. longimucronata* is distinct from *U. Atkinsonii* because there are fairly constant, though small, morphological distinctions between the two rusts, and because efforts have failed to secure infection of *D. Thelypteris* var. *pubescens* through the use of culturally produced aeciospores of *U. longimucronata* as inoculum. In any case, whatever may be the fate of *U. longimucronata* at the hands of taxonomists, this is the first time that it has been made the subject of life history investigation. It has been successfully carried from *Athyrium angustum* to *Abies balsamea* and then back to *A. angustum*. On the latter, both ordinary urediospores and teliospores were formed. Tests have also shown that it does not cause infection of *Cystopteris bulbifera* (L.)

Bernh., *C. fragilis* (L.) Bernh. *Dryopteris Linnaeana* C. Chr., *D. Thelypteris* var. *pubescens* (Lawson) A. R. Prince, *Matteuccia Struthiopteris* (L.) Todaro, *Onoclea sensibilis* L., *Osmunda Claytoniana* L. Summaries of the experiments are recorded in Tables 5 and 6.

TABLE 5.

CULTURES OF UREDINOPSIS LONGIMUCRONATA FROM ATHYRIUM ANGUSTUM TO ABIES BALSAMEA

1. *Sixty inoculation experiments* were made; fifty-three gave *positive* results.
2. The dates of inoculation ranged from June 10 to July 6.
3. Yellowing of the needles appeared 9 to 17 days after inoculation. *The average was 11 days.*
4. The spermogonia were first observed 9 to 18 days after inoculation. *The average was 12 days.*
5. The peridermia were first observed 17 to 25 days after inoculation. *The average was 20 days.*
6. The peridermia usually began to rupture the second day following their first appearance.
7. The production of the peridermia was practically completed within 41 days after inoculation. *The average was about 30 days.*
8. The number of infected needles with peridermia varied from 1 to 143. *The average was 52.*
9. J. H. Faull Herbarium nos. 7751–7753 and 8472–8481.

TABLE 6.

CULTURES OF UREDINOPSIS LONGIMUCRONATA FROM ABIES BALSAMEA TO VARIOUS FERNS, USING AS INOCULUM AECIOSPORES CULTURALLY PRODUCED IN THE EXPERIMENTS RECORDED IN TABLE 5.

A. *From Abies balsamea to Athyrium angustum*

1. *Eleven inoculation experiments* were made; all gave *positive* results.
2. The dates of inoculation ranged from July 9 to July 21.
3. Mature uredia were first observed 16 to 30 days after inoculation. *The average was 23 days.*
4. The experiments were harvested 22 to 34 days after inoculation. *The average was 28 days.*
5. The approximate number of uredia present at the time of harvesting varied from 0 to 450. *The average was 88.* In one experiment uredia were absent but telia were present.
6. J. H. Faull Herbarium nos. 7754 and 8482–8485.

B. *From Abies balsamea to Cystopteris bulbifera*

1. *Two inoculation experiments* were made; both gave *negative* results.
2. The date of inoculation was July 12.
3. The experiments were harvested 50 days after inoculation.

C. *From Abies balsamea to Cystopteris fragilis*

1. *One inoculation experiment* was made; it gave *negative* results.
2. The date of inoculation was July 12.
3. The experiment was harvested 50 days after inoculation.

D. *From Abies balsamea to Dryopteris Linnaeana*

1. *Seven inoculation experiments* were made; all gave *negative* results.
2. The dates of inoculation ranged from July 9 to July 18.
3. The experiments were harvested 30 to 50 days after inoculation.

E. *From Abies balsamea to Dryopteris Thelypteris var. pubescens*

1. *Four inoculation experiments* were made; all gave *negative* results.
2. The dates of inoculation ranged from July 12 to July 21.
3. The experiments were harvested 44 to 53 days after inoculation.

F. *From Abies balsamea to Matteuccia Struthiopteris*

1. *Four inoculation experiments* were made; all gave *negative* results.
2. The dates of inoculation ranged from July 11 to July 21.
3. The experiments were harvested 48 to 51 days after inoculation.

G. *From Abies balsamea to Onoclea sensibilis*

1. *Five inoculation experiments* were made; all gave *negative* results.
2. The dates of inoculation ranged from July 9 to July 21.
3. The experiments were harvested 27 to 51 days after inoculation.

H. *From Abies balsamea to Osmunda Claytoniana*

1. *Seven inoculation experiments* were made; all gave *negative* results.
2. The dates of inoculation ranged from July 7 to July 18.
3. The experiments were harvested 36 to 51 days after inoculation.

4. **Uredinopsis Phegopteridis** Arthur

Fraser (6) included *Uredinopsis Phegopteridis* in his life history studies of *Uredinopsis*, although his work on that species was fragmentary. He suspended teliosporic material "in the usual way" above *Abies balsamea* and a meager infection followed — "about twenty of the young leaves bearing aecia." Fraser's work has been repeated here and the experimentation extended to include reverse inoculations on the fern host with the culturally produced aeciospores and also tests on the

resistance of several other ferns. In the experiments, as summarized in Tables 7 and 8, abundant crops of aecia resulted from inoculations on *Abies balsamea;* and on sowing the aeciospores back on *Dryopteris Linnaeana* C. Chr., profuse crops of uredia developed within a surprisingly short time. Cultures also showed that the following ferns are immune to *U. Phegopteridis* — *Athyrium angustum* (Willd.) Presl, *Matteuccia Struthiopteris* (L.) Todaro, *Onoclea sensibilis* L., *Osmunda Claytoniana* L.

TABLE 7.

CULTURES OF UREDINOPSIS PHEGOPTERIDIS
FROM DRYOPTERIS LINNAEANA TO ABIES BALSAMEA

1. *Seventeen inoculation experiments* were made; fourteen gave *positive* results.
2. The dates of inoculation ranged from June 14 to July 2.
3. Yellowing of the needles appeared 10 to 15 days after inoculation. *The average was 12 days.*
4. The spermogonia were first observed 11 to 15 days after inoculation. *The average was 13 days.*
5. The peridermia were first observed 21 to 23 days after inoculation. *The average was 23 days.*
6. The peridermia usually began to rupture the second day following their first appearance.
7. The production of peridermia was practically completed within 35 days after inoculation. *The average was about 28 days.*
8. The number of infected needles with peridermia varied from 8 to 72. *The average was 34.*
9. J. H. Faull Herbarium nos. 7748 and 8488–8493.

TABLE 8.

CULTURES OF UREDINOPSIS PHEGOPTERIDIS
FROM ABIES BALSAMEA TO VARIOUS FERNS, USING AS INOCULUM AECIOSPORES CULTURALLY PRODUCED IN THE EXPERIMENTS RECORDED IN TABLE 7.

A. *From Abies balsamea to Dryopteris Linnaeana*

1. *Three inoculation experiments* were made; all gave *positive* results.
2. The dates of inoculation ranged from July 26 to July 31.
3. Mature uredia were first observed 7 to 8 days after inoculation.
4. The experiments were harvested 7 to 12 days after inoculation.
5. The approximate number of uredia present at the time of harvesting varied from 100 to 375.
6. J. H. Faull Herbarium nos. 7749–7750.

B. *From Abies balsamea to Athyrium angustum*

1. *Three inoculation experiments* were made; all gave *negative* results.
2. The dates of inoculation ranged from July 27 to July 31.
3. The experiments were harvested 23 to 27 days after inoculation.

C. *From Abies balsamea to Matteuccia Struthiopteris*

1. *Four inoculation experiments* were made; all gave *negative* results.
2. The dates of inoculation ranged from July 26 to July 31.
3. The experiments were harvested 23 to 28 days after inoculation.

D. *From Abies balsamea to Onoclea sensibilis*

1. *Three inoculation experiments* were made; all gave *negative* results.
2. The dates of inoculation ranged from July 26 to July 30.
3. The experiments were harvested 24 to 28 days after inoculation.

E. *From Abies balsamea to Osmunda Claytoniana*

1. *Two inoculation experiments* were made; both gave *negative* results.
2. The date of inoculation was July 27.
3. The experiments were harvested 27 days after inoculation.

5. **Uredinopsis Osmundae** Magnus

Uredinopsis Osmundae is known to occur in North America only. All three of the species of *Osmunda* growing in that part of the world, namely, *O. cinnamomea* L., *O. Claytoniana* L. and *O. regalis* var. *spectabilis* (Willd.) A. Gray, are susceptible to *U. Osmundae*. It is of interest to note that *U. Osmundae* has never been reported from Europe or Asia, although *O. regalis* L. is widely distributed in each of those continents.

Fraser (6) included *Uredinopsis Osmundae* in his life history studies of *Uredinopsis*. His efforts were restricted to carrying it over from *O. Claytoniana* to *Abies balsamea*, and in that he was successful. Fraser's work has been repeated here and extended to a comprehensive life history investigation of the rust in three series, each beginning with the rust from a different one of its three known fern hosts. For example, in one series overwintered telial material from *O. cinnamomea* was used in inoculating *Abies balsamea*. Next, the culturally produced aeciospores were sown on fronds of each of the three species of *Osmunda* mentioned above. Then the culturally produced urediospores from each of the fern species of these experiments were used to inoculate the other two species of *Osmunda*. Finally tests were made on fern species other than those of

Osmunda. The same program was followed in the two other series. Summaries of the experiments are recorded in Tables 9 to 21.

The main findings of the investigations are as follows:

(a) *Uredinopsis Osmundae* from *Osmunda cinnamomea, O. Claytoniana* and *O. regalis* var. *spectabilis* has *Abies balsamea* as an alternate host.

(b) Morphologically no distinctions are recognizable that can be correlated with the fern host origins of the rust. Throughout, on that basis, the rust is *U. Osmundae* Magnus.

(c) Some differences in developmental periods exist according to the fern origins of the rust and the ferns on which it is cultured. In certain instances these point to the existence of different biological strains; but more often they seem to indicate different degrees of host resistance.

(d) There are at least two biological strains of *U. Osmundae*. One of them is capable of causing infection of all three species of *Osmunda*. A second one infects *O. Claytoniana* and *O. regalis* var. *spectabilis*, but not *O. cinnamomea*.

(e) The following ferns are immune to *Uredinopsis Osmundae* — *Athyrium angustum* (Willd.) Presl, *Dryopteris Linnaeana* C. Chr., *Matteuccia Struthiopteris* (L.) Todaro, *Onoclea sensibilis* L.

TABLE 9.

CULTURES OF UREDINOPSIS OSMUNDAE
FROM OSMUNDA CLAYTONIANA TO ABIES BALSAMEA

1. *Forty-eight inoculation experiments* were made; forty-six gave *positive* results.
2. The dates of inoculation ranged from June 10 to July 1.
3. Yellowing of the needles appeared 10 to 14 days after inoculation. *The average was 12 days.*
4. The spermogonia were first observed 11 to 17 days after inoculation. *The average was 14 days.*
5. The peridermia were first observed 21 to 26 days after inoculation. *The average was 23 days.*
6. The peridermia usually began to rupture one to two days following their first appearance.
7. The production of peridermia was practically completed within 47 days after inoculation. *The average was about 30 days.*
8. The number of infected needles with peridermia varied from 0 to 157. *The average was 58.* One infection only produced no peridermia.
9. J. H. Faull Herbarium nos. 7713–7721 and 8430–8431.

TABLE 10.

CULTURES OF UREDINOPSIS OSMUNDAE (OF OSMUNDA CLAYTONIANA ORIGIN) FROM ABIES BALSAMEA TO VARIOUS FERNS, USING AS INOCULUM AECIOSPORES CULTURALLY PRODUCED IN THE EXPERIMENTS RECORDED IN TABLE 9.

A. *From Abies balsamea to Osmunda Claytoniana*

1. *Ten inoculation experiments* were made; all gave *positive* results.
2. The dates of inoculation ranged from July 8 to July 29.
3. Mature uredia were first observed 8 to 12 days after inoculation.
4. The experiments were harvested 11 to 19 days after inoculation. *The average was 15 days.*
5. The approximate number of uredia present at the time of harvesting varied from 150 to 1100. *The average was 390.*
6. J. H. Faull Herbarium nos. *7722–7724.*

B. *From Abies balsamea to Osmunda regalis var. spectabilis*

1. *Nine inoculation experiments* were made; all gave *positive* results.
2. The dates of inoculation ranged from July 8 to July 29.
3. Mature uredia were first observed 10 to 17 days after inoculation.
4. The experiments were harvested 16 to 32 days after inoculation. *The average was 20 days.*
5. The approximate number of uredia present at the time of harvesting varied from 10 to 450. *The average was 185.*
6. J. H. Faull Herbarium nos. *7726–7728* and 8432–8433.

C. *From Abies balsamea to Osmunda cinnamomea*

1. *Ten inoculation experiments* were made; all gave *negative* results.
2. The dates of inoculation ranged from July 8 to July 29.
3. The experiments were harvested about 40 days after inoculation.

D. *From Abies balsamea to Athyrium angustum*

1. *Three inoculation experiments* were made; all gave *negative* results.
2. The dates of inoculation ranged from July 20 to July 25.
3. The experiments were harvested 29 to 33 days after inoculation.

E. *From Abies balsamea to Dryopteris Linnaeana*

1. *Four inoculation experiments* were made; all gave *negative* results.
2. The dates of inoculation ranged from July 16 to July 28.
3. The experiments were harvested 26 to 33 days after inoculation.

F. *From Abies balsamea to Matteuccia Struthiopteris*

1. *Four inoculation experiments* were made; all gave *negative* results.

2. The dates of inoculation ranged from July 17 to July 29.
3. The experiments were harvested 25 to 30 days after inoculation.

G. *From Abies balsamea to Onoclea sensibilis*

1. *Four inoculation experiments* were made; all gave *negative* results.
2. The dates of inoculation ranged from July 17 to July 28.
3. The experiments were harvested 26 to 33 days after inoculation.

TABLE 11.

CULTURES OF UREDINOPSIS OSMUNDAE (OF OSMUNDA CLAYTONIANA ORIGIN) FROM OSMUNDA CLAYTONIANA TO VARIOUS FERNS, USING AS INOCULUM UREDIOSPORES CULTURALLY PRODUCED IN THE EXPERIMENTS RECORDED IN TABLE 10 (A).

A. *From Osmunda Claytoniana to Osmunda Claytoniana*

1. *Three inoculation experiments* were made; all gave *positive* results. One control was slightly infected.
2. The dates of inoculation ranged from July 25 to July 31.
3. Mature uredia were first observed 8 to 12 days after inoculation.
4. The experiments were harvested 11 to 12 days after inoculation.
5. The approximate number of uredia present at the time of harvesting varied from 300 to 1400. *The average was 700.*
6. J. H. Faull Herbarium nos. 7725 and 8434–8435.

B. *From Osmunda Claytoniana to Osmunda regalis var. spectabilis*

1. *Four inoculation experiments* were made; all gave *positive* results.
2. The dates of inoculation ranged from July 25 to July 31.
3. Mature uredia were first observed 9 to 12 days after inoculation.
4. The experiments were harvested 13 to 17 days after inoculation.
5. The approximate number of uredia present at the time of harvesting varied from 90 to 700. *The average was 302.*
6. J. H. Faull Herbarium nos. 7729–7730 and 8432–8433.

C. *From Osmunda Claytoniana to Osmunda cinnamomea*

1. *Four inoculation experiments* were made; all gave *negative* results.
2. The dates of inoculation ranged from July 25 to July 31.
3. The experiments were harvested 22 to 38 days after inoculation.

TABLE 12.

CULTURES OF UREDINOPSIS OSMUNDAE (OF OSMUNDA CLAYTONIANA ORIGIN) FROM OSMUNDA REGALIS VAR. SPECTABILIS TO VARIOUS FERNS, USING AS INOCULUM UREDIOSPORES CULTURALLY PRODUCED IN THE EXPERIMENTS RECORDED IN TABLE 10 (B).

A. *From Osmunda regalis var. spectabilis to Osmunda Claytoniana*

1. *One inoculation experiment* was made; it gave *positive* results.
2. The date of inoculation was July 24.
3. Mature uredia were first observed 12 days after inoculation.
4. The experiment was harvested 13 days after inoculation.
5. The approximate number of uredia present at the time of harvesting was 1000.
6. J. H. Faull Herbarium no. 8438.

B. *From Osmunda regalis var. spectabilis to Osmunda regalis var. spectabilis*

1. *One inoculation experiment* was made; it gave *positive* results.
2. The date of inoculation was July 24.
3. Mature uredia were first observed 12 days after inoculation.
4. The experiment was harvested 15 days after inoculation.
5. The approximate number of uredia present at the time of harvesting was 250.
6. J. H. Faull Herbarium no. 8439.

C. *From Osmunda regalis var. spectabilis to Osmunda cinnamomea*

1. *Two inoculation experiments* were made; both gave *negative* results.
2. The date of inoculation was July 24.
3. The experiments were harvested 35 days after inoculation.

TABLE 13.

CULTURES OF UREDINOPSIS OSMUNDAE FROM OSMUNDA REGALIS VAR. SPECTABILIS TO ABIES BALSAMEA

1. *Twenty-five inoculation experiments* were made; all gave *positive* results.
2. The dates of inoculation ranged from June 13 to June 23.
3. Yellowing of the needles appeared 10 to 14 days after inoculation. *The average was 12 days.*
4. The spermogonia were first observed 11 to 16 days after inoculation. *The average was 13 days.*
5. The peridermia were first observed 20 to 26 days after inoculation. *The average was 23 days.*
6. The peridermia usually began to rupture the first or second day following their first appearance.
7. The production of peridermia was practically completed within 33 days after inoculation. *The average was about 28 days.*

8. The number of infected needles with peridermia varied from 1 to 78. *The average was 24.*
9. J. H. Faull Herbarium nos. 8440–8441.

TABLE 14.

CULTURES OF UREDINOPSIS OSMUNDAE (OF OSMUNDA REGALIS VAR. SPECTABILIS ORIGIN) FROM ABIES BALSAMEA TO VARIOUS FERNS, USING AS INOCULUM AECIOSPORES CULTURALLY PRODUCED IN THE EXPERIMENTS RECORDED IN TABLE 13.

A. *From Abies balsamea to Osmunda regalis var. spectabilis*

1. *Five inoculation experiments* were made; all gave *positive* results.
2. The dates of inoculation ranged from July 14 to July 20.
3. Mature uredia were first observed 9 to 13 days after inoculation.
4. The experiments were harvested 15 to 17 days after inoculation. *The average was 16 days.*
5. The approximate number of uredia present at the time of harvesting varied from 100 to 1100. *The average was 530.*

B. *From Abies balsamea to Osmunda Claytoniana*

1. *Five inoculation experiments* were made; all gave *positive* results. One control showed slight infection.
2. The dates of inoculation ranged from July 16 to July 20.
3. Mature uredia were first observed 10 to 11 days after inoculation.
4. The experiments were harvested 13 to 15 days after inoculation. *The average was 14 days.*
5. The approximate number of uredia present at the time of harvesting varied from 130 to 1000. *The average was 436.*

C. *From Abies balsamea to Osmunda cinnamomea*

1. *Six inoculation experiments* were made; all gave *negative* results.
2. The dates of inoculation ranged from July 14 to July 20.
3. The experiments were harvested about 40 to 43 days after inoculation.

TABLE 15.

CULTURES OF UREDINOPSIS OSMUNDAE (OF OSMUNDA REGALIS VAR. SPECTABILIS ORIGIN) FROM OSMUNDA REGALIS VAR. SPECTABILIS TO VARIOUS FERNS, USING AS INOCULUM UREDIOSPORES CULTURALLY PRODUCED IN THE EXPERIMENTS RECORDED IN TABLE 14 (A).

A. *From Osmunda regalis var. spectabilis to Osmunda regalis var. spectabilis*

1. *Two inoculation experiments* were made; both gave *positive* results.
2. The dates of inoculation were July 31 and August 5.

3. Mature uredia were first observed 12 and 14 days after inoculation.
4. The experiments were harvested 13 and 16 days after inoculation.
5. The approximate numbers of uredia present at the time of harvesting were 65 and 550.
6. J. H. Faull Herbarium nos. 8442–8443.

B. *From Osmunda regalis var. spectabilis to Osmunda Claytoniana*

1. *Two inoculation experiments* were made; both gave *positive* results.
2. The dates of inoculation were July 31 and August 5.
3. Mature uredia were first observed 12 days after inoculation.
4. The experiments were harvested 14 and 19 days after inoculation.
5. The approximate numbers of uredia present at the time of harvesting were 250 and 400.
6. J. H. Faull Herbarium nos. 8444–8445.

C. *From Osmunda regalis var. spectabilis to Osmunda cinnamomea*

1. *Three inoculation experiments* were made; all gave *negative* results.
2. The dates of inoculation ranged from July 31 to August 5.
3. The experiments were harvested 31 to 32 days after inoculation.

TABLE 16.

CULTURES OF UREDINOPSIS OSMUNDAE (OF OSMUNDA REGALIS VAR. SPECTABILIS ORIGIN) FROM OSMUNDA CLAYTONIANA TO VARIOUS FERNS, USING AS INOCULUM UREDIOSPORES CULTURALLY PRODUCED IN THE EXPERIMENTS RECORDED IN TABLE 14 (B).

A. *From Osmunda Claytoniana to Osmunda regalis var. spectabilis*

1. *Two inoculation experiments* were made; both gave *positive* results.
2. The dates of inoculation were July 29 and August 2.
3. Mature uredia were first observed 11 and 12 days after inoculation.
4. The experiments were harvested 13 and 15 days after inoculation.
5. The approximate numbers of uredia present at the time of harvesting were 120 and 500.
6. J. H. Faull Herbarium nos. 8446–8447.

B. *From Osmunda Claytoniana to Osmunda Claytoniana*

1. *Two inoculation experiments* were made; both gave *positive* results.
2. The dates of inoculation were July 29 and August 5.
3. Mature uredia were first observed 12 and 13 days after inoculation.
4. The experiments were harvested 13 and 15 days after inoculation.

5. The approximate numbers of uredia present at the time of harvesting were 500 and 1700.
6. J. H. Faull Herbarium no. 8448.

C. *From Osmunda Claytoniana to Osmunda cinnamomea*

1. *Three inoculation experiments* were made; all gave *negative* results.
2. The dates of inoculation ranged from July 29 to August 2.
3. The experiments were harvested 33 to 34 days after inoculation.

TABLE 17.

CULTURES OF UREDINOPSIS OSMUNDAE FROM OSMUNDA CINNAMOMEA TO ABIES BALSAMEA

1. *Forty inoculation experiments* were made; thirty-seven gave *positive* results.
2. The dates of inoculation ranged from June 14 to June 25.
3. Yellowing of the needles appeared 9 to 16 days after inoculation. *The average was 11 days.*
4. The spermogonia were first observed 10 to 16 days after inoculation. *The average was 12 days.*
5. The peridermia were first observed 19 to 27 days after inoculation. *The average was 22 days.*
6. The peridermia usually began to rupture about the second day following their first appearance.
7. The production of peridermia was practically completed within 38 days after inoculation. *The average was about 30 days.*
8. The number of infected needles with peridermia varied from 1 to 134. *The average was about 55.*
9. J. H. Faull Herbarium nos. 8449–8456.

TABLE 18.

CULTURES OF UREDINOPSIS OSMUNDAE (OF OSMUNDA CINNAMOMEA ORIGIN) FROM ABIES BALSAMEA TO VARIOUS FERNS, USING AS INOCULUM AECIOSPORES CULTURALLY PRODUCED IN THE EXPERIMENTS RECORDED IN TABLE 17.

A. *From Abies balsamea to Osmunda cinnamomea*

1. *Six inoculation experiments* were made; all gave *positive* results.
2. The dates of inoculation ranged from July 10 to July 24.
3. Mature uredia were first observed 11 to 16 days after inoculation. *The average was 13 days.*
4. The experiments were harvested 15 to 26 days after inoculation. *The average was 19 days.*
5. The approximate number of uredia present at the time of harvesting varied from 550 to 1700. *The average was 917.*

B. *From Abies balsamea to Osmunda Claytoniana*

TABLE 21.

CULTURES OF UREDINOPSIS OSMUNDAE (OF OSMUNDA CINNAMOMEA ORIGIN) FROM OSMUNDA REGALIS VAR. SPECTABILIS TO VARIOUS FERNS, USING AS INOCULUM UREDIOSPORES CULTURALLY PRODUCED IN THE EXPERIMENTS RECORDED IN TABLE 18 (C).

A. *From Osmunda regalis var. spectabilis to Osmunda cinnamomea*

1. *Three inoculation experiments* were made; all gave *positive* results.
2. The dates of inoculation ranged from July 30 to August 10.
3. Mature uredia were first observed 14 days after inoculation.
4. The experiments were harvested 14 to 21 days after inoculation.
5. The approximate number of uredia present at the time of harvesting varied from 250 to 800. *The average was 567.*
6. J. H. Faull Herbarium nos. 8466–8467.

B. *From Osmunda regalis var. spectabilis to Osmunda regalis var. spectabilis*

1. *Two inoculation experiments* were made; both gave *positive* results.
2. The dates of inoculation were July 30 and August 10.
3. Mature uredia were first observed 11 and 14 days after inoculation.
4. The experiments were harvested 13 and 22 days after inoculation.
5. The approximate numbers of uredia present at the time of harvesting were 100 and 60.
6. J. H. Faull Herbarium nos. 8468–8469.

C. *From Osmunda regalis var. spectabilis to Osmunda Claytoniana*

1. *Two inoculation experiments* were made; both gave *positive* results.
2. The dates of inoculation were July 30 and August 10.
3. Mature uredia were first observed 18 days after inoculation.
4. The experiments were harvested 20 and 22 days after inoculation.
5. The approximate numbers of uredia present at the time of harvesting were 19 and 10.
6. J. H. Faull Herbarium nos. 8470–8471.

6. **Uredinopsis ceratophora** Faull

A rust of the genus *Uredinopsis* has long been known to occur on *Cystopteris bulbifera* (L.) Bernh. It was originally identified as *U. Atkinsonii* Magnus and it has been carried along as a representative of that species with every subsequent change of nomenclature. But as Faull (3) has recently stated, "a comparative study of type specimens shows that it stands by itself as a distinctive, well-marked, heretofore

C. *From Osmunda cinnamomea to Osmunda regalis var. spectabilis*

1. *Three inoculation experiments* were made; all gave *positive* results.
2. The date of inoculation was August 9.
3. Mature uredia were first observed 15 to 18 days after inoculation.
4. The experiments were harvested 23 days after inoculation.
5. The approximate number of uredia present at the time of harvesting varied from 50 to 225. *The average was 125.*
6. J. H. Faull Herbarium nos. 8460–8462.

TABLE 20.

CULTURES OF UREDINOPSIS OSMUNDAE (OF OSMUNDA CINNAMOMEA ORIGIN) FROM OSMUNDA CLAYTONIANA TO VARIOUS FERNS, USING AS INOCULUM UREDIOSPORES CULTURALLY PRODUCED IN THE EXPERIMENTS RECORDED IN TABLE 18 (B).

A. *From Osmunda Claytoniana to Osmunda cinnamomea*

1. *One inoculation experiment* was made; it gave *positive* results.
2. The date of inoculation was August 3.
3. Mature uredia were first observed 16 days after inoculation.
4. The experiment was harvested 20 days after inoculation.
5. The approximate number of uredia present at the time of harvesting was 43.
6. J. H. Faull Herbarium no. 8463.

B. *From Osmunda Claytoniana to Osmunda Claytoniana*

1. *One inoculation experiment* was made; it gave *positive* results.
2. The date of inoculation was August 3.
3. Mature uredia were first observed 16 days after inoculation.
4. The experiment was harvested 16 days after inoculation.
5. The approximate number of uredia present at the time of harvesting was *7*.
6. J. H. Faull Herbarium no. 8464.

C. *From Osmunda Claytoniana to Osmunda regalis var. spectabilis*

1. *One inoculation experiment* was made; it gave *positive* results.
2. The date of inoculation was August 8.
3. Mature uredia were first observed 14 days after inoculation.
4. The experiment was harvested 17 days after inoculation.
5. The approximate number of uredia present at the time of harvesting was 80.
6. J. H. Faull Herbarium no. 8465.

TABLE 21.

CULTURES OF UREDINOPSIS OSMUNDAE (OF OSMUNDA CINNAMOMEA ORIGIN) FROM OSMUNDA REGALIS VAR. SPECTABILIS TO VARIOUS FERNS, USING AS INOCULUM UREDIOSPORES CULTURALLY PRODUCED IN THE EXPERIMENTS RECORDED IN TABLE 18 (C).

A. *From Osmunda regalis var. spectabilis to Osmunda cinnamomea*

1. *Three inoculation experiments* were made; all gave *positive* results.
2. The dates of inoculation ranged from July 30 to August 10.
3. Mature uredia were first observed 14 days after inoculation.
4. The experiments were harvested 14 to 21 days after inoculation.
5. The approximate number of uredia present at the time of harvesting varied from 250 to 800. *The average was 567.*
6. J. H. Faull Herbarium nos. 8466–8467.

B. *From Osmunda regalis var. spectabilis to Osmunda regalis var. spectabilis*

1. *Two inoculation experiments* were made; both gave *positive* results.
2. The dates of inoculation were July 30 and August 10.
3. Mature uredia were first observed 11 and 14 days after inoculation.
4. The experiments were harvested 13 and 22 days after inoculation.
5. The approximate numbers of uredia present at the time of harvesting were 100 and 60.
6. J. H. Faull Herbarium nos. 8468–8469.

C. *From Osmunda regalis var. spectabilis to Osmunda Claytoniana*

1. *Two inoculation experiments* were made; both gave *positive* results.
2. The dates of inoculation were July 30 and August 10.
3. Mature uredia were first observed 18 days after inoculation.
4. The experiments were harvested 20 and 22 days after inoculation.
5. The approximate numbers of uredia present at the time of harvesting were 19 and 10.
6. J. H. Faull Herbarium nos. 8470–8471.

6. **Uredinopsis ceratophora** Faull

A rust of the genus *Uredinopsis* has long been known to occur on *Cystopteris bulbifera* (L.) Bernh. It was originally identified as *U. Atkinsonii* Magnus and it has been carried along as a representative of that species with every subsequent change of nomenclature. But as Faull (3) has recently stated, "a comparative study of type specimens shows that it stands by itself as a distinctive, well-marked, heretofore

unnamed species." Moreover, he has shown that *U. longimucronata* Faull from *Athyrium angustum*, until now regarded as *U. Atkinsonii* Magnus, does not cause infection of *Cystopteris bulbifera*. So he has called it *Uredinopsis ceratophora*. Scant attention seems to have been given to this rust and until now nothing has been published on its life history. My culture work with *U. ceratophora* has been fragmentary; but sufficient was done to show that its life history follows the known Uredinopsis pattern. Using teliosporic material for inoculum it has been found that *Abies balsamea* serves as alternate host, but no reverse cultures were made. A summary of the experiments is recorded in Table 22.

TABLE 22.

CULTURES OF UREDINOPSIS CERATOPHORA
FROM CYSTOPTERIS BULBIFERA TO ABIES BALSAMEA

1. *Seven inoculation experiments* were made; two gave *positive* results.
2. The date of inoculation was June 25.
3. The production of peridermia was completed within 40 days after inoculation.
4. The number of infected needles with peridermia varied from 6 to 12.
5. J. H. Faull Herbarium no. 9308.

III. DEVELOPMENTAL PERIODS

(a) Haploid phase

The haploid phase of all species of *Uredinopsis* of known life history, except *U. macrosperma*, is begun and completed on Abies needles of the current season. So far as my demonstrations go, it begins at the time of or soon after expansion of the needles and is well over before the end of August. How long the new needles remain susceptible was not determined; but the probability is that their period of susceptibility closely coincides with the normal time range of basidiospore production. This does not mean that the inner tissues of the needles ever acquire resistance, but rather that the epidermal defenses soon become adequate to resist entrance of the rust germ tubes.

After the inception of infection, the interval that elapses until the first fructifications make their appearance is relatively short. Thus, it was found that the first spermogonia were mature in 12 to 14 days on the average and the first peridermia in 20 to 23 days. Comparative developmental data are assembled in Table 23.

As for *U. macrosperma*, however, the haploid phase is of long duration — a year or more. It probably begins on young needles of the cur-

rent season, but peridermia do not develop until the affected needles are in their second year, and occasionally they are found on needles of the third to the fifth year. Although no direct experiments have been made this conclusion can be drawn fairly from field observations and the experiments of Weir & Hubert (14) in culturing *U. macrosperma* on *Pteridium aquilinum* var. *lanuginosum* (Bong.) Fernald. In that work they used as inoculum the aeciospores of *Peridermium pseudo-balsameum* (D. & H.) Arthur and Kern, a rust occurring only on needles of the second to the fifth year.

TABLE 23.

COMPARATIVE DEVELOPMENTAL DATA ON THE HAPLOID PHASE OF SPECIES OF UREDINOPSIS ON ABIES BALSAMEA.

Rust species	No. of expmts.	First appearance of spermogonia	Average	First appearance of peridermia	Average	Av. no. of infected needles per experiment
U. Struthiopteridis	49	10–15 days	12 days	19–24 days	21 days	37
U. mirabilis	39	10–15 days	12 days	21–28 days	23 days	27
U. longimucronata	53	9–18 days	12 days	17–25 days	20 days	52
U. Phegopteridis	14	10–15 days	12 days	21–23 days	23 days	34
U. Osmundae (of Osmunda Claytoniana origin)	46	11–17 days	14 days	21–26 days	23 days	58
U. Osmundae (of Osmunda regalis var. spectabilis origin)	25	11–16 days	13 days	20–26 days	23 days	24
U. Osmundae (of Osmunda cinnamomea origin)	37	10–16 days	12 days	19–27 days	22 days	55

The recognition of Uredinopsis species in the field is complicated by the fact that certain species of *Milesia*, also with white peridermia on *Abies*, often occur in the same localities along with them. Thus, two species of *Milesia*, namely *M. intermedia* Faull and *M. marginalis* Faull & Watson, characterized by peridermia on the first year needles of *Abies balsamea*, are abundant throughout the North American area in which the species of *Uredinopsis* of Table 23 abound; and in certain portions of the same region *M. fructuosa* Faull also occurs. The peridermia of these species are so like those of *Uredinopsis* that offhand generic recognition is perhaps impossible. But evident distinctions do reside in such

microscopic characters as minor spermogonial structures and the larger size of the aeciospores of the species of *Milesia*.

Comparing Table 23 on Uredinopsis rusts with the records published by Faull (3) on the biology of Milesian rusts, it is plain, however, that another distinction exists, namely, differences in the lengths of the developmental periods of the haploid phases of the compared species of the two genera. In the Uredinopsis species the spermogonia are mature within an average of 12 to 14 days, while in the Milesia species the average is 18–19 days. The comparable times up to maturity of the peridermia are 20 to 23 days for *Uredinopsis* and 34 to 43 days for *Milesia*. Thus the sequence of these white rusts on *Abies balsamea* under natural conditions is (1) *Uredinopsis*, (2) *Uredinopsis* and *Milesia*, (3) *Milesia*. Moreover, as the peridermia of the species of *Milesia* are quite persistent, they may be found up until late in the summer or even early fall, that is, until long after no trace of *Uredinopsis* remains.

(b) Diploid phase

The diploid phase of species of *Uredinopsis* can apparently be initiated on their fern hosts at any time after the fronds are fairly well expanded; and, once established, its mycelium continues to grow as long as the infected fronds are photosynthetically active. Primary inoculation is by means of aeciospores or overwintered urediospores. Secondary infections result from inoculation with urediospores of the ordinary type. In most species the developmental period up to the appearance of the first uredia is quite short. Table 24 presents comparative data for five of them.

TABLE 24.

COMPARATIVE DATA ON THE INITIAL DEVELOPMENT OF THE DIPLOID PHASE OF SPECIES OF UREDINOPSIS ON THEIR FERN HOSTS

A. *Using culturally produced aeciospores as inoculum.*

Rusts	No. of expmts.	First appearance of uredia	Average no. of uredia per expmt.
U. Struthiopteridis on Matteuccia Struthiopteris	6	10–11 days	138
U. mirabilis on Onoclea sensibilis	6	8–9 days	350
U. longimucronata on Athyrium angustum	11	16–30 days (av. 23 days)	88

TABLE 24 (Continued)

Rusts	No. of expmts.	First appearance of uredia	Average no. of uredia per expmt.
U. Phegopteridis on Dryopteris Linnaeana	3	7–8 days	258
U. Osmundae (of Osmunda Claytoniana origin)			
(a) on O. Claytoniana	10	8–12 days (av. 10 days)	390
(b) on O. regalis var. spectabilis	9	10–17 days (av. 13 days)	185
(c) on O. cinnamomea	10	*negative*	*negative*
U. Osmundae (of Osmunda regalis var. spectabilis origin)			
(a) on O. regalis var. spectabilis	5	9–13 days	530
(b) on O. Claytoniana	5	10–12 days	436
(c) on O. cinnamomea	6	*negative*	*negative*
U. Osmundae (of Osmunda cinnamomea origin)			
(a) on O. cinnamomea	6	11–16 days (av. 13 days)	917
(b) on O. regalis var. spectabilis	8	11–16 days (av. 13 days)	183
(c) on O. Claytoniana	6	14–18 days (av. 16 days)	12
B. *Using culturally produced urediospores as inoculum.*			
U. Osmundae (of Osmunda Claytoniana origin)			
(a) From O. Claytoniana to O. Claytoniana	3	8–12 days	700
(b) From O. Claytoniana to O. regalis var. spectabilis	4	9–12 days	302
(c) From O. Claytoniana to O. cinnamomea	4	*negative*	*negative*
(d) From O. regalis var. spectabilis to O. Claytoniana	1	12 days	100
(e) From O. regalis var. spectabilis to O. regalis var. spectabilis	1	12 days	250
(f) From O. regalis var. spectabilis to O. cinnamomea	2	*negative*	*negative*

TABLE 24 (Continued)

Rusts	No. of expmts.	First appearance of uredia	Average no. of uredia per expmt.
U. Osmundae (of O. regalis var. spectabilis origin)			
(a) From O. regalis var. spectabilis to O. regalis var. spectabilis	2	13–16 days	355
(b) From O. regalis var. spectabilis to O. Claytoniana	2	12 days	325
(c) From O. regalis var. spectabilis to O. cinnamomea	3	*negative*	*negative*
(d) From O. Claytoniana to O. Claytoniana	2	13–15 days	1100
(e) From O. Claytoniana to O. regalis var. spectabilis	2	13–15 days	310
(f) From O. Claytoniana to O. cinnamomea	3	*negative*	*negative*
U. Osmundae (of O. cinnamomea origin)			
(a) From O. cinnamomea to O. cinnamomea	2	17 days	188
(b) From O. cinnamomea to O. regalis var. spectabilis	3	15–18 days	125
(c) From O. cinnamomea to O. Claytoniana	2	15 days	19
(d) From O. regalis var. spectabilis to O. cinnamomea	3	14 days	567
(e) From O. regalis var. spectabilis to O. regalis var. spectabilis	2	11–14 days	80
(f) From O. regalis var. spectabilis to O. Claytoniana	2	18 days	15
(g) From O. Claytoniana to O. cinnamomea	1	16 days	43
(h) From O. Claytoniana to O. regalis var. spectabilis	1	14 days	80
(i) From O. Claytoniana to O. Claytoniana	I	16 days	7

From the data recorded in Table 24 several conclusions logically follow. (1) The developmental period for *U. longimucronata* on its fern host is notably longer than that of the other species on their respective fern hosts. (2) There are evidently two biological strains of *U. Osmundae;* one passes to all three species of *Osmunda; Osmunda*

cinnamomea is immune to the other strain. (3) *Osmunda regalis* var. *spectabilis* is a congenial host for both strains. (4) *Osmunda Claytoniana* is not a congenial host for the strain that parasitizes *O. cinnamomea*.

No efforts were made in my culture experiments to determine what length of time might elapse after inoculation before amphispores are formed. None developed in the cultures, but that was probably because they were harvested too soon.

Likewise no attempt was made to determine the length of the developmental period up to the time of the appearance of the first teliospores. Teliospores, however, did develop in five of the cultures of *Uredinopsis longimucronata* on *Athyrium angustum*. They were formed 23, 25, 26, 28 and 31 days, respectively, after inoculation made with aeciospores.

IV. HABITS OF SPORE PRODUCTION

(a) Spermatia

The spermatia of the species studied here are produced in abundance and they are discharged in a copious spermatial fluid. The discharge continues over many days. These phenomena are apparently correlated with the relatively large size of the spermogonia and the ample protection afforded them by the host tissues in which they are embedded.

(b) Aeciospores

The peridermia of the species of *Uredinopsis* cultured by me made their appearance in a week to two weeks after the spermatial discharge began. The average was found to be 11 days for *U. Struthiopteridis*, 11 days for *U. mirabilis*, 8 days for *U. longimucronata*, 10 days for *U. Phegopteridis*, and 10 to 11 days for *U. Osmundae*. The production of peridermia was practically complete 28 to 33 days after inoculation. The ripe peridermia ruptured at their apices and discharge of the aeciospores then began. Rupture usually occurred within one to two days after the peridermia were apparently mature.

These data, it will be seen, are quite different from those obtained for *Milesia* (Faull, 3). Thus, for *M. intermedia* Faull, the period of peridermial formation was found to be 16 days after spermatial discharge began, for *M. marginalis* it was 24 days, and for *M. polypodophila* 30 days. Moreover, the peridermia in those species did not rupture sooner than 3 or 4 days on the average after they were mature. Comparing also the discharge periods of the peridermia of Uredinopsis and Milesia species observed, they are much shorter in the former. While in *Uredinopsis* aeciospore production is entirely over before the end of the sum-

mer months, Faull records that "it has frequently been noted that peridermia of *M. intermedia* formed soon after the middle of August were shedding spores until towards the end of September."

(c) Urediospores

Following inoculation of the fern hosts, the ordinary uredia of the species cultured were not long in making their appearance. For *Uredinopsis Struthiopteridis* it was 10 to 11 days, for *U. mirabilis* 8 to 9 days, for *U. longimucronata* 16 to 30 days (23 days on the average), and for *U. Osmundae* 9 to 10 days. Rupture of the uredia of Uredinopsis species takes place at once after maturity and typically it is apical. In species on *Pteridium,* however, it is often lateral or subbasal. Unless the weather is too damp, the discharged spores adhere in long, more or less slender, white tendrils. The spores are immediately viable. They are provided with four germ pores, two near each pole, and on germination a germ tube, as was first demonstrated by Bell (1), may issue through each pore.

The amphisporic uredia, in such species as are characterized by them, occur on the same lesions as those that produce the ordinary uredia; but they are later in making their appearance. The occurrence of amphisporic uredia in one species as compared with another, or even for the same species, often exhibits interesting contrasts with respect to frequency and earliness of production. For example, in *U. Kameiana* they are so prevalent and their production so soon replaces that of ordinary uredia, that the latter are rarely well represented in collections. The opposite situation prevails in *U. virginiana.* In that species ordinary uredia abound and amphisporic uredia are infrequent. Differences within the same species are aptly illustrated by *U. longimucronata.* In cooler regions the amphisporic uredia are relatively uncommon and appear late in the season; in warmer localities they are often very abundant and develop quite early.

The amphispores are retained within their uredia until the following spring and they are not viable before that time. When, finally, discharge does take place, they may issue, as observed particularly for *U. ceratophora,* in more or less well defined tendrils.

(d) Teliospores and basidiospores

The teliospores of *Uredinopsis* are produced in profusion immediately under the lower epidermis of infected fronds and a few are located under the upper epidermis. They occur separately or in more or less broken crusts of indefinite extent within the subepidermal intercellular spaces. Their cells all lie close to, or more often in actual contact with, the

epidermis. Each spore cell possesses a single germ pore and it is located in the outer cell wall.

Teliospores are abundant for all species growing in regions in which *Abies* is native. But in other parts of the world, that is, in areas beyond the natural distribution of *Abies*, teliospores are rarely present.

Regarding the time of formation of teliospores in *Uredinopsis*, the misconception prevails that their production is postponed to the end of the growing season (cf. Pady, 13). The time, however, seems not to be governed by the seasonal period; more likely it is determined by a nutritional influence in the lesions. However that may be, I have often found them before midsummer has arrived. It may be added that in a few species the tendency to form teliospores is so pronounced that not only is their formation active in midsummer, but also that comparatively few or even no uredia may occur on the lesions. In all cases, of course, teliospore formation is completed by the end of the growing season and the spores overwinter in the dead host leaves.

The teliospores are not viable until after the winter's rest. In the succeeding spring, however, they germinate promptly under suitable conditions of warmth and moisture. A basidium quickly grows out from each cell through the epidermis. The aërial portion divides into four cells, each of which produces a single basidiospore.

V. HOST RESTRICTIONS

The haploid phase of Uredinopsis species seems to occur on *Abies* only. To that extent there is apparently a generic host restriction. But few tests or observations have been made with respect to specific host resistance or specific rust aggressiveness. The likelihood is, however, that just as in the case of *Milesia* and *Abies* (cf. Faull, 3) the majority of and perhaps all species of *Abies* are more or less susceptible to all species of *Uredinopsis*, and conversely that all species of *Uredinopsis* may be passed more or less easily to most or perhaps all species of *Abies*. At all events the following incidental results of experimentation point to the correctness of those conclusions: (1) *Uredinopsis Struthiopteridis* has been cultured on *Abies alba, A. balsamea* and *A. Mayriana;* (2) *U. ossaeiformis* has been cultured on *A. firma, A. Mayriana* and *A. sachalinensis;* (3) nine species of *Uredinopsis* have been cultured on *A. Mayriana,* namely, *U. Adianti, U. Athyrii, U. filicina, U. hirosakiensis, U. intermedia, U. Kameiana, U. ossaeiformis, U. Struthiopteridis* and *U. Woodsiae;* (4) seven species of *Uredinopsis* have been cultured on *A. balsamea,* namely, *U. Atkinsonii, U. ceratophora, U. longimucronata, U. mirabilis, U. Osmundae, U. Phegopteridis* and *U. Struthiopteridis;*

(5) there are no records of negative experiments to offset the conclusions expressed above.

The diploid phase of Uredinopsis species, on the other hand, seems to be very closely host restricted — usually to one host. A single species only, *U. glabra,* is recognized by the writer (4) as occurring on representatives of more than one fern genus; and but five others are recognized as occurring on more than one species of the same genus. But even in such cases the only efforts made to determine whether or not these rusts may comprise biological strains are those recorded for *U. Osmundae* in this paper. In that instance two biological forms have been demonstrated — one can infect three species of *Osmunda,* the other but two, and the host species concerned exhibit different relative degrees of susceptibility.

Fraser and Faull, however, have independently made some tests on the fern host restrictions of a few species of *Uredinopsis,* each choosing as experimental subjects ferns known to be susceptible to some species of *Uredinopsis.* In all cases close host restrictions were demonstrated.

Fraser's findings were as follows: (1) **Uredinopsis Struthiopteridis** from *Matteuccia Struthiopteris* does not infect *Dryopteris Linnaeana, Onoclea sensibilis, Osmunda Claytoniana.* (2) **U. mirabilis** from *Onoclea sensibilis* does not infect *Athyrium angustum, Dryopteris Linnaeana, D. Thelypteris* var. *pubescens, Osmunda Claytonia, O. regalis* var. *spectabilis.*

Faull's results were as follows: (1) **Uredinopsis Struthiopteridis** from *Matteuccia Struthiopteris* does not infect *Athyrium angustum, Dryopteris Linnaeana, Onoclea sensibilis, Osmunda Claytoniana.* (2) **U. mirabilis** from *Onoclea sensibilis* does not infect *Athyrium angustum, Dryopteris Linnaeana, Matteuccia Struthiopteris, Osmunda Claytoniana.* (3) **U. longimucronata** from *Athyrium angustum* does not infect *Cystopteris bulbifera, C. fragilis, Dryopteris Linnaeana, D. Thelypteris* var. *pubescens, Matteuccia Struthiopteris, Onoclea sensibilis, Osmunda Claytoniana.* (4) **U. Phegopteridis** from *Dryopteris Linnaeana* does not infect *Athyrium angustum, Matteuccia Struthiopteris, Onoclea sensibilis, Osmunda Claytoniana.* (5) **U. Osmundae** from *Osmunda Claytoniana* does not infect *Athyrium angustum, Dryopteris Linnaeana, Matteuccia Struthiopteris, Onoclea sensibilis.*

VI. ECONOMIC CONSIDERATIONS

Uredinopsis not infrequently occurs so abundantly on firs that considerable injury to them must surely result. This would apply particularly to seedlings and young saplings. But so far as I am aware,

Kamei (11) is the only one to have made statistical studies of any kind on that topic. He made a detailed analysis of the effect of *U. hirosakiensis* on seedlings of *Abies Mayriana* growing in nursery plots. He found that infected plants in the plots varied from 12 to 58.7% of the total and that the number of infected needles per seedling varied from one to eleven. Obviously under such circumstances attention should be paid to the fern population adjacent to a nursery in which firs are grown. It is apparent, too, that studies on the influence of *Uredinopsis* on the natural reproduction of *Abies* in the forest might yield some interesting results.

The injurious effects of *Uredinopsis* on ferns are often very severe. They might conceivably be matters of concern to owners of properties in regions in which firs and ferns occur and in which the latter are of ornamental value. Thus, in such cases, *Athyrium angustum, Matteuccia Struthiopteris* and species of *Osmunda* frequently become unsightly by midsummer as a result of Uredinopsis infection. Probably the resultant injuries could largely be prevented by adopting means known to be effective in controlling rust diseases in other kinds of plants.

SUMMARY

1. Species of *Uredinopsis* in their diploid phase are known on *Osmunda* of the Osmundaceae and twelve genera of the Polypodiaceae, namely, *Adiantum, Athyrium, Blechnum, Cheilanthes, Cystopteris, Dryopteris, Matteuccia, Onoclea, Pellaea, Pteridium, Woodsia, Woodwardia.* The haploid phase occurs in nature or has been obtained by culturing on *Abies alba, A. balsamea, A. firma, A. grandis, A. Mayriana, A. sachalinensis.*

2. The life histories of sixteen of the twenty-five recognized species of *Uredinopsis* (cf. Faull, 4) have been demonstrated by culturing. This paper records detailed studies on the life histories of *U. ceratophora, U. longimucronata, U. mirabilis, U. Osmundae, U. Phegopteridis* and *U. Struthiopteridis.*

3. Teliospores are known for all of the twenty-five recognized species of *Uredinopsis* except *U. investita* and *U. Mayoriana.*

4. Data on the developmental periods of the species experimentally studied by the writer, up to the times the spermogonia and the peridermia first appear, are summarized in Table 23, and on the periods up to the first appearance of the uredia in Table 24.

5. Teliospore formation may begin as early as midsummer. The important determining factor is probably nutritional rather than seasonal.

The teliospores overwinter in dead infected fronds and first become viable in the following spring.

6. There is incidental evidence in support of the assumption that most, if not all, species of *Abies* are more or less susceptible to all species of *Uredinopsis*, and conversely that all species of *Uredinopsis* may be passed more or less easily to most or perhaps all species of *Abies*. But these conclusions await direct investigation.

On the other hand, it is reasonably certain that the species of *Uredinopsis* are closely restricted as to their fern hosts. This has been indicated by Fraser's experiments with *U. mirabilis* and *U. Struthiopteridis* and by my own experiments with *U. longimucronata, U. mirabilis, U. Osmundae, U. Phegopteridis* and *U. Struthiopteridis*.

7. It has been demonstrated here that *U. Osmundae* comprises two biological strains, one of them infecting three species of *Osmunda* and the other *O. Claytoniana* and *O. regalis* var. *spectabilis* only.

8. Economically, Uredinopsis rusts are of some importance in relation to both firs and ferns.

ACKNOWLEDGMENTS

I am under deep obligation, gratefully acknowledged, to Dr. E. H. Bensley for competent and devoted assistance in culturing *Uredinopsis longimucronata, U. mirabilis, U. Osmundae, U. Phegopteridis* and *U. Struthiopteridis*, and to Professor E. H. Moss for assistance in making some preliminary cultures.

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LABORATORY OF PLANT PATHOLOGY,
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THE RELATION BETWEEN STOMATA COUNTS AND CHROMOSOME NUMBER

HALLY J. SAX

RELIABLE MEANS for the detection of polyploid series in races and species of plants are especially desirable. Several plant characters have been found to show some degree of correlation with chromosome number. Various means, such as pollen grain size, cell size, and size and frequency of stomata have been used in studies of polyploidy.

In both plants and animals, the doubling of the chromosome number is accompanied by increase in volume in nucleus and cytoplasm. The work on differences in cell size and other characters has been discussed in papers on polyploidy (Navashin 1931, Müntzing 1936, and others).

Wettstein (1937), following polyploid races of mosses through a series of generations, finds that there is an increase in cell size with the increase in chromosome number when the hybrid *Bryum Corrensii* Corr. is formed. With the passage of generations, the polyploid gradually becomes smaller, so that at the end of eleven years, the polyploid race has the same cell size as the haploid race. Fertility is also restored gradually. Yet the chromosome number remains the same, the reduction division is normal, and it does not cross with the original form.

In an earlier paper (Sax and Sax 1937), a comparative study of diploid and tetraploid races of *Tradescantia canaliculata* Rafinesque showed a high degree of correlation between chromosome number and size of pollen mother cells, microspores, chloroplasts, and stomata size and stomata frequency, and other characters, though the tetraploids were not very different in external appearance from the diploid races.

Stomata frequency was compared from fresh leaves in several genera of plants where tetraploids were known. There was a positive correlation between stomata frequency per square centimeter of leaf surface and the known chromosome number in diploid and tetraploid races of *Tradescantia* and *Secale* and in species of *Staphylea*, *Deutzia*, and *Lonicera*.

Some counts made from herbarium material of the genera *Malus*, *Staphylea*, *Vaccinium*, and others, showed some correlation with the known chromosome counts, although discrepancies were found in certain species of *Malus* and *Vaccinium*.

The present study is an extension of the above-mentioned work (Sax and Sax 1937). The frequency of stomata in a number of genera of trees and shrubs was determined from herbarium material, in order to test the correlation of stomata frequency in a species with the chromosome number, and to learn whether herbarium material could be used successfully in such work. If tetraploids could be thus separated from diploids, the use of herbarium material in studies of plant distribution, or in experimental problems, would be most helpful and time-saving, and might be suggestive when entertaining problems in which species from widely separated regions were concerned.

The material for this work was collected from several genera of trees and shrubs in the Arnold Arboretum, where there is an opportunity to obtain genera from various parts of the world. Since fruiting specimens are usually found in herbarium material, an effort was made to collect mature leaves of about the same size from each tree and from each species. They were collected from similar positions on the trees. These collections were made on September 6, 1937. Uniformity of maturity, size, and position on tree was sought.

I wish to thank Mr. George Skirm, who collected and pressed the leaves used for this work.

Five counts or more were made from each leaf, and ten leaves from each tree were used, so that there were made not less than fifty counts for each species (TABLE 1). Similar regions at approximately the same locations were studied on the different leaves. There were, of course, some differences due to venation, type of leaf, even or uneven size, and distribution of stomata, etc., but an effort was made to count stomata on regions as nearly comparable as possible.

Counts of stomata were made with the help of the collodion peel method, a modification of that used by Long and Clements (1934). A drop of collodion was placed on the leaf in the region where the stomata were to be counted. The impression of the surface of the leaf with the stomata was usually obtained fairly easily, but at times several peels were made before the mount was satisfactory, especially if hairs or excretions were present. Usually, a succession of peels from the same place cleared the surface so that the impression of the leaf was distinct. In one case, owing to great irregularities, the count was abandoned. In *Fraxinus americana* L. the stomata were depressed so that an imprint was not obtainable.

The collodion peels were placed directly under the high power of the microscope. The stomata over the entire field were counted and recorded. The average of the counts for each species is given in tabulated

TABLE 1.

STOMATA COUNTS FROM LEAVES OF HERBARIUM MATERIAL

Genus	Species	No. of counts	Average no. of stomata per sq. mm.	Number of chromosomes
Betula	nigra L.*	50	82	2N
	papyrifera Marsh.	100	37	5N
	lutea Michx.	57	43	6N
Ulmus	laevis Pall.	50	177	2N
	americana L.	50	79	4N
Crataegus	punctata Jacq.	50	105	2N
	crus-galli L.	50	71	3N
	rotundifolia Moench	50	65	4N
Malus	baccata Borkh.	50	89	2N
	baccata mandshurica (Maxim.) Schneid.	50	141	2N
	robusta Rehd. (M. baccata × prunifolia)	51	90	2N
	angustifolia Michx.	50	137	4N
	" "	50	100	
Staphylea	Bumalda D.C.	50	157	2N
	pinnata L.	50	129	2N
	colchica Stev.	50	118	4N
	trifolia L.	50	63	6N
Acer	platanoides L.	50	113	2N
	saccharum Marsh.	50	110	2N
	saccharinum L.	50	133	4N
	Pseudoplatanus L.	54	32	4N
	rubrum L.	52	116	8N
Tilia	americana L.	56	127	2N
	petiolaris Hook. f.	50	133	2N
	cordata Mill.	52	53	2N
	amurensis Rupr.	54	41	4N
	Maximowicziana Shiras.	52	71	4N
Fraxinus	pennsylvanica Marsh.	50	162	2N
	chinensis Roxb.	50	76	6N
Lonicera	Maackii Maxim.	53	127	2N
	tatarica L.	70	373	2N

*In the case of *Betula nigra,* when the leaf showed a diseased spot on the top surface, the stomata varied greatly in number, running all the way from 9 to more than 90. Only leaves without spots were used in the data in the table.

form (TABLE 1), along with the chromosome numbers. The chromosome numbers were available from papers published previously in the Journal of the Arnold Arboretum.

In most cases the data presented above show that there is a positive correlation between stomata frequency and chromosome number. There are instances, as in *Betula nigra*, where the counts are fairly uniform in normal specimens, but varied from nine to ninety in diseased specimens. This case may have been misleading, but the great diversity in the counts from those of adjacent tissue make a closer survey desirable.

In *Acer* there is very little correlation with the known chromosome counts. *Acer saccharinum*, a tetraploid, has the highest count obtained. The number found in *A. rubrum*, an octoploid, is like that of the diploid. This is rather in keeping with the results found by others. Beyond a certain size, there seems to be a tendency for the number of stomata and the cell size not to increase with the number of chromosomes. It will be noted that the genera showing greatest discrepancies (*Acer* and *Lonicera*) also have the greatest variation in leaf size and shape between species.

As Long and Clements (1934) have shown, the number of stomata may vary with the position on the leaf and with the environmental conditions. For instance, the number of stomata per square millimeter near the edge of the leaf varies greatly from those near the midrib.

In most of the genera studied, where the counts were made from regions which were comparable in as many respects as were practical, there is usually a rather definite correlation between the number of stomata per square millimeter and the chromosome number. This does not seem to hold indefinitely as the chromosome numbers increase, and it apparently varies with different genera and different environmental conditions. Although stomata frequency may not serve as an absolute index to polyploidy, it may give most useful suggestions in a preliminary survey of a genus. It may be obtained from herbarium specimens as well as from fresh material.

In his work on the mosses, Wettstein (1937) discovered that after many generations the polyploid *Bryum Correnssii* Corr. recovers gradually the cell size and fertility found in the haploids. Yet it keeps its polyploid constitution. If this should prove to be true for the angiosperms, there may be need for considerable caution in announcing results based on cell size. We must consider that we are dealing, in the latter case, with plants where the generations may be widely separated. In the moss, we have a simpler plant with shorter generations. Regression may be slower in more complicated plants, and it may not occur.

If it should be established that there is a general tendency for polyploids to regress in cell size to that of diploids, the relative time of origin of a polyploid species might be suggested according to the approach in size of its cells to that of the diploid. If the tetraploid approached the diploid in cell size or frequency of stomata, a very early origin might be indicated. The origin in a case like that of *Tradescantia canaliculata*, where the differences in cell size are so striking, would be considered relatively recent.

Of course, the known cases where the higher chromosome numbers are found with greater frequency of stomata and smaller cell size, suggest that this relationship may be extremely complicated. Cell size may not be maintained, not only because of gradual recession in size, as Wettstein found to occur in the mosses, but it may decrease because of genetic control. Mutations may occur bringing the cells of a species to a smaller size. Within limits, the smaller cell size may be better adapted to carry on the normal functions of the species. Physiological disturbances may be adjusted through chromosome mutation, and only those species capable of such genetic control may survive.

CONCLUSIONS

The number of stomata per square millimeter of leaf surface was determined from herbarium material for a number of genera of trees and shrubs in which the chromosome number was known. With some exceptions, there was a positive correlation between stomata counts and chromosome number. Stomata frequency could not be used as an absolute index to polyploidy, but it would be suggestive of polyploidy in many cases, and it would prove very helpful in a preliminary survey of herbarium material.

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THE EFFECT OF COLCHICINE ON THE DEVELOPING EMBRYO SAC OF TRADESCANTIA PALUDOSA

RUTH I. WALKER

With plates 224 and 225

THE RESPONSE of somatic and microspore mother cells of *Tradescantia paludosa* to the colchicine treatment has been described by the author in two previous papers. It was found that certain concentrations of colchicine suppress spindle fiber formation and nuclear division. This effect may be temporary in the case of the microspore mother cells as normal diploid and tetraploid pollen grains are formed. However, in the somatic cells of the ovule, nuclear division is suppressed for at least five or six division cycles of the chromosomes. Giant polyploid cells are formed which apparently never recover from the effects of the colchicine. Similar conditions have been found by other workers in cells treated with colchicine: (Nebel and Ruttle, 1938); (Eigsti, 1938); (Levan, 1938); (Dermen, 1938).

The effect of colchicine in disturbing the polarity of the cell is even more striking in the developing embryo sac. Material for this study was obtained by placing the cut ends of flowering stalks of *Tradescantia paludosa* Anderson & Woodson in 0.1 per cent aqueous solution of colchicine for twenty-four hours, after which they were transferred to water and placed in the greenhouse. Flowering stems of intact plants were treated with colchicine by making a tongue-like slit in the stem just below the second node from the tip and inserting the slit part in a micro test tube containing the solution. After forty-eight hours the cut surfaces were bound together. Fixations were made over a period of twenty days. Entire flowers of treated and control material were fixed in Karpechenko's modification of Navaschin's fluid and in formalin acetic alcohol solutions. The material was dehydrated and embedded in paraffin in the usual manner, butyl alcohol being used as the clearing agent. Cross sections were cut from twelve to twenty-five microns in thickness and stained in either Delafield's haematoxylin, Heidenhaim's iron-alum haematoxylin or with safranin and fast green.

Under normal conditions a single hypodermal cell is differentiated at the apex of the nucellus as the archesporical cell. This enlarges in size

and functions directly as the macrospore mother cell. Six pairs of chromosomes are visible at diakinesis (fig. 1) and at the equatorial plate of the heterotypic division (fig. 2). At the end of the heterotypic division the macrospore mother cell is unequally divided into two cells, the apical (micropylar) being smaller than the basal (chalazal) cell (fig. 4). In the second division the axis of the spindle of the basal cell is longitudinal while that of the apical cell may be longitudinal or transverse to the long axis of the ovule (figs. 5 & 6). Nuclear division in this cell appears to proceed more slowly and irregularly than in the chalazal cell. Figure five shows an instance in which the chromosomes of the apical cell are at metaphase while those of basal cell are at telophase. The apical dyad ceases to grow and the two macrospore nuclei soon disintegrate (fig. 6). The basal cell increases rapidly in size, spindle fibers disappear, and the cytoplasm becomes more vacuolate. Ultimately, a large central vacuole is formed between the nuclei (fig. 7). At no time is there any indication of a cell plate between the two daughter nuclei formed by the homoeotypic division. The macrogametophyte grows, and the two nuclei divide (fig. 8). In consequence of one further nuclear division an eight nucleate embryo sac is formed. This develops into a seven celled structure consisting of a large egg and two smaller synergids, a primary endosperm cell with fusion nucleus and three antipodal cells (fig. 9).

Material treated with 0.1 per cent colchicine was examined the first day after treatment and at intervals for 20 days after treatment. The effect of the colchicine on the developing macrospore is not visible until nine days after treatment although it may have occurred earlier.

Nine to thirteen days after treatment, macrospore mother cells are found in which two daughter nuclei are adjacent to one another (fig. 10). Chromosomes at the equatorial plate arrangement were not observed in the treated material, but the position of the nuclei as shown in figure ten would indicate that a normal metaphase plate had been formed and that the chromosomes had failed to migrate to the pole. It is assumed from the size of the nuclei and by the absence of a disintegrating apical cell that the heterotypic division has been inhibited and that each nucleus contains the diploid chromosome complement.

Frequently cells are seen in which there are three nuclei, one large and two smaller (fig. 11). These may be attributed to an irregularity in distribution of the chromosomes in the first division, a condition frequently found in the cells surrounding the developing embryo sac and occasionally in the developing microspore. It is not improbable, however, that one of the daughter nuclei resulting from the first division

has undergone a second division. This has been observed by the writer in somatic cells of the ovule.

Following the two nucleate condition previously described (fig. 10) a second nuclear division occurs (fig. 12). Chromosome separation is entirely inhibited as the nuclei are seen in close contact with one another.

In a more advanced stage of embryo sac development (fig. 13) giant cells with very little cytoplasm and large irregularly shaped resting nuclei with numerous nucleoli are visible. In these instances separation of chromosomes is so slight that the entire chromatic mass is enclosed within a single nuclear membrane. It is difficult to determine in such figures the exact number of times nuclear division has been inhibited.

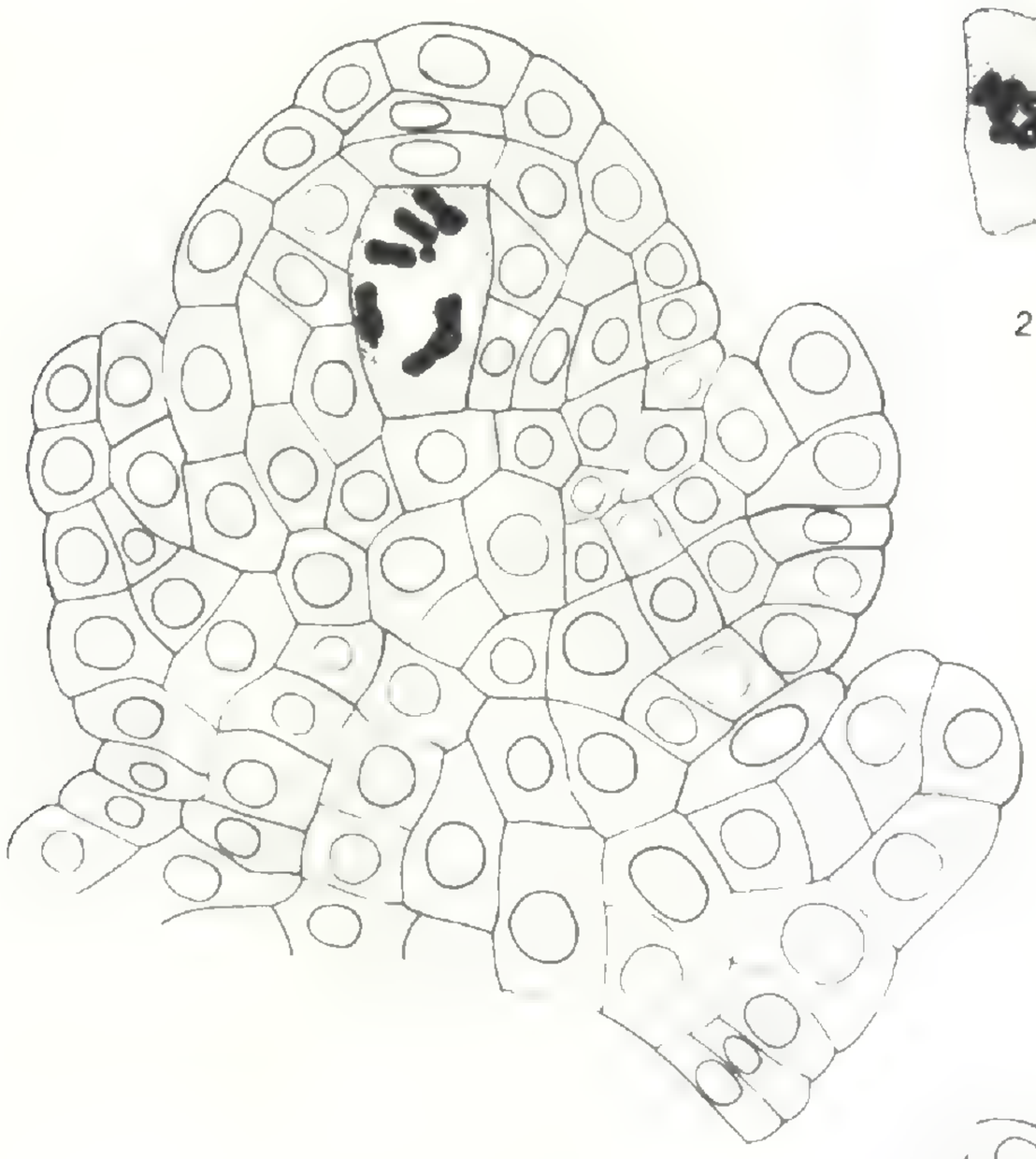
It is expected that the size of the cells will be in proportion to the number of chromosomes. Figures twelve and thirteen indicate that the increase in chromatin content, brought about by the continued multiplication of chromosomes without cell division, is accompanied by an increase in cell volume. Colchicine apparently does not inhibit growth, and there appears to be in the case of developing embryo sac an increase in cell volume over that of chromatin mass.

The suppression of meiosis and mitosis is brought about by the effect of colchicine on the cytoplasm. Spindle fibers are not formed and the normal polarity of the cell is disturbed. This apparently is increased with the prolonged effect of the colchicine on the cytoplasm. If the treatment is not too prolonged the disturbance may be temporary and the cells may recover as in the case of the microspore mother cells. The macrospore mother cells, however, appear to be permanently affected and are not able to function normally. In all cases the effect of colchicine on the cytoplasm is the same — an alteration of the normal polarity of the cell.

This study was done while the writer held fellowships granted by American Association of University Women and Radcliffe College. She is indebted to Professor Karl Sax for helpful suggestions and criticisms.

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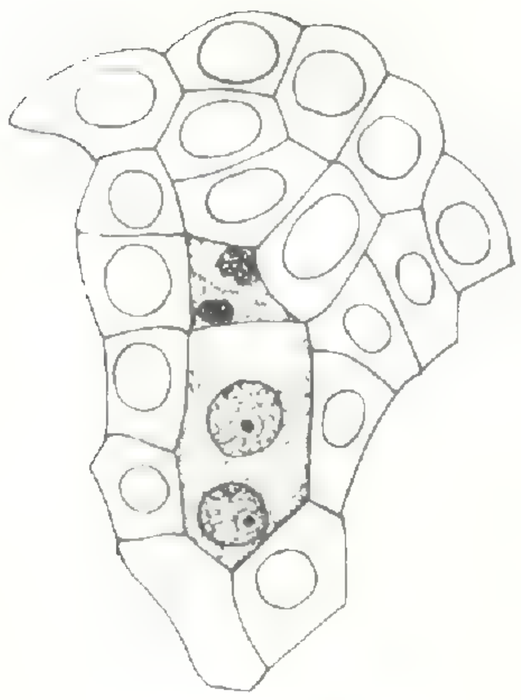
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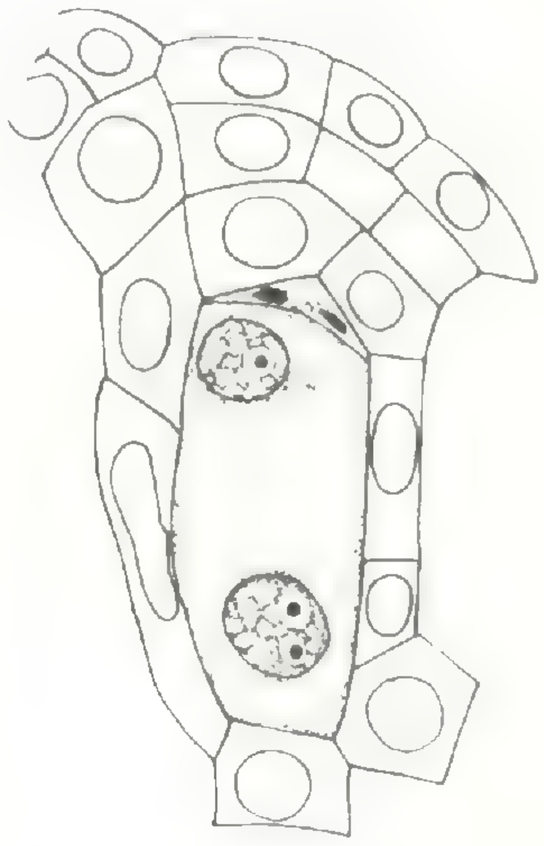
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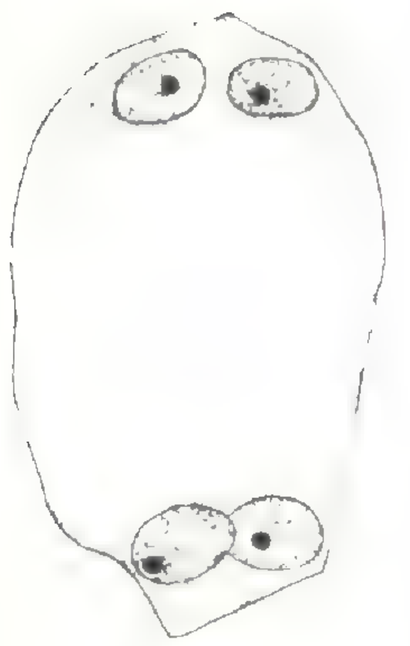
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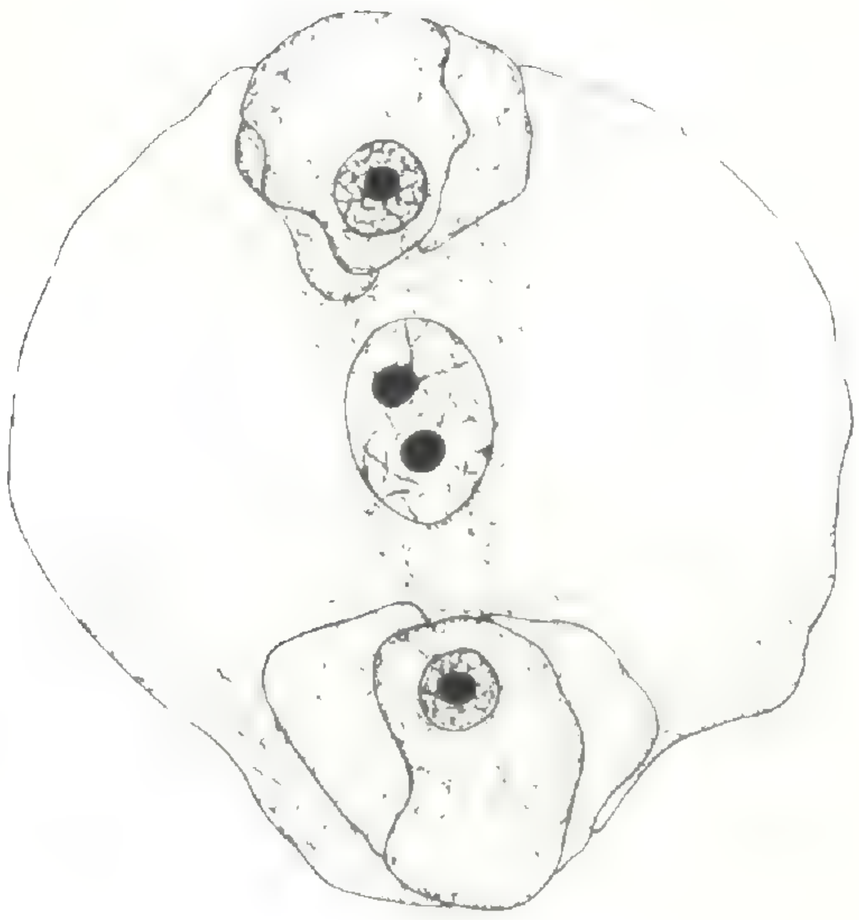
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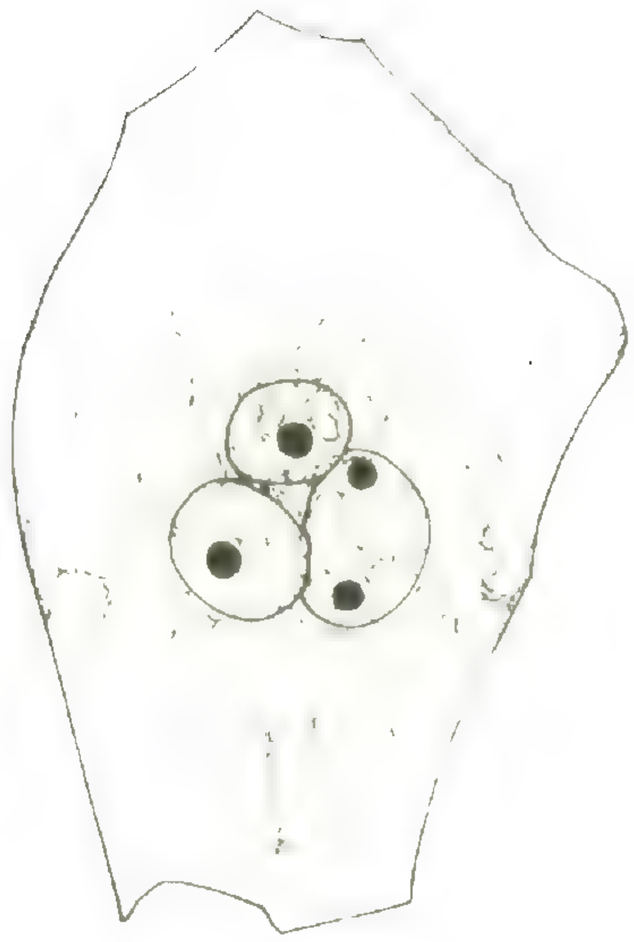
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THE EFFECT OF COLCHICINE ON THE DEVELOPING EMBRYO SAC OF TRADESCANTIA PALUDOSA

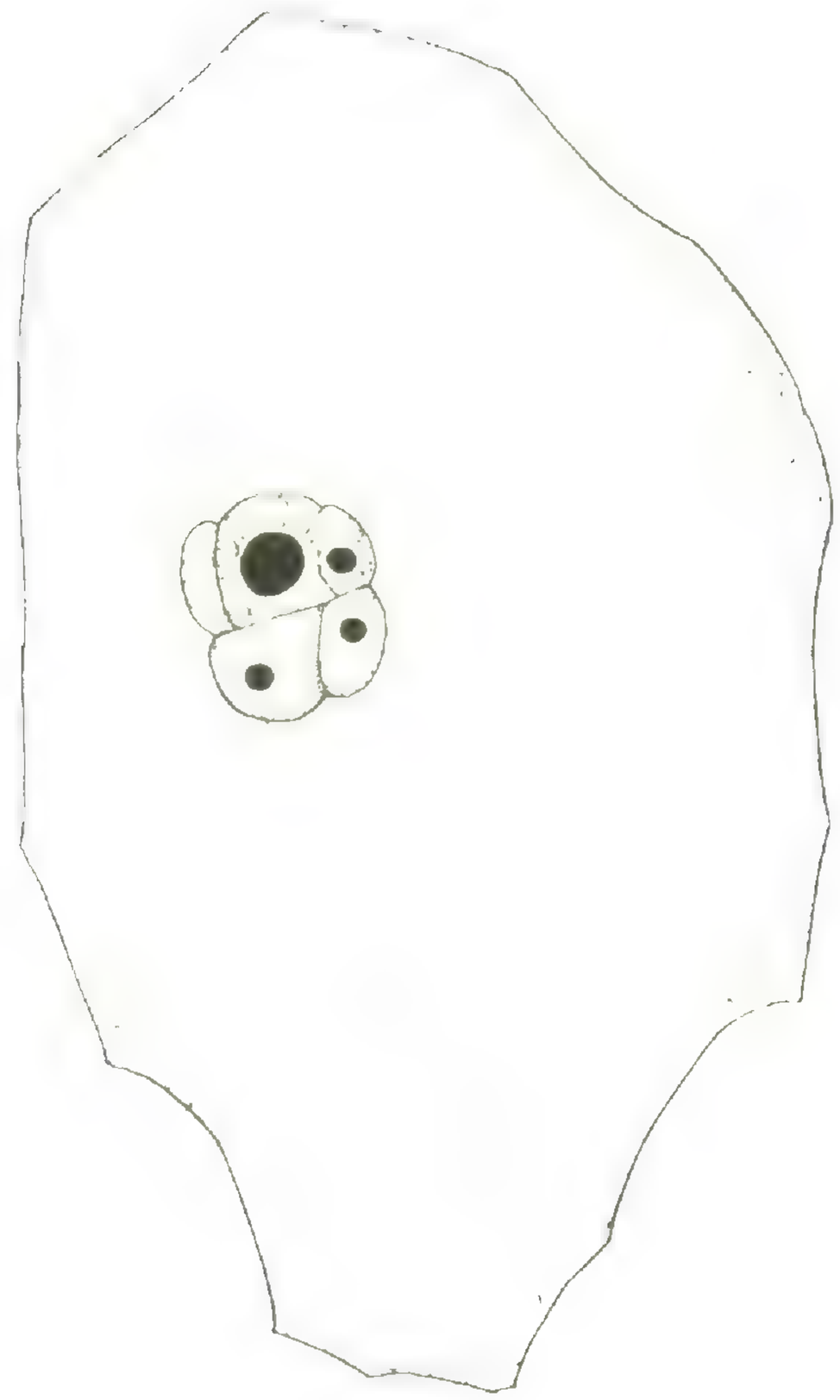
FULL-TONE — MERIDEN



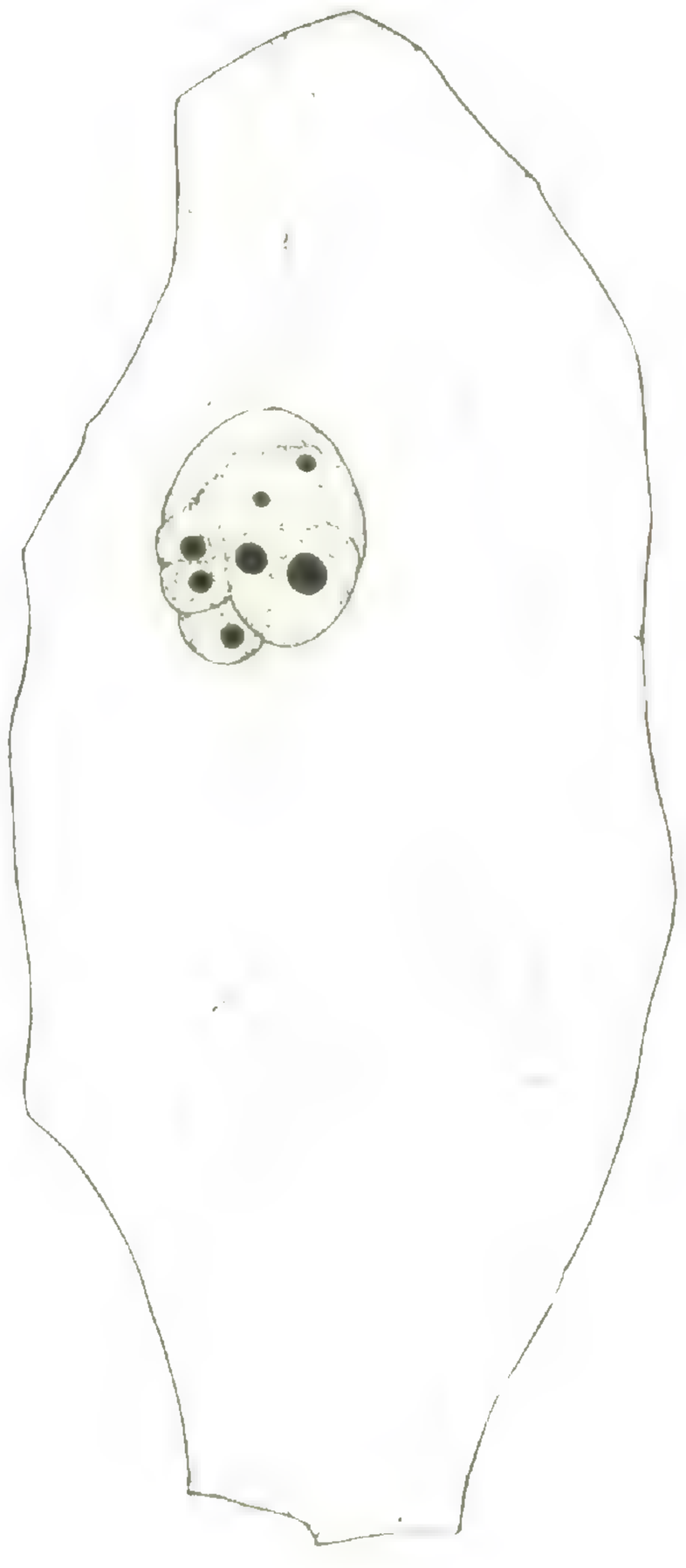
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THE EFFECT OF COLCHICINE ON THE DEVELOPING EMBRYO SAC OF TRADESCANTIA PALUDOSA

FULL-TONE — MERIDEN

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EXPLANATION OF PLATES

PLATE 224

Stages in the development of the embryo sac of *Tradescantia paludosa*. Drawings were made with camera lucida at table level × 250.

Figure 1. Young ovule, macrospore mother cell at diakenesis.
Figure 2. Macrospore mother cell, heterotypic division, equatorial plate.
Figure 3. Macrospore mother cell heterotypic division, telophase.
Figure 4. Two cells resulting from heterotypic division.
Figure 5. Homoeotypic division.
Figure 6. Portion of ovule with two-nucleate embryo sac and disintegrating apical cell.
Figure 7. Same as figure 6, later stage of development.
Figure 8. Four-nucleate embryo sac.
Figure 9. Seven-celled, eight nucleate embryo sac.

PLATE 225

Stages in the development of the embryo sac 0.1 per cent colchicine.

Figure 10. Two nucleate embryo sac, 9 days after treatment.
Figure 11. Three nucleate embryo sac.
Figure 12. Embryo sac 13 days after treatment.
Figure 13. More advanced stage in embryo sac development.

UNIVERSITY OF WISCONSIN, EXTENSION DIVISION,
MILWAUKEE, WISCONSIN.

THE ARNOLD ARBORETUM DURING THE FISCAL YEAR ENDED JUNE 30, 1938

THERE were no radical changes in the financial situation, the endowment and the income therefrom remaining the same as at the end of the preceding year. From voluntary gifts and in response to a much more limited appeal to the friends and supporters of the Arboretum than the one sent out in the early part of 1937, our extra-budgetary gift fund for current expenditure was increased by about $6100. Supplementing this unrestricted amount, about $8560 was received for restricted purposes. Of the latter $6500 was provided to help meet the cost of printing the Bibliography of Eastern Asiatic Botany, made up of a grant of $2000 from the Harvard-Yenching Institute, $500 from the Smithsonian Institution, and $4000 from an anonymous donor. Other restricted gifts include $500 for the construction of a lath house in which to exhibit the Larz Anderson collection of dwarf Japanese trees, $500 for the care of conifers, $500 for lichen research, and $125 for special photographic equipment. Three payments from the American Philosophical Society, amounting to $562.50, represent three-fourths of a grant of $750 to the director to cover a part of the cost of the revision of the Bornean species of *Eugenia*. Dr. Raup has received a grant of $1500 from the Milton Fund of Harvard University which will be utilized for financing field work in Northwestern Canada in the summer of 1939. The Arboretum is grateful to its friends and supporters for their continued interest, as the contributions, large and small, enable its staff to amplify the work of the institution and to undertake important improvements that could not be financed from its regular income.

Buildings and Grounds. — No major expenditures were needed to maintain the permanent buildings of the Arboretum. All of these are now in excellent condition, although the Administration building is now badly crowded because of the constant and steady increase of the library and reference collections. The grounds have been maintained in their usual attractive condition, and the usual program of pruning, spraying, thinning, transplanting and fertilizing has been continued. It is only by constant attention to these details that the existing plantings can be maintained and improved. The winter season was not a severe one and there was little loss from winter killing. We enjoy the full cooperation

of the City authorities in the fulfillment of the City's duty to the Arboretum through the Park, Police, and Fire Departments.

The outstanding accomplishment of the year has been the practical completion of the field work on a detailed map of the entire Arboretum area. Several earlier maps had been prepared and partly completed, but all of them were out of date. In addition to accomplishing the necessary field surveys Dr. Croizat, taking advantage of rainy days, has completed the drawing of 60 maps of which about 20 had been field checked before the close of the fiscal year. For this purpose the entire Arboretum area, approximately 265 acres, was divided into 74 compartments, each 400 x 600 ft. On each compartment map the exact position of each planted tree and shrub is shown; and on these master maps the name of each plant will be indicated. Supplementing these compartment maps 26 additional ones, on a larger scale, have been prepared to show the exact position of shrubs in crowded plantings. Once completed, this series of detail maps will be kept up to date, and as plants are removed, or new ones placed in permanent positions, the detail maps will reflect these changes. This is the first time that a detailed planting map has been prepared to cover the entire Arboretum area, and after its completion in 1938–39 it will be infinitely useful for a variety of purposes. The chief work that remains to be done is the verification and checking of the binomial plant names, and with this objective in view, Mr. Palmer has devoted two seasons' work to the task of preparing many thousands of herbarium specimens, to be checked on the accession records, in the herbarium, and in the library.

Horticulture. — The horticultural and landscape features of the Arboretum are among its greatest assets. Consistently developed in a masterful manner through many years, every effort must be devoted to the preservation and amplification of those features that have most materially helped in making the institution the outstanding one of its kind. During the year 2762 living plants, cuttings of 72 species, and 315 packets of seeds have been received; of the living plants received, 1830 came from various sources in the United States, 734 from England, 110 from Russia, 60 from the Netherlands, 50 from France and 11 from Germany. In the same period 1404 packets of seeds have been sent to fill requests from various parts of the United States and fifteen foreign countries. Supplementing this seed distribution, 1671 plants and 611 cuttings were distributed, mostly to individuals and institutions in the United States and Canada, but some in England, the Netherlands and Germany. Over 400 plants, many new to the permanent collections,

were removed from the nursery and placed in their permanent positions in the grounds. A temporary nursery to take care of about 500 plants received from American nurserymen was established on the Bussey Institution grounds, and a new, more extensive piece of land is being prepared for a permanent nursery on the Walter Street tract.

Mr. Judd was authorized to spend about two months in Great Britain and in Europe for the purpose of locating in public and private institutions desirable additional woody plants for the Arboretum collections. As a result of his summer's work the Arboretum received, in the early spring, shipments from England and the Continent containing about 373 species of woody plants, imported under a special permit granted by the Federal Horticultural Board, all being new to the Arboretum collections.

An extensive poison ivy eradication campaign was initiated with a view of reducing the number of these undesirable plants within the entire Arboretum tract, and this will be continued until the objective is attained. The old willows along the Arborway, decrepit with age, and dangerous because of falling branches, received attention during the winter months when about one-third of them were removed. Others will be taken out later until the last of them are gone. Replacement plantings of red maple and sour gum are being made. The entire juniper collection, badly damaged in the severe winter of 1933–34, was renovated and a part of it rearranged. Large plantings on Bussey Hill, the cherries and plums near the Forest Hills entrance, and considerable parts of the lilac, *Philadelphus*, *Viburnum*, and crabapple collections have been extensively fertilized in furtherance of our general plan of improving existing plantings by supplying the elements essential to good plant growth.

Close contacts have been maintained with Dr. Sax and his assistants in the extensive hybridization work that has been carried on during the spring and summer season. The practical objective here is to originate new ornamental forms, emphasizing the potential possibilities of this or that species or variety as one of the parents. In such work it is highly important that careful attention be given to the horticultural characters of the plants used for making crosses. To amplify the propagating program and to make it more efficient, two electric hotbeds were installed in the greenhouses, where investigations are constantly being made with woody plants known to be difficult to root from cuttings. Considerable progress has been made and the program will be continued during the coming year.

A notable acquisition in the late fall was the famous Larz Anderson

collection of dwarf Japanese trees. This unique collection, including plants at least 200 years old, was delivered to the Arboretum in the fall of 1937 by Mrs. Anderson, a gift of the late Mr. Larz Anderson as a memorial to his friend Charles Sprague Sargent. The plants were stored in our pit during the winter, and in the spring were placed on display in a specially designed lath house which had been constructed during the winter. This construction was made possible through a generous donation from Mrs. Anderson. This gives the Arnold Arboretum the only extensive collection of these unique plants in any public institution in America. (See: The Larz Anderson collection of Japanese Dwarf Trees, Arnold Arb. Bull. Pop. Inf. IV. 6: 31–39. 1938.)

Associated with the horticultural work is a certain amount of publicity through the daily press, through lectures, and through the preparation of special articles for various magazines. About 50 illustrated lectures on the Arboretum and its work were delivered by Dr. Wyman, involving trips to points as far away as Washington, Detroit, Cleveland, Ann Arbor and Grand Rapids. In the spring an unusually large number of garden club members visited the Arboretum to inspect the plantings under guidance of staff members. Somewhat over 2000 letters in answer to inquiries regarding ornamental plants were prepared and dispatched. In natural color photography about 250 Leica slides and approximately 2400 feet of film were prepared.

Much attention has been devoted to the Bulletin of Popular Information, the usual number having been prepared and issued during the year. The mailing list now approximates 1600, and the demand for the publication is increasing, clearly indicating that it fills a distinct need.

Supplementing the regular work of the Arboretum, Dr. Wyman and Professor Rehder have devoted considerable time and energy in cooperating with the American Joint Committee on Horticultural Nomenclature in revising Standardized Plant Names. This involved an actual examination of over 1200 nursery catalogues from all over the world, as well as many standard reference works and accredited manuals. The net result is the addition of approximately 40,000 new names to this reference work. The Arboretum does not sponsor Standardized Plant Names, but as a part of its service to horticulture, made the resources of the institution available to the committee charged with the preparation of the lists. Of direct benefit to the Arboretum from this project was the compilation of a card catalogue of nurserymen's offerings, through which we have actually received to date over 500 species and varieties of woody plants new to the Arboretum plantings, and have

located about 1000 more in various European nurseries which we shall attempt to acquire in the next few years.

Cytogenetic Laboratory. — Cytological analyses of X-ray effects have been completed during the past year, under the direction of Dr. Sax and his associates. These results have thrown some light on the effect of irradiation on both chromosome structure and gene mutation. The irradiation work is being continued, using heat, X-rays, and neutrons.

The irradiation of seeds and seedlings of ornamental shrubs has given interesting results. High dosage with X-rays produces gross chromosome aberrations which result in an immediate effect on plant growth. Dwarf and spreading types of cherries have been produced; and dwarf types of roses, lilacs, and apples were obtained. Second generations of these X-rayed plants should also show additional variation caused by gene mutation. This work is being continued on a larger scale, since we now have adequate nursery space for growing experimental plants.

Crossing work with ornamental shrubs and trees has been continued, with successful results in the cherries, lilacs, roses, and apples. Open pollinated seeds have also been planted, with the hope that natural hybrids will be obtained. Natural hybrids should occur frequently in the Arboretum, where single specimens of each of several species are growing in close proximity. Of the artificial hybrids already obtained, the more promising include a dwarf apple, crosses of several rose species with *Rosa rugosa,* a chlorophyll-deficient lilac hybrid, a weeping form of *Crataegus,* and a cross between *Forsythia intermedia* and *F. ovata.*

Wood anatomy. — To facilitate the work of Dr. Bailey, the entire Arboretum wood collection, about 5600 specimens, was transferred to the Biological Laboratory, and incorporated in the collections of the Bussey Institution and the Biological Laboratory. There new quarters have been provided and equipped to house the combined collections now approximating 22,000 specimens, supplemented by nearly 17,000 microscope slides.

During the year Dr. Bailey devoted much time to the study of the comparative structure of xylem in various plant families as a basis for a contemplated monograph on the cambium and its derivative tissues. Dr. Senn, a National Research Fellow, with the assistance of Mrs. Vestal, made a comprehensive study of the secondary xylem in the three subfamilies of the Leguminosae, these data now being correlated with the available cytological and taxonomic evidence. Mr. Barghoorn has under-

taken an extensive investigation of ray ontogeny in the xylem of both the gymnosperms and the angiosperms. During the year about 1200 photomicrographs, with accompanying lantern slides, were made in connection with the several research projects. All work accomplished by Dr. Bailey and his associates is closely coordinated with that of the staff members of the Division of Biology working in the same general field, and all available collections of anatomical and histological specimens, photographs, and microscope slides have been catalogued and rendered available for general use.

Plant Pathology. — The specialized herbarium in this unit serves a two-fold purpose, the general collections needed for constant reference and for the use of students, and the specialized collections as auxiliaries to or subjects for research. The herbarium has been steadily increased in both fields since the department was established in 1928. During the past year notably important research additions were made as the result of a collecting trip made by Dr. Faull in November and December, 1937 to Mexico and Guatemala.

The utilization of the extension services afforded by the laboratory continues to expand. Inquiries during the past season have been particularly numerous because of the prevalence of certain contagious plant diseases due to the unusually humid conditions. Among the diseases frequently reported, those appertaining to the Juniperus-Pomaceae rusts, crown rot of the dogwood and maples, tree wilts of the Verticillium types, and the coniferous rusts are being actively investigated. Work continues to be done on the Dutch elm disease, for the Arboretum is cooperating in the attempt to eradicate this threatening pest in America. Dr. Faull recently made an independent survey of the present situation in reference to this serious menace to our elms, visiting infected areas in New York, Connecticut and New Jersey. Maps and records of the Dutch Elm Disease Eradication offices were examined, Federal and State officials interviewed, and critical parts of the infected areas were inspected. Generally speaking, there has been no significant spread of the disease except in New York. There an area of about 900 square miles has been added by the detection of the disease in Dutchess County. In many places in New York and elsewhere the infected areas have been notably reduced as a result of the eradication and sanitation campaign now being actively prosecuted. There is still hope that complete eradication can be accomplished. Progress is being slowed up and success threatened by continuing the project as a W.P.A. activity. It is emphatically believed that the project should be turned over imme-

diately to the United States Department of Agriculture, to be supported from the regular appropriation of that unit.

The research activities have been largely centered on the crown rot of the dogwood, wilt diseases of the elm, maples and honey locusts, and the rusts of conifers. The cause of the crown rot has been determined and the research has been extended to various other broad-leaved trees. A new, highly virulent wilt disease of the honey locusts has been discovered and its cause demonstrated. Attention is now being given to control measures. In the coniferous rusts a monograph of the genus *Uredinopsis* has been completed and two publications are about to be issued. In addition, work has been completed on rusts of the genera *Pucciniastrum* and *Calyptospora*.

The Herbarium. — During the year 25,252 mounted specimens were distributed into the herbarium, bringing the total to 479,724 sheets of woody plants. Of these about 6300 came from India, Indo-China, and Malaysia, 2300 from China, 2700 from other parts of Asia, 5200 from North America, 2500 from Central and South America, 1800 from Europe and western Asia, and 1100 from Australia and Africa. The Japanese collections were greatly increased by the purchase of the Kenzo Shiota herbarium, 7331 sheets. Of these 2279 were added to the Arboretum herbarium, 4882 herbs and ferns transferred to the Gray Herbarium, 228 cellular cryptogams to the Farlow Herbarium, and 179 orchids to the Botanical Museum.

Within the year important new accessions, not yet mounted, approximately 48,000 numbers, often with numerous duplicates, have been received. Of these 3570 are from Hainan, Kwangsi, Kiangsi and Kwangtung, received from Lingnan University, each with four or five duplicates; 14,300 numbers from the Wang collection in Yunnan, through the Fan Memorial Institute of Biology, Peiping; 2778 numbers of Hainan plants from Sun Yatsen University, also with duplicates; 761 from the Lu Shan Arboretum; 612 Chinese plants from Handel-Mazzetti, collected by Licent; 1139 specimens from the Copenhagen Botanical Museum from the old Indian collections of Wallich, Voigt, and Didrichsen; 344 Helfer Indian plants from Prague; 385 numbers with numerous duplicates of Burma plants from Dr. Dickason of Judson College, Rangoon; 723 Sumatra and Philippine plants from the University of Michigan; 200 Bornean and Siam plants collected by Coolidge and Griswold; 857 Manchurian plants collected by Skvortzov; 2373 numbers of Asiatic plants from Leningrad, in exchange; 2500 numbers with ample duplicates, Brass New Guinea collections, second Archbold expedition

(Fly River region); 539 numbers from the Puget Sound region, collected by Thompson, with many duplicates; 350 Mexican plants collected by Hinton, 532 by Gentry, 1000 by Matuda, 486 by Lyonnet; 218 from Skutch, Costa Rica; 202 from Gentle, Honduras; 1290 Brazilian plants from Krukoff, 550 from Ducke; 2144 numbers from plants collected in the Arboretum; and 2922 specimens of Boraginaceae from various sources for identification. To the collection of photographic negatives of types and critical specimens 411 new negatives were added, bringing the total to 3723.

Loans to specialists in Europe, Asia and America amounted to 3866 specimens, while on our general exchange account 45,521 duplicates were distributed to institutions in Europe, Asia, Malaysia, Australia, North and South America. Supplementing this distribution of duplicates, 21,366 mounted specimens, representing herbaceous plants and ferns, were transmitted to the Gray Herbarium, 358 cryptogams were sent to the Farlow Herbarium, and 474 orchid specimens to the Botanical Museum. A general survey of the entire exchange situation was made, the net result being the partial elimination of institutions to which the Arboretum had sent much in the past and received little in return, and the development of important new exchanges with institutions with which we had formerly little or no exchange relations. The net result has been excellent in that we are to receive many important historical collections on an exchange basis, material that could be secured in no other way.

The number of visitors consulting the herbarium increased considerably, including not only botanists from various American institutions, but also individuals from the Netherlands, Germany, Japan, New Zealand, and China. Miss Luetta Chen, a graduate student at Oberlin College, spent about two months working in the herbarium and library on her thesis during the winter. Office and herbarium space has been provided for Dr. Lawrence Ames of the United States Department of Agriculture throughout the year who continues his studies at the Arboretum on *Berberis* species in relation to rust resistance.

During the year the important Merrill-Walker Bibliography of Eastern Asiatic Botany was issued, a quarto volume of 719 pages. In association with Dr. Perry much work has been accomplished on the Old World *Eugenia* problem, several papers published, and others nearing completion. In association with Miss Freeman, the major part of the work on a revision of *Microtropis* has been completed. Prof. Rehder has concluded his study of the ligneous plants described from Eastern Asia by Léveillé, started in 1929 and involving the critical study of about

1200 species and varieties; he has devoted much time to the identification of plants cultivated in the Arboretum, and the current collections of Chinese plants as received. Dr. Johnston continues his studies on South American plants and on the Boraginaceae. Dr. Kobuski has continued his *Eurya* investigations. Dr. Allen has published a synopsis of the Chinese species of *Litsea*, *Neolitsea* and *Actinodaphne*, and is continuing her studies of Chinese Lauraceae. Dr. Raup has published the results of the Black Rock Forest studies based on his summer's work there in 1937. Dr. Croizat has published a number of papers on the Euphorbiaceae and plans to continue his studies. Dr. Jones has prosecuted work on the flora of the Puget Sound region and has initiated work on a revision of the American species of *Sorbus*.

In further development of cooperative botanical exploration for the benefit of the Arboretum, grants were made to the Fan Memorial Institute of Biology, Peiping; Lingnan University and Sun Yatsen University, Canton; Judson College, Rangoon, Burma; Royal Botanic Garden, Calcutta, and the Madras Museum, Madras, India; the Botanic Gardens, Singapore; Botanic Gardens, Buitenzorg, Java; the New York Botanical Garden for work in Colombia; the Missouri Botanic Garden for work in Panama; the University of Michigan for work in the Philippines; the Atkins Institution for work in Cuba; the University of Minnesota for Dr. Abbe's projected trip to the unexplored eastern shore of Hudson's Bay; the Botanical Museum for work in Louisiana and Mississippi by Mr. Correll; to K. Uno for field work in Japan; to Dr. A. Pételot for field work in Indo-China; to the Richard Archbold Expedition for the exploration of New Guinea; and to J. W. Thompson of Seattle for field work in British Columbia.

The making of these modest grants from the unrestricted gift funds of the Arboretum has proved to be unquestionably the most economical and at the same time the most efficient method of increasing its essential reference collections. Combined with the botanical field work arrangements have been completed for securing extensive collections of seeds, particularly from those regions from which we may expect additions to the list of hardy species that may thrive in the New England climate. The accessions from this source have been important in the past few years but give every promise of becoming infinitely more important in the immediate future. Such collections supply us with not only the important study set for our own herbarium, but also ample duplicates for exchange purposes, placing the institution in a most favorable position for negotiating important new exchanges.

An important herbarium innovation initiated during the year has

been the breaking down of the large and cumbersome genera by geographic areas, stressing first the Old World representatives. For this purpose new jute genus covers in eleven different colors have been selected. The task was approximately one-third completed before the end of the year. The net result is a great saving of time when one is making identifications by comparison. Associated with this work the task of inserting clipped or typed descriptions and critical notes has been extended, and about 20,000 items have been inserted during the year. The card catalogue index to new genera, species, varieties, and illustrations of ligneous plants now contains 117,387 entries, 3774 having been added during the year. Preliminary work has been done on the proposition to clip and paste all the entries in Index Kewensis and its nine supplements in a single alphabetic sequence in loose-leaf ledger form. Once completed this will be a vast improvement and one that will greatly increase the efficiency of our staff.

The Library. — At the end of the fiscal year the library contained 43,557 bound volumes, 12,303 pamphlets, 18,178 photographs, 200 unbound volumes, 2500 slides, and several thousand nursery catalogues. Additions during the year include 585 volumes, 300 pamphlets, and 369 photographs, including 173 of lilacs, the gift of Mrs. Susan D. McKelvey for whom they were made for publication in her book, The Lilac. A total of 10,231 cards were distributed in the various indices, 1510 slips were filed in preparation for a supplement to the author and subject catalogues of the library, making the number now available for publication 26,209. Two hundred and eighty volumes were bound. The number of inter-library loans increased. Fifteen new periodicals have been added to our subscription and exchange lists. To facilitate the work of our staff members in the Biological Laboratories, 309 publications on wood anatomy and morphology were temporarily deposited in these Laboratories. A new stack of five double sections was acquired and installed in the upper library to relieve the congestion in the American periodical room, and a new map case was designed and constructed to accommodate the map collection.

The Atkins Institution of the Arnold Arboretum, Soledad, Cienfuegos, Cuba. — During the year much thinning has been done where there were too many specimens of a single species. Poorly located and sickly specimens have been removed where the same species was represented by better specimens in suitable locations. The extensive native wood lot is now much easier to control as undesirable vines and spiny

shrubs have been largely eliminated. Several hundred young timber trees have been received from the Bureau of Mines of the Cuban government, and planted in the native wood lot. All the native orchids have been assembled in one particular area in this section.

The new cactus garden is now well established. The large number of cacti and other succulents now being received has made it necessary to provide extra space for these plants. A high, sloping, partly rocky area of approximately 12 acres has been selected for this succulent garden, and is being prepared for planting. This should provide ample space for immediately contemplated and future plantings. The old garden has now been fully planted with young palms and the old storm-wrecked trees in this area are being gradually removed as conditions warrant. A collection of fruit-bearing trees has been established in the Harvard House grounds and this will be gradually extended, thus supplying the material essential to a comprehensive breeding project. A small grant from Arboretum funds enables the institution to subsidize botanical and horticultural explorations in Cuba.

The opening of the new road direct from Havana to Cienfuegos via Soledad has greatly increased the number of visitors to the Garden and a number of official visits have been made by the Governor of the Province of Santa Clara and many other persons to whom we are very glad to demonstrate what the Institution has accomplished in bringing new plants into cultivation in Cuba. In recognition of their repeated visits and the many gifts which they have made, not only of living material but of additions to the herbarium, on nomination by the Custodian, the Corporation appointed the following individuals to the newly established position of Collaborators of the Atkins Institution of the Arnold Arboretum. These new Collaborators, all distinguished botanists or individuals interested in forestry and sylviculture, are:

Dr. Juan T. Roig y Mesa
Brother Leon (Joseph Sylvestre Sauget y Barbier)
Dr. Gonzalo Martinez Fortun y Foyo
Dr. Julián Acuna y Galé
Dr. Alberto J. Fors y Reyes
Dr. Jorge Dechapelle
Dr. José Perez Carabia

The interests of these gentlemen has caused them frequently to spend a considerable amount of time at Harvard House so that the question of space has become acute. Thanks largely to the generosity of Mrs. Atkins, an annex is being built which will relieve this situation and make it possible to offer hospitality to visiting scientists from other universities.

Professor James A. Needham of Cornell spent nearly two months studying the metamorphosis of the Cuban dragonflies in the ponds in the Garden and was delighted with the results of his trip. Aside from this the Harvard College Fellowships for work at Soledad were held by Charles William Heimsch and Elso Sterrenberg Barghoorn. Doctor Harold E. Senn of the University of Virginia, holding a National Research Council Fellowship at Harvard University, also spent some months at the Garden preparing cytological material of flowers of many species of Acacieae. Doctor David E. Davis went to Soledad early last spring, aided by an anonymous friend of the Garden, to continue his studies of the breeding habits of the Ani, *Crotophaga*, and is still down there. Doctor Barbour visited the Garden as usual in February, and Doctor Merrill in March.

Up to the end of 1937 approximately 700 species were added to the living collections, these being received by gift and in exchange from a great variety of sources from the tropical and subtropical regions of both hemispheres. The planting list at the end of the year shows approximately 2750 species and varieties actually in cultivation at Soledad.

Publications. — The usual issues of the Journal and the Bulletin of Popular Information were prepared and regularly issued. Again as usual, a number of technical, semitechnical, and popular articles written by staff members were published in standard serials. The Merrill-Walker Bibliography of Eastern Asiatic Botany mentioned in the last annual report, was issued in May 1938. It is the most extensive publication issued during the year, comprising 719 quarto pages. Second in importance is Mrs. Susan Delano McKelvey's comprehensive treatment of the species of *Yucca* of the southwestern United States, part 1, a small quarto of 150 pages, beautifully printed on Worthy permanent paper, illustrated by 80 collotype plates. This was issued as a special publication of the Arnold Arboretum in a limited edition of 325 copies, publication being rendered possible by the author's generous offer to meet a part of the printing costs, particularly the plates. This appeared in June 1938.

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E. D. MERRILL, Director.

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CORRECTIONS

Page 135, lines 5 and 15, for *Leveilleanus* read *Leveillanus*.

" 175, line 2, for **IX** read **XI.**

" 234, line 23, for *Syllisium* read *Syllysium*.

" 241, line 9 from below, for *Tsiang* read *Tsang*.

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Synonyms are printed in *italics;* new names in **bold-face** type.

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