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NOTES ON THE USE OF Ca^{45} IN DETERMINING LEAF THICKNESS

Charles R. Gunn 1/

Abstract

The usefulness of leaf thickness as taxonomic character can be enhanced by a simple, rapid method of determining dry leaf lamina thickness. Several experiments were conducted with Calcium^{45} testing the principle that thicker laminae absorb more soft beta particles than thinner laminae. By measuring the changes in particle intensity, mass is obtained; to the degree that thickness correlates with mass, one has determined the thickness. Shards of Magnolia grandiflora L., Asimina triloba (L.) Dunal, and Vicia americana Willd. were used. Results of these tests indicate that there is a correlation between the amount of beta particles passing through the laminae of dry leaves and the thickness of the laminae.

Introduction

Leaf characters are commonly used in taxonomic treatments. Leaf thickness, if reported, usually is determined by inspection. Aside from this empirical method, there is apparently no simple method of ascertaining thickness. Thickness has been determined by 1) use of cursory examination, 2) use of either freehand or microtome sections in conjunction with an optical-measurement system, 3) use of a micrometer or, 4) use of a punch-weigh system. The section-optical-measurement system is not simple; the micrometer method results in large error; and the punch-weighing system is time consuming and cannot be applied to leaves with narrow laminae. The usefulness of leaf thickness as a taxonomic character would be augmented if objective measurement techniques were available.

Radioactive isotopes, as the sources of beta particles for determining thickness, have had practical application in industry. Zumwalt (1954) reported two common uses of beta particles in industry. These are the determination of the thickness of continuously moving materials, and the concentrations of solutions. Measurements are based on two principles. The absorption of the beta particles as they pass through a material

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provides an indication of the thickness of the material. The degree of backscattering of beta particles from a substance also can be used to determine thickness.

The principle of absorption of beta particles as they pass through a material is applicable to leaf studies. The few investigations that have been published are concerned with water content of leaves, leaf thickness being a complicating variable (Nakayama and Ehrler, 1964; and Yamada, et al., 1958). No reference has been found to studies undertaken from the taxonomic point of view.

When a leaf is irradiated with beta particles, the intensity of the rays decreases as a result of interaction with the leaf. Thickness may be calculated from the equation

$$I=I_o e^{-\mu d}$$

where d is the weight per unit area and μ the absorption coefficient (a constant, which is determined only by the maximum energy of the beta particles and is peculiar to the nuclide used); for Ca^{45} it is 0.128. The logarithmic constant e is 2.718, I_o is the unmodified intensity, and I is the modified intensity. When d=0, $I=I_o$. Therefore when thickness is measured by using beta particles, the expression is not in units of distance, but in units of weight per unit area, e.g., milligrams per square centimeter. The results can also be reported as counts per unit of time from a standardized source. By inserting the leaf between the radiation source and the Geiger-Müller (GM) tube, the intensity of the radiation changes proportionately to the leaf mass. Thus by measuring such intensity changes, mass is obtained; to the degree that thickness correlates with mass, one has determined the thickness.

Not all beta sources are amenable to herbarium leaf studies. Sources such as $Strontium^{90}$, $Yttrium^{90}$, and Radium D&E (all used in industry) are not useful in leaf studies because of the strong penetration capacity of their beta particles. Sources such as $Calcium^{45}$ and $Sulpher^{35}$ are applicable because of the weaker penetration capacity of their beta rays. The former have been labelled hard sources, the latter soft sources.

Materials and Methods

A Radiation Counter Laboratories Scaler-ratemeter, model 20324 was used to measure and record the beta radiation (Fig. 1). The lead shields covering the plastic planchets (Fig. 2) holding the sources contained 300 milligrams of lead per square centimeter. This thickness of lead absorbed the radiation from all sources tested. The holes drilled through the shields were 1/16 inch in diameter. These holes allowed the passage of beta

rays from the source through the shield and test material to the GM tube. Since the isotopes were not uniformly distributed in the matrices, the shields were taped to the planchets. The distance between the source and the test material was 2.5 mm.; the distance between the tested material and the GM tube, 11 mm. The background count averaged 9.2 counts per minute with a range of 11.8 to 6.3 counts per minute. The high voltage varied from 810 to 830, usually holding steady at 820, a setting recommended by the manufacturer.

Sixty herbarium sheets of Vicia americana and its varieties (Gunn, 1968) were selected to represent the variation of leaflet thickness in its North American range. The leaflets were selected at random from these sheets. The count per minute from the open source was ± 2700.

A single leaflet of Vicia americana Willd. was tested for one half hour; readings were taken every minute using a 1-hole plate. When the resulting information was analyzed by means of maximum curvature, it was found that a 3-minute count interval was sufficient.

The thickness of V. americana leaflet shards was also measured by using a compound microscope equipped with an ocular micrometer and an oblique above-stage microscope light. The measurements were recorded in increments of 11.1 microns, rounded to the nearest whole number.

Results and Discussion

Saran Wrap with Ca^{45} as the beta producing isotope was used to test the equation $I=I_0e^{-\mu d}$. In a sequence of tests, layers of Saran Wrap were added (from 1 to 13) to the top of a one-hole plate, and readings were taken every 3 minutes. In Fig. 3 the layers of Saran Wrap were plotted against the log of the counts per minute producing nearly a straight line. These results illustrate that thickness can be determined by counting the beta particles that are not absorbed by the test material. The linear arrangement of the averaged counts per minute in Fig. 3 proves this point. The extension of this concept from a homogeneous material (Saran Wrap) to a hetergeneous material (leaf laminae) was tested.

Radium D&E, Carbon 14, and Calcium 45 were surveyed with shards of two test leaves taken from herbarium (dry) material possessing obvious differences in thickness, Magnolia grandiflora (magnolia) and Asimina triloba (pawpaw). Of the three isotopes used, only Ca^{45} gave results which were commensurate with the 8.1 thickness ration of dried magnolia and pawpaw. The results from the Radium D&E test were inconclusive, since there was more intra- than inter-leaf variation. Readings

obtained from C^{14} were too close to the background count to be usable.

Before testing Ca^{45} on the other leaves, lead shields with 1, 2, and 3 holes (Fig. 2) were used with the magnolia and paw-paw leaves. In Fig. 4 each dot represents five, 3-minute counts averaged. Based on the results of the 3-hole test when compared to the 1-hole test, the Ca^{45} concentration was trebled in Vicia americana leaflet tests. This increased the 1-minute count through a 1/16 inch diameter aperature from ± 385 to ± 2700 counts per minute, a seven-fold increase.

Magnolia shards with the red indumentum of hairs intact absorbed as much beta radiation as the same shards when denuded. This indicates that pubescence is not a factor affecting the outcome of this type of thickness determination.

When the leaflets of Vicia americana were introduced into the system, the counts ranged from 846 (the thickest leaflet) to 1874 (the thinnest leaflet). These counts were converted to logs and plotted against the measurements recorded in microns obtained from the optical system. These results are given in Fig. 5. The larger dots represent the 95 percent confidence limits of the population means. The means are represented by the smaller dots. The decrease in the counts per minute with the increase of leaflet thickness indicates a direct relationship between leaflet thickness and the amount of absorbed beta particles. A comparison of Figs. 3 and 5 reveals that while the leaflet means are more variable than the Saran Wrap means, the test did measure leaflet thickness. An analysis of the leaflet data indicates that 57 percent (r^2=56.94) of the variation in the counts per minute can be attributed to the thickness of the leaflets.

The measurements in microns are at best an estimate. Therefore, the 57 percent correlation figure may be low because of errors in the measurement system. Additional tests on other leaves using other standards would help to establish the correct correlation between true leaf thickness and the amount of absorbed beta particles.

Literature

Gunn, C. R. 1968. The Vicia americana complex (Leguminosae). Ia. Jour. Scie. 42(3):171-214.

Nakayama, F. S. and W. L. Ehrler. 1964. Beta ray gauging techniques for measuring leaf water contents changes and moisture status of plants. Plant Physiology 39(1):95-98.

Yamada, Y. S. Tamai, and T. Miyaguchi. 1961. A-19. The measurement of thickness of leaves using S^{35}. AEC-tr-4482. Translation Series. U.S.A.E.C.

Zumwalt, L. R. 1954. The best performance from beta gauges. Nucleonics 12(1):55-58.

Mention of material by trade-name implies no preference over similar equipment made by other manufacturers.

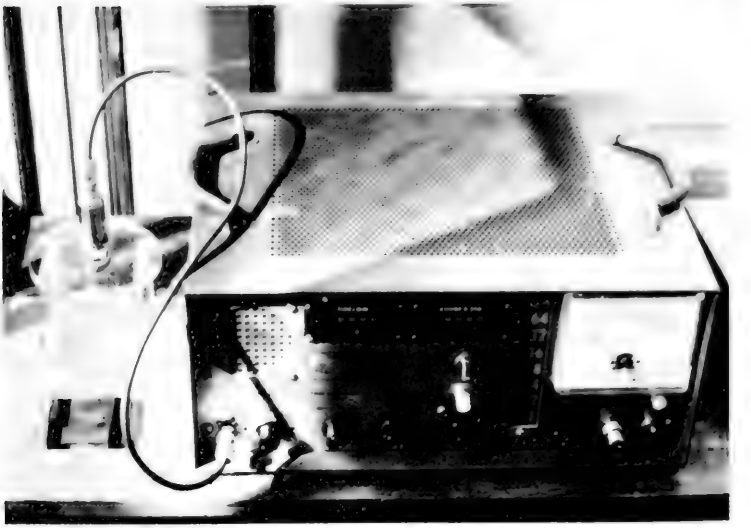

Fig. 1. Radiation Counter Laboratories Scaler-ratemeter, model 20324.

Fig. 2. A 2-hole lead shield taped to a planchet and carrying slide with a Vicia americana leaflet.

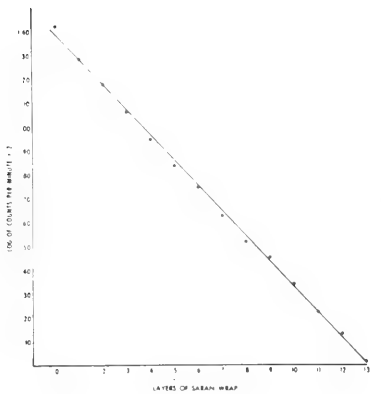

Fig. 3. Layers of Saran Wrap plotted against log of counts per minute plus 2. Ca^{45} count per minute was ± 2700.

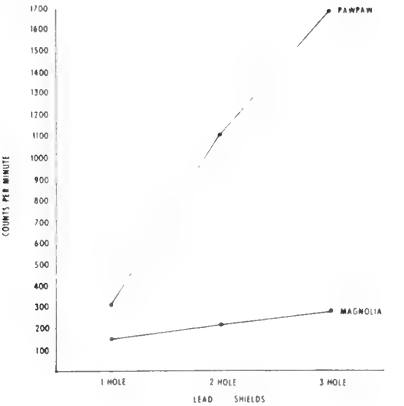

Fig. 4. Pawpaw and magnolia leaf shards tested with 1-, 2-, and 3-hole lead shields. The Ca^{45} count per minute was ± 3°5.

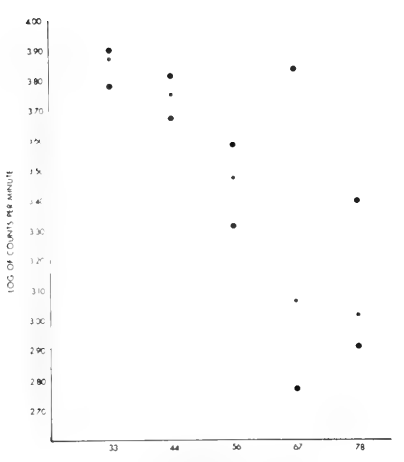

Fig. 5. Vicia americana leaflets thickness in microns plotted against the logs of the count per minute. The Ca^{45} count per minute was ± 2700. The larger dots represent the 95% confidence limits of the population means. The smaller dots represent the population means.

ADDITIONAL NOTES ON THE GENUS VITEX. VIII

Harold N. Moldenke

VITEX KUYLENII Standl.

Additional bibliography: Moldenke, Phytologia 16: 502. 1968.

Additional citations: GUATEMALA: Izabal: Jones & Facey 3500 (W—2565868); Jones, Proctor, & Facey 3031 (W—2565867). BRITISH HONDURAS: Gentle 5551 (Mi).

VITEX KWEICHOWENSIS P'ei

Additional bibliography: Moldenke, Phytologia 15: 251. 1967.

The Tsiang 5831 collection, cited below, is marked "paratype" on its label, but the original description of the species by P'ei plainly designated Tsiang 6317 as the type collection. I see no valid reason for giving any other collection a type designation.

Additional citations: CHINA: Kweichow: Tsiang 5831 (W—1575154).

VITEX LANUGINOSA Mohl

Synonymy: Vitex lanuginosus Mohl, Beitr. Anat. & Physiol. Gew. 85. 1834.

Bibliography: Mohl, Beitr. Anat. & Physiol. Gew. 85. 1834; Mohl, Ann. Sci. Nat. Bot., ser. 2, 3: 319. 1835; Selling, Bishop Mus. Spec. Publ. 38: 274, 275, & 411. 1947.

I know nothing about this plant beyond what is given in the bibliography above. It seems most probable that the binomial is the result of a typographic error or an error in copying.

VITEX LEUCOXYLON L. f., Suppl. Pl. 293. 1781 [not V. leucoxylon Blanco, 1895, nor Naves, 1918, nor Roth, 1956, nor Roxb., 1814, nor Span., 1856, nor Schau., 1893].

Additional synonymy: Vitex leucoxylon Willd. ex Roxb., Fl. Ind., ed. 2 [Carey], 3: 74--75. 1832.

Additional & emended bibliography: J. F. Gmel. in L., Syst. Nat., ed. 13, pr. 1, 2: 963 (1789) and pr. 2, 2: 963. 1796; Pers., Sp. Pl. 3: 361. 1819; Steud., Nom. Bot., ed. 1, 888. 1821; Roxb., Fl. Ind., ed. 2 [Carey], 3: 74 & 75. 1832; Gamble, Man. Ind. Timb., ed. 1, 298. 1881; Watt, Econ. Prod. India 5: 294 (1883), 6: 191 (1883), and 7: 255. 1883; Gamble, Man. Ind. Timb., ed. 2, 542. 1902; Prain, Beng. Pl., ed. 1, 2: 832 & 833. 1903; Gamble, Fl. Presid. Madras 2: 1102 & 1103. 1924; Stapf, Ind. Lond. 6: 478 & 489. 1931; H. F. MacMillan, Trop. Plant. & Gard., ed. 5, pr. 3, 197, 198, & 529. 1962; Prain, Beng. Pl., ed. 2, 2: 621, 622, & 1012. 1963; Sen & Naskar, Bull. Bot. Surv. India 7: 60. 1965; Sebastine & Ramamurthy, Bull. Bot. Surv. India 8: 180. 1966; Moldenke, Phytologia 15: 253 & 316 (1967) and 16: 500 & 501. 1968.

Jain (1963) records this species from Madhya Pradesh, India, while Sebastine & Ramamurthy found only a "few" in Madras, citing a National Herbarium number 16096. Prain (1963) records it from

Orissa, but comments "on islands in the river Mahanadi; perhaps only introduced". He cites the first of the Watt references given by me in the bibliography above as "E. D. 5: 160", but this appears to be a paragraph reference, not a page reference! An additional vernacular name recorded for the plant is "kaddu-nochchi".

Additional citations: CULTIVATED: India: Herb. Drake s.n. [Hort. Bot. Calcutt.] (W--2497125).

VITEX LIMONIFOLIA Wall.

Additional synonymy: Vitex limonifolia "Wall. ex Kurz" apud Deb, Bull. Bot. Surv. India 3: 315. 1961. Vitex aminifolia Wall., in herb.

Additional bibliography: Gamble, Man. Ind. Timb., ed. 1, 296 (1881) and ed. 2, 541. 1902; A. Chev., Cat. Pl. Jard. Bot. Saigon 36. 1919; Deb, Bull. Bot. Surv. India 3: 315. 1961; Moldenke, Phytologia 15: 253--254. 1967.

Chevalier (1919) records this species as cultivated in Vietnam under the common name of "binh linh vàng". In Burma it is called "kyungaukmwe". In Thailand the name "tin nok" is applied both to this species and to V. peduncularis Wall. Deb (1961) says of the plant "shoots hairy or wooly, petiole broadly winged, panicles long branched, fulvous hairy" and cites Mukerjee 2943.

Banterngsuk describes the plant as a large tree, common in dry deciduous forests in Thailand; Rock also refers to it as a common tree in that country. It has been collected in anthesis also in July and December. The corollas on Banterngsuk 6 are described as having been "purple".

Additional citations: BURMA: Herb. Burma Forest School 22 (W--1716644); Huk s.n. [Burma, 1890] (W--73891). THAILAND: Banterngsuk 6 [Herb. Roy. Forest Dept. 1991] (W--2064782); Rock 466 (W--1171368, W--1171369).

VITEX LONGISEPALA King & Gamble

Additional bibliography: Moldenke, Phytologia 15: 254--255 & 325. 1967.

VITEX LUCENS T. Kirk

Additional bibliography: Allan, Fl. N. Zeal. 1: 959--960. 1961; D. Price, Contrib. N. S. Wales Nat. Herb. 3: 194. 1961; Seikel, Chow, & Feldman, Phytochem. 5: 439--455. 1966; J. S. Beard, Journ. Ecol. 55: 277. 1967; Seikel, Chow, & Feldman, Biol. Abstr. 48: 9450. 1967; Moldenke, Phytologia 15: 255--256 (1967) and 16: 501. 1968.

Seikel and her associates (1966) report that the wood of this species is a rich source of glycoflavonoid (C-glycosylflavonoid) compounds. In addition to the previously described apigenin derivatives vitexin (4',5,7-trihydroxyl-8-C-glucopyranosylflavone) and isovitexin (the 6-C-glucosyl isomer), the corresponding luteolin derivatives orientin and isoorientin have been discovered. Compounds of vitexin and orientin, which have xylose attached to

the 8-glucosyl group, are also present. The most unusual constituents are wight compounds which appear to be 6,8-di-C-glycosyl derivatives of apigenin and luteolin. Several compounds in each series are inter-convertible in hot acidic solution.

Beard (1967) speaks of a V. glabrata which is one of the main members of the broadleaf tree level in Australia along with Eucalyptus and Terminalia. He is undoubtedly here referring to V. lucens.

VITEX MADIENSIS Oliv.

Additional bibliography: A. Chev., Sudania 1: 11. 1911; Moldenke, Phytologia 15: 257—260. 1967.

VITEX MADIENSIS var. BAUMII Pieper

Additional bibliography: Moldenke, Phytologia 15: 258—259. 1967.

Additional citations: ANGOLA: Bie-Cuando-Cubango: E. J. Mendes 2632 (Rf).

VITEX MADIENSIS var. MILANJIENSIS (Britten) Pieper

Additional bibliography: Moldenke, Phytologia 15: 259—260. 1967.

The corollas on Lewalle 1115 are described as having been "rose violacé clair", on his 1328 as "bleuté", on 2296 as "blanc sale", and on 2355 as "blanc et bleu". This collector has encountered this plant growing at 900 meters altitude.

Additional citations: BURUNDI: Lewalle 403 (Ac), 1115 (Ac), 1328 (Ac, Rf), 2296 (Ac), 2355 (Ac, Rf). ANGOLA: Huila: Gossweiler 13444 (Rf).

VITEX MASONIANA Pittier

Additional bibliography: Moldenke, Phytologia 15: 260. 1967.

Recent collectors describe this plant as a tree, 50—75 feet tall [Allen says "50 m.", but surely in error], with a trunk diameter of 6—15 inches at breast height, coarse leaves, and fruit brown and "fruity in odor", green when immature, growing at the edge of roads, at 15—400 meters altitude, in anthesis also in February and March, in immature fruit in June and in mature fruit in October. Allen describes it as "infrequent" in Darién. The corollas are described as having been "white" on J. A. Duke 8387, "lavender" on P. H. Allen 265, and "blue" on P. H. Allen 4588 and J. A. Duke 9784. Vernacular names for the tree are reported as "cuajado", "kwidi machi", and "pu-pu-chiru". The specific epithet is often uppercased. Duke assures us that the tree is not used by the Chocoi Amerinds in Panama.

The H. Pittier 6604, distributed as V. masoniana, is actually V. floridula Duchass. & Walp.

Additional citations: PANAMA: Darien: P. H. Allen 265 (E—1191569), 4588 (E—1572218); J. A. Duke 8387 (Rf), 13116 (Ac), 14639 (Ac, E—1909076); Stern, Chambers, Dwyer, & Ebinger 299 (E—

1757555), 903 (E--1757560). Panamá: J. A. Duke 14489 (E--1909075). COLOMBIA: Chocó: J. A. Duke 9784 (Oh).

VITEX MEGAPOTAMICA (Spreng.) Moldenke

Additional bibliography: Schnitzl., Icon. Fam. Nat. Reg. Veg. 137. 1856; Rosengurtt, Estud. Prad. Nat. Urug. 5: 394. 1946; Rios de Moura Baptista, Anais XV Congr. Soc. Bot. Bras. 200. 1964; Dombrowski & Kuniyoshi, Araucariana 1: 14. 1967; Anon., Biol. Abstr. 48 (20): S.181. 1967; Rimpler & Schulz, Tetrahed. Lett. 22: 2033--2035. 1967; Rimpler & Schulz, Biol. Abstr. 48: 9253. 1967; Moldenke, Phytologia 15: 261--263. 1967.

Recent collectors describe this plant as a tree, 8 m. tall, growing in forests and at forest margins, at 500 to 1000 meters altitude, with the vernacular names "flor anil" and "taruña".

Additional citations: BRAZIL: Paraná: Hatschbach 15363 (W--2564724). Rio Grande do Sul: Rambo 37993 (B), 44520 (B), 49270 (B), 51795 (B). Santa Catarina: Smith & Klein 14164 (N). ARGENTINA: Misiones: A. G. Schulz 7151 (N).

VITEX MEGAPOTAMICA f. ALBIFLORA Moldenke

Additional bibliography: Moldenke, Phytologia 15: 263. 1967.

Additional citations: BRAZIL: Paraná: Hatschbach 13392 (W--2564667); Hatschbach & Guimarães 15151 (W--2563953, Z).

VITEX MICRANTHA Gürke

Additional bibliography: Cave, Ind. Pl. Chromosome Numb. 1: 54. 1958; Moldenke, Phytologia 15: 263--264 & 314. 1967; N. H. A. Cole, Bull. Inst. Fond. Afr. Noire 30: 107. 1968.

Cole (1968) reports that this species grows among trees in matured secondary forests on slopes in Sierra Leone, flowering in February and March. Cave (1958) reports the diploid chromosome number for the species as 32.

VITEX MOLLIS H.B.K., Nov. Gen. & Sp. Pl., ed. folio, 2: 199. 1817.

Additional & emended synonymy: Vitex mollis Humb. & Bonpl. apud Steud., Nom. Bot., ed. 1, 888. 1821. Vitex trifolia Sessé & Moc. ex Moldenke, Prelim. Alph. List Invalid Names 52, in syn. 1940 [not V. trifolia Graham, 1966, nor Hemsl., 1949, nor L., 1753, nor L. f., 1895, nor Moon, 1895, nor Vahl, 1941, nor "sensu Matsumura & Hayata", 1963].

Additional & emended bibliography: H.B.K., Nov. Gen. & Sp. Pl., ed. folio, 2: 199 (1817) and ed. quart., 2: 245. 1818; Steud., Nom. Bot., ed. 1, 888. 1821; Barnhart, Bull. Torrey Bot. Club 29: 590. 1902; Moldenke, Phytologia 15: 264--267 (1967) and 16: 495. 1968.

It should be noted that the H.B.K. reference dates given above have been authenticated by consultation of the work on this subject by Barnhart (1902).

The corollas are described as having been "purple" on J.

Rzedowski 2207 and the plant was collected in a deciduous tropical forest. A note on the sheet states that "one digit [is] missing in [the] collection no. given". What that missing digit is has not been determined.

Additional citations: MEXICO: Chiapas: F. Miranda 8184 (W—2508354). México: J. Rzedowski 2207 (Mi). Morelos: Pringle 6993 (Ms—30948).

VITEX MOMBASSAE Vatke

Additional bibliography: Watt & Breyer-Brandwijk, Med. & Poison. Pl. S. Afr., ed. 2, 1055 & 1454. 1962; Moldenke, Phytologia 15: 266—267. 1967; Friedrich-Holzhammer in Merxm., Prodr. Fl. SüdW. Afr. 122: 10. 1967.

Additional citations: ANGOLA: Huila: E. J. Mendes 1625 (Rf). PORTUGUESE EAST AFRICA: Mozambique: M. F. Correira 119 (Rf).

VITEX NEGUNDO L., Sp. Pl., ed. 1, 638. 1753 [not V. negundo Curtis, 1832, nor Lour., 1934, nor Noronha, 1790].

Additional & emended synonymy: Vitex negunda Willd. ex Roxb., Fl. Ind., ed. 2 [Carey], 3: 70. 1832 [not V. negunda Mill., 1768]. Vitex leucoxylon Blanco apud Jacks. in Hook. f. & Jacks., Ind. Kew., pr. 1, 2: 1214, in syn. 1895 [not V. leucoxylon L., 1829, nor L. f., 1781, nor Roth, 1956, nor Roxb., 1814, nor Schau., 1893, nor Span., 1856, nor Wall., 1847, nor Willd., 1832]. Vitex negundo L. f. apud Naithani, Bull. Bot. Surv. India 8: 260. 1966. Vitex trifolia Graham ex Chavan & Oza, Mahar. Savaj. Univ. Baroda Bot. Mem. 1: 187, in syn. 1966 [not V. trifolia Hemsl., 1949, nor L., 1753, nor L. f., 1895, nor Moon, 1895, nor Sessé & Moc., 1940, nor Vahl, 1941, nor "sensu Matsumura & Hayata", 1963].

Additional & emended bibliography: J. F. Gmel. in L., Syst. Nat., ed. 13, pr. 1, 2: 963 (1789) and pr. 2, 2: 963. 1796; Pers., Sp. Pl. 3: 361. 1819; Steud., Nom. Bot., ed. 1, 888. 1821; Roxb., Fl. Ind., ed. 2 [Carey], 3: 70 & 71. 1832; Hook. & Arn., Bot. Beech. Voy. 206. 1836; Schnitzl., Icon. Fam. Nat. Reg. Veg. 137. 1856; Gamble, Man. Ind. Timb., ed. 1, 297. 1881; Watt, Econ. Prod. India 5: 294 (1883) and 7: 255. 1883; Vidal, Phan. Cuming. Philip. 134. 1885; Watt, Dict. Econ. Prod. India 6 (4): 248—250. 1893; Gamble, Man. Ind. Timb., ed. 2, 539—540. 1902; Prain, Beng. Pl., ed. 1, 2: 832 & 833. 1903; Duthie, Fl. Upper Gang. Plain 2: 224. 1911; R. N. Parker, For. Fl. Punjab 394. 1918; A. Chev., Cat. Pl. Jard. Bot. Saigon 36. 1919; Gamble, Fl. Presid. Madras 2: 1101 & 1102. 1924; Hosokawa, Journ. Soc. Trop. Agr. Taiwan 6: 206. 1934; Selling, Bishop Mus. Spec. Publ. 38: 274, 275, & 411. 1947; Li & Keng, Taiwania 1 (2—4): 127. 1950; Kuck & Tongg, Mod. Trop. Gard. 77 & 236. 1955; Encke, Pareys Blumengärtn., ed. 2, 446. 1960; Cave, Ind. Pl. Chromosome Numb. 2: 137. 1961; Deb, Bull. Bot. Surv. India 3: 315. 1961; H. F. MacMillan, Trop. Plant. & Gard., ed. 5, pr. 3, 198 & 366. 1962; Prain, Beng. Pl., ed. 2, 2: 621, 622, & 1012. 1963; Sharma & Mukhopadhyay, Journ. Genet. 58: 359, 366, 376, 383, & 539, pl. 11, fig. 30. 1963; Maheshwari,

Fl. Delhi 281. 1963; A. Banerjee in Lahiri, West Beng. Forests 56. 1964; Puri, Jain, Mukerjee, Sarup, & Kotwal, Rec. Bot. Surv. India 19: 107. 1964; Cave, Ind. Pl. Chromosome Numb. 2: 331 (1964) and 2: 438. 1965; Banerji, Rec. Bot. Surv. India 19: 75. 1965; Sen & Naskar, Bull. Bot. Surv. India 7: 60. 1965; M. S. Mani, Bull. Bot. Surv. India 7: 114. 1965; B. C. Stone, Micronesica 2: 132. 1966; S. V. Ramaswami, Study Flow. Pl. Bangalore [thesis] xxix, 1029--1039, & 1467. 1966; Panigrahi, Bull. Bot. Surv. India 8: 3, 4, & 11. 1966; Panigrahi & Joseph, Bull. Bot. Surv. India 8: 151. 1966; Matthew, Bull. Bot. Surv. India 8: 164. 1966; Balapure, Bull. Bot. Surv. India 8: 190 & 194. 1966; Jain & De, Bull. Bot. Surv. India 8: 247. 1966; Naithani, Bull. Bot. Surv. India 8: 260. 1966; Rao & Rabha, Bull. Bot. Surv. India 8: 301. 1966; J. L. Ellis, Bull. Bot. Surv. India 8: 337. 1966; Santapau, Bull. Bot. Surv. India 8: 39. 1967; Moldenke, Biol. Abstr. 48: 10560. 1967; R. R. Stewart, Pakistan Journ. Forest. 17: 515. 1967; Moldenke, Phytologia 15: 304—311 (1967) and 16: 493—495, 500, & 501. 1968; Moldenke, Biol. Abstr. 49: 851 (1968) and 49 (2): S. 72 & S.186. 1968.

It should be noted here that the Vitex trifolia of Hemsley, referred to in the synonymy above, as well as that of "sensu Matsumura & Hayata", is a synonym of V. trifolia var. simplicifolia Cham., that accredited to Moon is V. altissima L. f., that accredited to Vahl is V. triflora Vahl, that of Sessé & Mociño is V. mollis H.B.K., while that of Linnaeus is a valid species, with the homonym accredited the Linnaeus the younger as a synonym. The V. leucoxylon of Linnaeus the younger is a valid species, with the homonym accredited to Linnaeus the elder as a synonym, as well as that ascribed to Willdenow, while the V. leucoxylon accredited to Schauer is V. glabrata R. Br., that ascribed to Roth and to Roxburgh is V. glabrata var. bombacifolia (Wall.) Moldenke, that accredited to Spanoghe is V. parviflora A. L. Juss. and that ascribed to Wallich is V. leucoxylon L. f.

Aggarwal & Mukherjee (1963) state that this plant, along with Clerodendrum inerme, Cyperus stoloniferus, and Sporobolus maderaspatanus, play an important rôle in stabilizing dunes on Rameswaram Island and Krusadi Island, but surely the typical form of the species is not here being referred to -- probably it is V. trifolia var. simplicifolia Cham. to which reference is here being made.

Balapure (1966) records V. negundo from Madhya Pradesh, where he found it growing in moist shady places along riverbanks and "very common" in waste places, along roadsides, and on riverbanks. Rao & Sastry (1964) also refer to it as common along watercourses in that state. Ellis (1966) records it from Andhra Pradesh and cites a National Herbarium no. 15911. Jain (1963) found it in Gujerat, Rao & Rabha (1966) in Assam, and Santapau (1967) in Saurashtra. Bhattacharyya (1964) reports it as "common" in Uttar Pradesh. Panigrahi and his associates (1964) found it to be "a-

bundant on river banks" in Orissa; Lau describes it as abundant in dry sandy soil on Hainan Island.

Jain & De (1966) report that in West Bengal, where it is known as "begna" and "ichur", a decoction is made of the leaves which is given with Andrographis and/or Hyoscyamus to cure coughs, gout, and symptoms related to colds and the leaves are used for fumigating huts to remove flies and mosquitoes, citing Jain 7903. Mukerjee (1965) also avers that V. negundo is a common shrub in the villages of West Bengal. Kuck & Tongg (1955) point out that it is wind-resistant and grows rapidly and irregularly. Janardhanan (1963) found it to be scarce in Maharashtra, where it is called "nirgud" or "nirgundi", and where the leaves are used as a tonic and vermifuge and the leaf-juice by the local population to remove fetid discharges and worms from ulcers.

Joseph (1963) found the plant "fairly common near streams" in Madhya Pradesh, while Malick (1966) describes it as "common" in West Bengal and cites Chatterji 3. Panigrahi & Joseph (1966) claim that it is "abundant" in Nefa and cite a National Herbarium no. 16788. Panigrahi (1966) reports it as "abundant on dry open flat hilltops" and on hill slopes in Bihar and cites no. 11891. Ramaswamy (1964) encountered it growing along riverbanks with Phyla nodiflora under a thick growth of Salix tetrasperma in Bangalore and also in hedges there. Naithani (1966) refers to it as "rare" and cites no. 23873. Vidal (1885) cites Cuming 1886. Deb (1963) reports that the species inhabits moist and dry deciduous forests.

Maheshwari (1963) describes V. negundo as it occurs in Delhi, India: "Flower clusters lax, in a widely spreading panicle; leaflets mostly broader [than in V. agnus-castus].....A shrub or small tree. Branchlets quadrangular, densely white-tomentose. Leaflets 3—5, 10—17 x 2.5—4 cm., petiolulate, lanceolate, acuminate, white-tomentose beneath. Flowers lavender to blue, in loose clusters, arranged in a large terminal panicle. Drupes black. Planted in gardens, lawns and along railway lines. Common in the Bangar tract on raised bunds along the roads. The warmed leaves are applied to painful and rheumatic swellings; the macerated ones are used as cooling medicine on the forehead in headache. Local name: Sambhalu. Flowers: Major part of the year." He cites Maheshwari 118 & 689. Banerji (1965) cites his no. 536.

Prain (1963) records the species from Bihar and Chota Nagpur and gives the following additional vernacular names for it: "begunia" and "sandbhalu". Banerjee (1964) records the name "sindubara" for it, while Stewart (1967) tells us that the species is very common "in graveyards and near streams" in Swat, Pakistan, while Chevalier (1919) reports it cultivated in Vietnam under the name "cây ngũ trảu".

Cave (1961, 1964, 1965) reports the haploid number of chromosomes as 12 and the diploid as 26 and 34.

MacMillan (1962) reiterates that in India the leaves and bark of this plant are used in the treatment of toothache, rheumatism,

and eye diseases, as well as for a tonic, carminative, and vermifuge. Watt (1893) includes V. bicolor Willd. and V. arborea Desf. in the synonymy of V. negundo. The latter, however, is a synonym of V. negundo f. alba P'ei, while the former is V. trifolia var. bicolor (Willd.) Moldenke

It should perhaps be noted here that the V. negundo accredited to Curtis is actually V. negundo var. heterophylla (Franch.) Rehd., that accredited to Loureiro is V. quinata (Lour.) F. N. Will., while that of Noronha is V. pinnata L.

Encke (1960) describes V. negundo as follows: "Indien bis Ostasien und Malesien. Juli--August. Bis 4 m hoher, baumartiger Strauch. Blätter fingerförmig-5zählig, mit linealisch-lanzettlichen, gezähnten, 5--10 cm langen Blättchen. Blüten in endständigen, 15--20 cm langen zusammengesetzten Rispen, lila oder lavendelblau."

The species has been collected in fruit in July as well as in the months previously recorded. Ching states that it is "common" along roadsides in Kwangsi, while Rodin describes it as "common along streambanks" in Swat. The corollas are described as having been "pink" on Liang 64661, "purplish" on R. C. Ching 5450, "blue-purple" on Koelz 4137, "bluish" on Taam 1728, and "blue" on Rodin 5427, Tsang s.n. [Herb. Lingnan Univ. 16629], and E. H. Wilson 10972. A note accompanying Clemens & Clemens 3804 indicates that the species occurs wild and also in cultivation in Annam.

Material has been widely misidentified and distributed in herbaria under the names V. agnus-castus L., V. incisa Lam., V. negundo var. cinnabifolia (S. & Z.) Metcalf, V. trifolia L., and even Buddleia asiatica Lour.

There seem definitely to be at least two forms of what is currently being regarded as the typical form of this species. One of these bears a striking similarity to the typical form of V. trifolia L. [e.g., Babu Ram 99, Hafizthan s.n. [Balakoli], Rodin 5427, S. N. Singh 18 [3.8.24 & 11.1.25], and R. R. Stewart 17067].

The other form is more typical of what I regard as V. negundo in the strict sense. Examples are Barchet 556, H. H. Bartlett 6267, R. C. Ching 5450, Clemens & Clemens 3804, Fraser 196, A. Henry 1142 & 9750, Koelz 3147, C. O. Levine s.n. [Herb. Canton Chr. Coll. 376], Liang 64661, Nagazawa s.n. [July 1928], Peng, Tak, & Kin s.n. [Herb. Canton Chr. Coll. 12670], Poilane 8130, Taam 1728, Tanaka 97, Tanaka & Shimada 17878, E. H. Wilson 1697, and Ying 1263. The complex needs further study. It is very possible that V. negundo and V. trifolia hybridize where they grow together.

Barchet 556 appears to be a mixture with var. cannabifolia (Sieb. & Zucc.) Hand.-Mazz. The Rock 3880, 5055, & 9044, distributed originally as V. negundo, are all cotypes of f. alba

P'ei; Ling 1721 & s.n. [Herb. Univ. Nanking 9386], as well as Herb. Univ. Nanking 9366, appear to be var. heterophylla (Franch.) Rehd.; and Chiao 2704, R. C. Ching 2429, Farges s.n., Fung 21196, Herb. Canton Chr. Coll. 894 & 1420, Herb. Univ. Nanking 1726, 2387, 14054, 14580, & 18774, Petelot 1170, Rock 6981, Tsang 27733 & 27843, Tsiang & P'ei 5725, Tsui 303, E. H. Wilson 790 & 2702, and Zimmermann 2 appear to represent var. intermedia (P'ei) Moldenke. It is, however, very obvious that the named varieties grade into each other in most confusing fashion.

I am not at all certain of the true identity of the Herb. Post s.n. [Hamath, Aug. 1884], cited below. It was originally identified and distributed as V. agnus-castus L., but most certainly cannot be that species in its restricted sense. It may be a mature fruiting specimen of V. agnus-castus var. pseudo-negundo Hausskn., but it also greatly resembles V. negundo.

Additional citations: SYRIA: Herb. Post s.n. [Hamath, Aug. 1884] (W—805058). PAKISTAN: Swat: Rodin 5427 (W—2242322). INDIA: East Punjab: Koelz 3147 (W—1667937), 4137 (W—1607992). Mussoorie: R. R. Stewart 17067 (W—1992176). Siwalik & Jaunsar: Babu Ram 99 (W—1170327). Uttar Pradesh: Crovalti 81 [July] (W—1372659), 81 [November] (W—1372659); Mohammed s.n. [13.7.29] (W-1716645), s.n. [5.11.29] (W—1716645); K. Singh 80 (W—1347706); S. N. Singh 18 [3.8.24] (W—1347745), 18 [11.1.25] (W—1347745). CEYLON: Fraser 196 (W—73890). CHINA: Chekiang: Barchet 556, in part (W—596118). Hupeh: E. H. Wilson 1241 (W—596717), 2701 (W—777469). Kiangsi: E. H. Wilson 1697 (W—777294). Kwangsi: R. C. Ching 5450 (W—1248670). Kwangtung: C. O. Levine s.n. [Herb. Canton Chr. Coll. 376] (W—778695); Peng, Tak, & Kin s.n. [Herb. Canton Chr. Coll. 12670] (W—1247923); Ying 1263 (W—1513156). Yünnan: A. Henry 9750 (W—457296). CHINESE COASTAL ISLANDS: Hainan: S. K. Lau 298 (W—1629164); Liang 64661 (W—1671297). Lantau: Tsang s.n. [Herb. Lingnan Univ. 16629] (W—1249326). HONGKONG: Taam 1728 (W—2244633). INDOCHINA: Annam: Clemens & Clemens 3804 (W—1427683, W—1427684); Poilane 8130 (W—2394576). WESTERN PACIFIC ISLANDS: FORMOSA: H. H. Bartlett 6267 (W—1248580); Nagazawa s.n. [July 1928] (W—2063380); Nakahara s.n. [1905] (W—1053769); A. Henry 1142 (W—455567); Tanaka 97 (W—1528110); Tanaka & Shimada 17878 (W—1700296); E. H. Wilson 10972 (W—1054281). CULTIVATED: India: Voigt 272 (W—2126892). LOCAKITY OF COLLECTION UNDETERMINED: Hafizthan s.n. [Balakoli] (W—1239953).

VITEX NEGUNDO f. ALBA P'ei

Additional bibliography: Watt, Dict. Econ. Prod. India 6 (4): 248. 1893; Moldenke, Phytologia 15: 308. 1967.

This plant has been collected at altitudes of 8000 to 10,000

feet, flowering in August. The corollas are described as having been "blue" on Rock 10465, "bluish" on Rock 5055, "pale-purple" on Rock 3880, and "lavender-blue" on Rock 9044. It is therefore evident that the statement made by me in Phytologia 15: 308 (1967) concerning V. arborea Fischer and V. arborea Desf. belonging here because the represent white-flowered plants is entirely incorrect. If Schauer and Jackson are correct in placing these binomials in V. negundo, then they appear to represent a white-flowered form for which I am proposing the name V. negundo f. albiflora Moldenke.

Additional citations: CHINA: Yünnan: J. F. C. Rock 3880 (W—1332136—cotype), 5055 (W—1332137—cotype), 9044 (W—13321138—cotype), 10465 (W—1332139).

VITEX NEGUNDO f. ALBIFLORA Moldenke, nom. nov.

Synonymy: Vitex arborea Fischer ex Desf., Cat. Hort. Paris, ed. 3, 391—392. 1829 [not V. arborea Bréon, 1955, nor Brown, 1806, nor Roxb., 1814]. Vitex arborea Desf. apud Schau. in A. DC., Prodr. 11: 685, in syn. 1847.

Bibliography: Desf., Cat. Hort. Paris, ed. 3, 391—392. 1829; Schau. in A. DC., Prodr. 11: 685. 1847; Watt, Dict. Econ. Prod. India 6 (4): 248. 1893; Jacks. in Hook. f. & Jacks., Ind. Kew., pr. 1, 2: 1213 (1895) and pr. 2, 2: 1213. 1946; Moldenke, Phytologia 5: 486. 1957; Jacks. in Hook. f. & Jacks., Ind. Kew., pr. 3, 2: 1213. 1960; Moldenke, Phytologia 15: 308. 1967.

This form differs from the typical form of the species in having white corollas.

As yet I have not seen the type of this taxon, doubtless preserved in the Paris herbarium, but I am assuming that Schauer, Watt, and Jackson are correct in placing it in V. negundo.

It should be noted here that the V. arborea ascribed to Bréon belongs in the synonymy of V. beraviensis var. acuminata, that accredited to Brown belongs in the synonymy of V. heptaphylla A. L. Juss., while that of Roxburgh is V. pinnata L.

VITEX NEGUNDO var. CANNABIFOLIA (Sieb. & Zucc.) Hand.-Mazz.

Additional synonymy: Vitex negundo var. cinnabifolia (S. & Z.) Metcalf ex Moldenke, Phytologia 17: 15 & 17, in syn. 1968

Additional bibliography: Kitamura & Okamoto, Col. Illustr. Trees & Shrubs Japan 221. 1960; Moldenke, Phytologia 15: 308 (1967) and 17: 15 & 17. 1968.

An additional vernacular name recorded for this plant is "nindinboku". Material of this variety has been widely misidentified and distributed as V. incisa Lam. and V. negundo f. intermedia P'ei. Zimmermann 442 appears to be a mixture with var. intermedia -- at least, on most specimens the leaf serration seems to be far too uniform for var. intermedia.

Additional citations: CHINA: Chekiang: Barchet 556, in part (W-

596117). Shantung: Zimmermann 442, in part (W—795490). HONGKONG: C. Wright s.n. [Hong Kong] (W—44916). WESTERN PACIFIC ISLANDS: JAPAN: Honshiu: Collector undetermined 365 (W—73902), s.n. [Sept. 1, 1890] (W—206182), s.n. [Yanaka, Musashi, 18 August 1910] (W—1178281); J. Matsumura s.n. [Tokio, Octob. 13, 1879] (W—147605); Maximowicz s.n. [Yokohama, 1862] (W—73892).

VITEX NEGUNDO var. HETEROPHYLLA (Franch.) Rehd.

Additional & emended synonymy: Vitex sinuata Raeusch. ex Steud., Nom. Bot., ed. 1, 888. 1821. Vitex negundo Curtis ex Roxb., Fl. Ind., ed. 2 [Carey], 3: 72, in syn. 1832 [not V. negundo L., 1753, nor Lour., 1934, nor Noronha, 1790, nor Royle, 1919, nor Willd., 1918]. Vitex incisa Willd. ex Roxb., Fl. Ind., ed. 2 [Carey], 3: 72. 1832. Vitex chinensis Banks ex Roxb., Fl. Ind., ed. 2 [Carey], 3: 72, in syn. 1832.

Additional bibliography: J. F. Gmel. in L., Syst. Nat., ed. 13, pr. 1, 2: 963 (1789) and pr. 2, 2: 963. 1796; Pers., Sp. Pl. 3: 360—361. 1819; Steud., Nom. Bot., ed. 1, 888. 1821; Roxb., Fl. Ind., ed. 2 [Carey], 3: 72—73. 1832; Watt, Dict. Econ. Prod. India 6 (4): 248 & 251. 1893; Bonstedt, Pareys Blumengärtn., ed. 1, 278. 1932; Encke, Pareys Blumengärtn., ed. 2, 2: 446. 1960; Moldenke, Phytologia 15: 307 & 309—311. 1967; Moldenke, Biol. Abstr. 49 (2): S.186. 1968.

Encke (1960) says of this variety: "In Kultur wohl nur durch die strauchige var. heterophylla (Franch.) Rehd. (syn. var. incisa (Bunge) Clarke; V. incisa Bunge). Nord- und Centralchina, Mandschurei, Philippinen. Mit eingeschnitten-gezähnten oder fast fiederspaltigen, 2—8 cm langen Blättchen. -- Um 1750. B.M. 364; N.K. 14: 12; B.C. III:3481. (K) Nur im Weinbauklima bedingt winterhart. In kalten Wintern auch dort immer wieder zurückfrierend, aber an einjährigen Trieben im gleichen Herbst noch blühend. Schöne Herbstblüher zur Verwendung in der Nähe des Hauses auf der Gartenterrasse oder in Verbindung mit andern tropischen Blattpflanzen. Am besten ist frostfreie Überwinterung und Mitte Mai Pflanzung ins Freie. Bei gute Pflege und Ernährung machen sie in wenigen Monaten lange Schösslinge, die in warmen Sommern fast immer noch zur Blüte kommen. Vermehrung durch Aussaat und ausgereifte, krautige Stecklinge im Sommer."

The variety has been collected at 200 meters altitude in Shantung. An additional vernacular name for it is "mu chin". The corollas are described as having been "bluish" on Chiao 3052 and as "lavender" on K. H. Beach 145.

The Herb. Hort. Bot. Petrop. s.n., originally distributed as this variety, appears to be V. negundo var. heterophylla f. multifida (Carr.) Rehd., C. O. Levine s.n. [Herb. Canton Chr. Coll. 250 & 1585], Fung 21196, J. B. Norton 1558, and W. T. Tsang 28047 are V. negundo var. intermedia (P'ei) Moldenke, C. O. Levine s.n. [Herb. Canton Chr. Coll. 376] is V. negundo L., and

C. O. Levine s.n. [Herb. Canton Chr. Coll. 746] is V. sampsoni Hance. The Zimmermann 442, originally distributed as this variety, seems to be mostly var. cannabifolia (Sieb. & Zucc.) Hand.-Mazz., although it was identified by P'ei as his f. intermedia and at least one specimen of it has been so cited by me. Certainly the collection is not var. heterophylla!

Additional citations: CHINA: Chahar: Kozlov 71 (W—1658549). Hopeh: K. H. Beach 145 (W—2070714), 228 (W—2070785); Chiao 227 [Herb. Univ. Nanking 21384] (W—1554261); Cowdry s.n. [Vicinity of Peking, 1919] (W—1051760); H. J. Sheehan 98 (W—1576691). Shansi: Ling 1467 [Herb. Univ. Nanking 9113] (W—1370452), 1721 [Herb. Univ. Nanking 9366] (W—1370453), s.n. [Herb. Univ. Nanking 9386] (W—1370454). Shantung: Chiao 3052 (W—1576506). Province undetermined: Bunge s.n. [Chin. bor. 1830] (W—2497090).

VITEX NEGUNDO var. HETEROPHYLLA f. ALBA (Carr.) Moldenke

Additional bibliography: Moldenke, Phytologia 15: 310. 1967; Moldenke, Biol. Abstr. 49: 851. 1968.

VITEX NEGUNDO var. HETEROPHYLLA f. MULTIFIDA (Carr.) Rehd.

Additional synonymy: Vitex dissecta Vasey ex Moldenke, Phytologia 17: 19, in syn. 1968.

Additional bibliography: Moldenke, Phytologia 15: 310—311. 1967.

Material of this form has been distributed in herbaria under the name V. incisa Lam.

Additional citations: CULTIVATED: District of Columbia: Vasey s.n. [Greenhouse, 1881] (W—73894). Russia: Herb. Hort. Bot. Petrop. s.n. (W—73895).

VITEX NEGUNDO var. INTERMEDIA (P'ei) Moldenke

Additional bibliography: S. V. Ramaswami, Study Flow. Pl. Bangalore [thesis] 1030—1031 & 1467. 1966; Moldenke, Phytologia 15: 307 & 311. 1967.

Recent collectors have found this plant growing on slopes. Tsang reports it as "fairly common" and "abundant scattered shrubs" in Kwangsi, Norton refers to it as "common on open hillsides" in Fukien, and Ching found it in "open thickets on stream banks" in Chekiang.

The corollas are described as having been "lavender" on Chiao 2704 & s.n. [Herb. Univ. Nanking 14054] and Koelz 4592, "bluish" on Rock 6981 and Tsiang & P'ei 5725, "bluish-purple" on R. C. Ching 2429, "blue" on J. B. Norton 1558 and Tsang 27733, "pink" on Tsang 27843, and "white" on Tsui 303.

Herbarium material has been identified and distributed under the epithet V. negunda L., in addition to the epithets previously recorded. On the other hand, the C. Wright s.n. [Hong Kong] and the Zimmermann 442 and Barchet 556, cited by P'ei or so identified

by him, seem to me to be better placed as var. cannabifolia (Sieb. & Zucc.) Hand.-Mazz.

Additional citations: INDIA: East Punjab: Koelz 4592 (W—1667949). CHINA: Anhwei: Herb. Univ. Nanking 1726 (W—1345970). Chekiang: Barchet s.n. (W—597586, W—597594); Chiao s.n. [Herb. Univ. Nanking 14054] (W—1426576), s.n. [Herb. Univ. Nanking 14580] (W—1426962); R. C. Ching 2429 (W—1247250); A. N. Steward s.n. [Herb. Univ. Nanking 2387] (W—1345971). Fukien: J. B. Norton 1558 (W—1172734). Hupeh: E. H. Wilson 790 [7/07] (W—777143), 790 [12/07] (W—777143), 2702 [6/07] (W—777470), 2702 [8/07] (W—777470). Kiangsi: Chiao s.n. [Herb. Univ. Nanking 18774] (W—1554014). Kwangsi: Fung 21196 (W—1704611); W. T. Tsang 27733 (W—1757177), 27843 (W—1757268), 28047 (W—1757432). Kwangtung: C. O. Levine s.n. [Herb. Canton Chr. Coll. 894] (W—1091674), s.n. [Herb. Canton Chr. Coll. 1420] (W—877508), s.n. [Herb. Canton Chr. Coll. 1585] (W—877507), s.n. [Herb. Canton Chr. Coll. 3442] (W—1270970); Tsui 303 (W—1754587). Kweichow: Tsiang & P'ei 5725 (W—1575153). Shantung: Chiao 2704 (W—1553816, W—1595051). Szechuan: Farges s.n. (W—2497126). Yünnan: J. F. C. Rock 6981 (W—1212126). Province undetermined: Schoch 427 (W—1174976). CHINESE COASTAL ISLANDS: Honam: C. O. Levine s.n. [Herb. Canton Chr. Coll. 250] (W—778606). THAILAND: Zimmermann 2)W—595002). INDOCHINA: Tonkin: Pételot 1170 (W—1717012).

VITEX ORINOCENSIS H.B.K., Nov. Gen. & Sp. Pl., ed. folio, 2: 200. 1817.

Additional synonymy: Vitex orinoccensis Humb. & Bonpl. apud Steud., Nom. Bot., ed. 1, 888. 1821. Vitex orineceasis Huber, in herb.

Additional & emended bibliography: H.B.K., Nov. Gen. & Sp. Pl., ed. folio, 2: 200 (1817) and ed. quart., 2: 247. 1818; Steud., Nom. Bot., ed. 1, 888. 1821; Barnhart, Bull. Torrey Bot. Club 29: 590. 1902; Veillon, Revist. Forest. Venez. 5: 59. 1962; Moldenke, Phytologia 15: 312—313. 1967.

It should be noted that the H.B.K. reference dates given above have been authenticated by consultation of the work by Barnhart (1902) on this subject.

VITEX ORINOCENSIS var. MULTIFLORA (Miq.) Huber

Additional synonymy: Vitex orineceasis var. multiflore (Mig) Huber, in herb.

Additional bibliography: Moldenke, Phytologia 15: 313. 1967.

Breteler describes this plant as a tree, 13 m. tall, the trunk 35 cm. in diameter at breast height, branched from low down, the bark shallowly and finely fissured, brownish-gray, the leaflets papery, slightly glossy and medium-green above, paler and dull beneath, the corolla pale-purple (on his no. 3662), the fruit subglobose, glossy, smooth, black at maturity, and growing at 350

meters altitude.

Additional citations: VENEZUELA: Barinas: Breteler 3662 (W—2465602), 3907 (W—2465856).

VITEX OXYCUSPIS J. G. Baker

Additional bibliography: Moldenke, Phytologia 15: 314. 1967; Anon., Biol. Abstr. 49: 390. 1968.

VITEX OXYCUSPIS var. MOSSAMBICENSIS Moldenke

Additional bibliography: Moldenke, Phytologia 15: 314—315. 1967; Anon., Biol. Abstr. 49: 390. 1968.

VITEX PARVIFLORA A. L. Juss.

Emended synonymy: Vitex leucoxylon Span. ex Miq., Fl. Ind. Bat. 2: 863. 1856 [not V. leucoxylon Blanco, 1895, nor L., 1829, nor L. f., 1781, nor Naves, 1918, nor Roth, 1956, nor Roxb., 1814, nor Schau., 1893, nor Wall., 1847, nor Willd., 1832].

Additional bibliography: Pers., Sp. Pl. 3: 360. 1819; Steud., Nom. Bot., ed. 1, 888. 1821; Vidal, Phan. Cuming. Philip. 134. 1885; Moldenke, Phytologia 15: 316—317 & 320 (1967) and 16: 500 & 501. 1968.

It should be noted that the V. leucoxylon of Linnaeus the younger is a valid species, with the homonyms ascribed to Linnaeus the elder, to Wallich, and to Willdenow as synonyms, that of Blanco and of Naves is V. negundo L., that ascribed to Schauer is V. glabrata R. Br., and that accredited to Roth and to Roxburgh is V. glabrata var. bombacifolia (Wall.) Moldenke.

The corollas are described as having been "light-blue" on Seibert 1535. This collector describes the plant as a tree, 6—8 meters tall, with blue-black fruit in August. He states that it is cultivated along the riverbank at Farm No. 5, Almirante, in the Changuinola District, by the United Fruit Company, in Panama, where it was originally introduced because "the wood is good for railroad ties".

Vidal (1885) cites Cuming 1144, 1365, & 1830 for this species. Herbarium material has been misidentified and distributed as V. floridula Duchass. & Walp.

Additional citations: CULTIVATED: Hawaiian Islands: Degener & Degener 30092 (Ms—49581). Panama: Seibert 1535 (E—1570765).

VITEX PEDUNCULARIS Wall.

Additional synonymy: Vitex peduncularis "Wall. ex Schau." apud Deb, Bull. Bot. Surv. India 3: 315. 1961.

Additional & emended bibliography: Watt, Dict. Econ. Prod. India 6 (4): 250. 1893; Gamble, Man. Ind. Timb., ed. 2, 541. 1902; Prain, Bengal Pl., ed. 1, 2: 832 & 833. 1903; Gamble, Fl. Presid. Madras 2: 1102 & 1103. 1924; Deb, Bull. Bot. Surv. India 3: 315. 1961; Prain, Bengal Pl., ed. 2, 2: 621, 622, & 1012. 1963; R. C. Ghosh in Lahiri, West Beng. Forests 197. 1964; Sen & Naskar, Bull. Bot. Surv. India 7: 60. 1965; Jain & De, Bull. Bot. Surv. India

8: 247. 1966; Rao & Rabha, Bull. Bot. Surv. India 8: 301. 1966; Moldenke, Phytologia 15: 319—320. 1967.

Prain (1963) describes this species as a tree, 20—40 feet tall, and records it from Bihar, Chota Nagpur, and Orissa. Deb (1961) says "leaflets densely covered with minute yellow glands beneath, panicles axillary", and cites Meebold 5739. Rao & Rabha (1966) record the species from Assam, while Jain & De (1966) tell us that in West Bengal it is known as "bhadu", the ripe fruits are eaten, the wood is used to make agricultural implements, and the leaves are eaten as a vegetable in the treatment of ophthalmia. Ghosh (1964) encountered the species at 150 meters altitude in the foothills of West Bengal. It has been found in flower and fruit in July.

An additional vernacular name recorded for V. peduncularis is "kyelyo", while the name, "tin nok", previously recorded for it, is said to be applied also to V. limonifolia Wall in Thailand.

Additional citations: INDIA: West Bengal: C. B. Clarke 11733c (W—802339). BURMA: Upper Burma: Annoon s.n. [Herb. Burma Forest School 93] (W—1716643); Prazer 7 (W—712906), 73 (W—712957). THAILAND: Native collector A.33 [Herb. Roy. Forest Dept. 5883] (W—2064806). INDOCHINA: Cochinchina: Thorel 1006 (W—2497093).

VITEX PEDUNCULARIS var. ROXBURGHIANA C. B. Clarke

Additional bibliography: Roxb., Fl. Ind., ed. 2 [Carey], 3: 72. 1832; Watt, Econ. Prod. India 7: 254. 1883; Watt, Dict. Econ. Prod. India 6 (4): 250. 1893; Gamble, Man. Ind. Timb., ed. 2, 541. 1902; Prain, Bengal Pl., ed. 1, 2: 832 & 833 (1903) and ed. 2, 2: 621 & 622. 1963; Moldenke, Phytologia 15: 320. 1967.

Prain (1963) records this variety from Bihar and from Chota Nagpur, and adds the vernacular name "marak'". In his 1903 work he cites the Watt reference given above as "E. D. 5: 174".

VITEX PHAEOTRICHA Mildbr.

Additional bibliography: Moldenke, Phytologia 15: 314 & 321—322. 1967.

VITEX PIERREI Craib

Additional bibliography: Moldenke, Phytologia 15: 323. 1967.

Additional citations: THAILAND: Mrs. D. J. Collins 706 (W—1700656).

VITEX PINNATA L., Sp. Pl., ed. 1, 638. 1753 [not V. pinnata Lour., 1847, nor "Lour. ex Schau.", 1963].

Additional & emended synonymy: Vitex negundo Noronha, Verh. Batav. Gen. 5, ed. 1, art. 4: 86. 1790 [not V. negundo Curtis, 1832, nor L., 1753, nor L. f., 1966, nor Lour., 1934, nor Royle, 1919, nor Willd., 1918]. Vitex arborea Roxb., Hort. Beng. 46, hyponym. 1814; Fl. Ind., ed. 2 [Carey], 3: 73. 1832 [not V. arborea Bréon, 1955, nor Brown, 1806, nor Desf., 1847, nor Fischer, 1829]. Pistacia vitex L. ex Watt, Dict. Econ. Prod. India 6 (4):

250, in syn. 1893. Vitex pubescens var. genuina Hochr., Candollea 5: 191. 1934.

Additional & emended bibliography: J. F. Gmel. in L., Syst. Nat., ed. 13, pr. 1, 2: 963 (1789) and pr. 2, 2: 963. 1796; Pers., Sp. Pl. 3: 360 & 361. 1819; Steud., Nom. Bot., ed. 1, 888. 1821; Roxb., Fl. Ind., ed. 2 [Carey], 3: 73—74. 1832; Gamble, Man. Ind. Timb., ed. 1, 297—298. 1881; Watt, Econ. Prod. India 7: 255. 1883; Watt, Dict. Econ. Prod. India 6 (4): 250. 1893; Gamble, Man. Ind. Timb., ed. 2, 541. 1902; Prain, Beng. Pl., ed. 1, 2: 832 & 833. 1903; Gamble, Fl. Presid. Madras 2: 1101—1103. 1924; C. Coster, Ann. Jard. Bot. Buitenz. 38: pl. 6, fig. 2. 1928; Hochr., Candollea 5: 191—192. 1934; M. R. Henderson, Common Malay. Wildfls. 39. 1961; Prain, Beng. Pl., ed. 2, 2: 621, 622, & 1012. 1963; Santapau & Wagh, Bull. Bot. Surv. India 5: 109. 1963; Douk, Trav. Lab. Mat. Méd. Pharm. Gal. Paris 50: 1—264. 1965; Sen & Naskar, Bull. Bot. Surv. India 7: 60. 1965; M. S. Mani, Bull. Bot. Surv. India 7: 114. 1965; Anon., Ind. Bibliog. Bot. Trop. 3 (2): 15. 1966; Moldenke, Phytologia 15: 323—325 (1967) and 16: 495. 1968; Moldenke, Biol. Abstr. 49: 851. 1968.

Additional illustrations: C. Coster, Ann. Jard. Bot. Buitenz. 38: pl. 6, fig. 2. 1928.

It should be noted here that the V. negundo of Linnaeus the elder is a valid species, with the homonyms accredited to Linlaeus the younger, to Royle, and to Willdenow as synonyms, while the V. negundo ascribed to Curtis belongs in the synonymy of V. negundo var. heterophylla (Franch.) Rehd. and that ascribed to Loureiro is V. quinata (Lour.) F. N. Will. The V. pubescens ascribed to Heyne is a synonym of V. altissima L. f. The V. arborea accredited to Bréon is a synonym of V. beraviensis var. acuminata Moldenke, that accredited to Brown is V. heptaphylla A. L. Juss., while that ascribed to Desfontaines and to Fischer is V. negundo var. albiflora Moldenke.

Santapau & Wagh (1963) feel that the name, V. pinnata Lour., should always be written "V. pinnata Lour. ex Schau.", but my contention has always been that such a double citation is desirably ONLY in a formal synonymy where complete bibliographic references are given. It is too cumbersome to give such a double credit citation on identification labels or in the text of a paper where it would be of little, if any, added value.

Banternsuk describes V. pinnata as a "medium tree common in dry deciduous forests" in Thailand. The corollas are described as having been "purplish" on his no. 13. Mani (1965) reports a plant gall found on this species, made by Eriophyes cryptotrichus Nalepa. It is an epiphyllous hemispheric verrucose pouch-gall 0.5—5 mm. in diameter, and is his gall no. 29.

The bibliographic reference "Gamble 772" is sometimes given in literature for this species, but has not as yet been located by me.

The Burma Forest School 22, distributed as V. pinnata, is actually V. limonifolia Wall.

Additional citations: INDIA: West Bengal: Helfer 132 (W—1669076). BURMA: Tenasserim: Gallatly 1012 (W—263078). THAILAND: Banternsuk 13 [Herb. Roy. Forest Dept. 2010] (W—2064783); Hansen & Smitinand 12186 (Rf).

VITEX PINNATA var. ALATA Moldenke

Additional bibliography: Moldenke, Phytologia 15: 324 & 325. 1967; Moldenke, Biol. Abstr. 49: 851. 1968.

Additional citations: INDIA: Khasi States: Hooker & Thomson s. n. [Mont. Khasia] (W—2497073).

VITEX PINNATA f. ANOMALA Moldenke

Bibliography: Moldenke, Phytologia 4: 184. 1953; Moldenke, Biol. Abstr. 27: 2026. 1953; Moldenke, Phytologia 6: 79—80. 1957; Moldenke, Résumé 198 & 478. 1959.

VITEX PINNATA var. PANTJARENSIS (Hochr.) Moldenke, comb. nov.

Synonymy: Vitex pubescens var. pantjarensis Hochr., Candollea 5: 191—192. 1934.

Hochreutiner's original description of this taxon is as follows: "Flores ochroleuci, calyx profundius dentatus, inflorescentia majus elongata thyrsoidea, folia 5-foliolata, sed ut in typo pubescentia et nervata. Java, Goenoeng Pantjar, à l'E. de Buitenzorg au pied de la montagne, formant de grands arbres especés dans la brousse et haute de ± 8 m. alt. ca. 350 m., 17 septembre 1904, fleurs jaunâtres (n. 1846). Comme on le voit, c'est une variété très distincte du type. D'aucuns y verront une espèce spéciale. Toitefois, comme les spécimens hindous du V. arborea Roxb. — considérés comme synonymes -- ont le temps à autre 4 et peut-être 5 folioles, on peut considérer ce caractère comme variétal."

VITEX POBEGUINI Aubrév.

This taxon has recently been shown to be conspecific with V. madiensis Oliv. and should therefore be deleted from my list of valid and accepted taxa.

VITEX POGGEI Gürke

Additional bibliography: Durand & Jacks., Ind. Kew. Suppl. 1, pr. 1, 457 (1906) and pr. 2, 457. 1941; Moldenke, Phytologia 6: 80. 1957; Moldenke, Résumé 143 & 478. 1959; Durand & Jacks., Ind. Kew. Suppl. 1, pr. 3, 457. 1959.

VITEX POLYGAMA Cham.

Additional bibliography: Bocq., Adansonia 3: [Rev. Verbenac.] 253. 1863; Jacks. in Hook. f. & Jacks., Ind. Kew., pr. 1, 1: 447 (1893) and 2: 1214. 1895; Sampaio, Bol. Mus. Nac. Rio Jan. 13: 258. 1937; Jacks. in Hook. f. & Jacks., Ind. Kew., pr. 2, 1: 447 (1946) and 2: 1214. 1946; Le Cointe, Amaz. Bras. III Arv. & Plant. Uteis, ed. 2, 292. 1947; Angely, Fl. Paran. 7: 13. 1957; Moldenke, Phytologia 6: 80—89. 1957; Jacks. in Hook. f. & Jacks.,

Ind. Kew., pr. 3, 1: 447 (1960) and 2: 1214. 1960; Moldenke, Phytologia 8: 75. 1961; Moldenke, Résumé Suppl. 12: 5. 1965.

Recent collectors refer to this plant as a "touceira com diversos caules, 2 m.", with red anthers and white pollen, growing in sandy soil, flowering in August, and known as "graúna". The corollas are described as "violet" on H. F. Martins 242 and as "violacea com tubo floral maisclaro" on Mattos & Mattos 8382.

A cotype collection, in fruit, Sellow s.n., deposited in the herbarium of the Botanisches Museum at Berlin, was photographed there by Macbride as his type photograph number 17565 (in part), but is now destroyed.

According to Sampaio (1937), the name "maria preta", recorded for Vitex polygama, is also applied to Blanchetia heterotricha P. DC., Cordia curassavica Roem. & Schult., Melanoxylum brauna Schott, and Zollernia ilicifolia Vog.

The Schwacke s.n. [Maná], distributed as V. polygama, is actually var. hirsuta Schau.

Additional citations: BRAZIL: Guanabara: Alston & Lutz 142 (Ja--114096, Ja); Hans s.n. [30-10-1946] (Ja--43757, Ja); B. Lutz 919 (Ja--29489); H. F. Martins 242 [Herb. Cent. Pesq. Florest. 1048] (Ac); Rosa 59 (Ja--52342, Ja, Ja); N. Santos 5268 [236-2] (Ac, Ja), 5300 [237-2] (Ac, Ja), 5373 [244-3] (Ja, Ja). Minas Gerais: A. Castellanos 25421 [Herb. Cent. Pesq. Florest. 4229] (Ac); Heringer 7257 (B). Rio de Janeiro: Glaziou 3860 (Ja--5959). São Paulo: Mattos & Mattos 8382 (W--2445191). State undetermined: Heringer 3594 (B); Sellow s.n. [Brasilia; fructifera; Macbride photos 17565, in part] (W--photo of cotype).

VITEX POLYGAMA var. BAKERI Moldenke

Additional & emended bibliography: Moldenke, Phytologia 6: 83 & 86--87 (1957) and 8: 75. 1961.

VITEX POLYGAMA var. DUSENII Moldenke

Additional & emended bibliography: Jacks. in Hook. f. & Jacks., Ind. Kew., pr. 1, 2: 1214 (1895) and pr. 2, 2: 1214. 1946; Angely, Fl. Paran. 7: 13. 1957; Moldenke, Phytologia 6: 83 & 87--88. 1957; Jacks. in Hook. f. & Jacks., Ind. Kew., pr. 3, 2: 1214. 1960; Moldenke, Phytologia 8: 75--76. 1961; Moldenke, Résumé Suppl. 12: 5. 1965.

A specimen of G. Gardner 582, deposited in the herbarium of the Conservatoire et Jardin Botaniques at Geneva, was photographed there by Macbride as his type photograph number 24703, but is not a type collection of any sort.

The original description of V. laciniosa by Turczaninow (1863) is as follows: "Vitex (pyrostoma) laciniosa. V. tota pilis rufescentibus tecta, ramis compresso-tetragonis; foliis longe petiolatis 5foliolatis, foliolis obovato-oblongis, basi longe attenuatis petiolulatis, apice obtusis mucronulatis vel acutiusculis integer-

rimis aut subrepandis inconspicue denticulatis, supra pilis adpressis scabris, subtus praesertim ad nervationes densius pilosis cinereis; cymis axillaribus petiolo duplo brevioribus bifidis, cum flore solitario in dichotomia; bracteis linearibus flores excedentibus; calycis dentibus tubum aequantibus, tubo corollae parum brevioribus. Bahia, Kegel No 12319. V. polygama Cham. et Schl. huic valde similis, differt tomento, praesertim in tergo foliorum multo densiore, atque corollis calycem duplo superantibus."

Additional citations: BRAZIL: Guanabara: A. Castellanos 24027 [Herb. Cent. Pesq. Florest. 2864] (Ac); H. F. Martins 337 [Herb. Cent. Pesq. Florest. 2870] (Z). Rio de Janeiro: G. Gardner 582 [Macbride photos 24703] (N--photo, W--photo).

VITEX POLYGAMA var. GLAZIOVII Moldenke

Additional bibliography: Moldenke, Phytologia 6: 82, 83, & 88. 1957; Moldenke, Résumé 111 & 478. 1959.

VITEX POLYGAMA var. HIRSUTA Schau.

Additional & emended bibliography: Moldenke, Phytologia 6: 83 & 87--89 (1957) and 8: 76. 1961.

A cotype specimen, Sellow s.n., deposited in the herbarium of the Botanisches Museum at Berlin, was photographed there by Macbride as his type photograph number 17565 (in part), but is now destroyed.

The corolla is described as "blue" on Schwacke s.n., and the plant has been found in anthesis in December. Material has been misidentified and distributed in herbaria as typical V. polygama Cham.

Additional citations: BRAZIL: Espirito Santo: Sellow s.n. [Macbride photos 17565, in part] (W--photo of cotype). Rio de Janeiro: Schwacke s.n. [Maná] (Ja--5968).

VITEX POLYGAMA var. WARMINGII Moldenke

Additional bibliography: Moldenke, Phytologia 6: 83 & 89. 1957; Moldenke, Résumé 112, 379, & 478. 1959.

VITEX POOARA Corbishley

Additional bibliography: A. W. Hill, Ind. Kew. Suppl. 6: 219. 1926; J. Hutchinson, Botanist in South. Afr. 294. 1946; Moldenke, Phytologia 8: 76. 1961; Watt & Breyer-Brandwijk, Medic. & Poison. Pl. S. Afr., ed. 2, 1055 & 1454. 1962; C. A. Sm., Common Names S. Afr. Pl. 243, 374, 438, 439, 498, & 601. 1966.

Smith (1966) records the vernacular names "hardekool", "poeraboom", "poerasboom", "stinkbessie", "stinkbos", "stinkbossie", and "weeluisbessie" for this species — the first of which is also applied to Combretum. He reports that the ripe drupes are black and have the offensive smell of bedbugs or "weeluis", but this does not deter the natives and Europeans from eating the fruit. Hutchinson (1946) cites his no. 1877.

VITEX PSEUDOCHRYSOCARPA Pieper

Additional synonymy: Vitex pseudo-chrysocarpa Pieper ex Worsdell, Ind. Lond. Suppl. 2: 500. 1941.

Additional bibliography: A. W. Hill, Ind. Kew. Suppl. 8: 249. 1933; Moldenke, Phytologia 6: 90--91. 1957; Moldenke, Résumé 133, 138, 143, 382, & 478. 1959; Huber in Hutchinson & Dalz., Fl. W. Trop. Afr., ed. 2, 2: 448. 1963; Moldenke, Phytologia 15: 95. 1967; Moldenke, Résumé Suppl. 15: 25. 1967.

Huber (1963) reduces this species to V. chrysocarpa Planch., but fails to cite the type collection, which is probably Dalziel 771 [not "Dabjiel" as stated in error previously], and, being a collection by one of the co-authors of the work in which Huber was writing, should have been available to him for examination. He does, however, cite Barter 1214, a collection also cited by Pieper, so therefore doubtless bases his opinion on this specimen.

VITEX PSEUDOCUSPIDATA Mildbr.

Additional bibliography: A. W. Hill, Ind. Kew. Suppl. 7: 252 (1929) and 8: 249. 1933; Moldenke, Phytologia 6: 91. 1957; Moldenke, Résumé 139 & 478. 1959.

VITEX PSEUDOLEA Rusby

Additional bibliography: A. W. Hill, Ind. Kew. Suppl. 8: 249. 1933; Moldenke, Phytologia 6: 91--93. 1957; Moldenke, Résumé 85, 115, & 478. 1959; Soukup, Biota 5: 137. 1964; Moldenke, Résumé Suppl. 15: 5. 1967.

Ferreyra describes this plant as a tree, 10--12 m. tall, with "violet" corollas, known locally as "palo de perro", the wood being used for timber.

Additional citations: PERU: San Martín: Ferreyra 4829 (W--1998617). BOLIVIA: Cochabamba: R. F. Steinbach 464 (S). El Beni: O. E. White 767 (G--isotype).

VITEX PUBERULA J. G. Baker

Additional bibliography: K. Schum. in Just, Bot. Jahresber. 28 (1): 497 & 498. 1902; Thiselt.-Dyer, Ind. Kew. Suppl. 2: 194. 1904; Moldenke, Phytologia 6: 93. 1957; Moldenke, Résumé 148, 383, & 478. 1959.

VITEX PULCHRA Moldenke

Bibliography: Moldenke, Phytologia 3: 445--446. 1951; Moldenke in Humbert, Fl. Madag. 174: 76, 132--133, 135, & 273, fig. 21, 1 & 2. 1956; Moldenke, Phytologia 6: 93--94. 1957; Moldenke, Résumé 157 & 478. 1959; G. Taylor, Ind. Kew. Suppl. 12: 151. 1959.

Illustrations: Moldenke in Humbert, Fl. Madag. 174: 135, fig. 21, 1 & 2. 1956.

VITEX PYRAMIDATA B. L. Robinson

Additional synonymy: Virex pyramidata Robins. ex Moldenke, Résumé Suppl. 6: 11, in syn. 1963.

Additional & emended bibliography: Durand & Jacks., Ind. Kew. Suppl. 1, pr. 1, 457. 1906; P. C. Standl., Contrib. U. S. Nat. Herb. 23: 1235 & 1236. 1924; H. B. Davis, Life & Works Pringle 115, 284, 668, & 669. 1936; Durand & Jacks., Ind. Kew. Suppl. 1, pr. 2, 457 (1941) and pr. 3, 457. 1959; Moldenke, Phytologia 8: 76. 1961; Langman, Select. Guide Lit. Flow. Pl. Mex. 596 & 1010. 1964; Moldenke in Shreve & Wiggins, Veg. & Fl. Son. Des. 2: 1261—1262. 1964; Moldenke, Phytologia 15: 265. 1967.

Recent collectors describe this plant as a tree, to 5 m. tall, with fragrant flowers, fruiting in November and December, known locally as "capulin" or "jupari", and ascending from 100 to 1400 meters altitude. It has been found growing in matorral with Byrsonima sp. or with B. crassifolia and Curatella sp., in disturbed matorral, or in open woods and pastures, "in rocky soil in association with Bursera, Erythrina, etc., in regular abundance" in Morelos. Feddema reports it "common" on savannas with Brysonima and Curatella, as well as in cleared areas, in Nayarit. In the same state it is said by McVaugh to be "occasional" with Brosimum, Platymiscium, and Sapium, or to be "abundant" in rocky disturbed woodlands.

The corolla is described as "blue" on J. Rzedowski 15267, "lavender" on R. Q. Abbott 141, and "bright-purple" on R. McVaugh 15223. In Shreve & Wiggins (1964) the distribution of the species is given as "On rocky hillsides, prairies, and basaltic mesas, in arroyos, and at edge of craters, Lower Sonoran to Tropical Zones, Sonora to Yucatán. Employed by the natives for food, fuel, and construction. When burned, the ash is blue."

The G. F. Gaumer 607, distributed as V. pyramidata, is actually the type collection of V. gaumeri Greenm., Arguelles s.n. [San Bernardo, 12 Agosto 1958] is V. mollis H.B.K., and Janzen s.n. [29 May 1964] is not verbenaceous.

Additional citations: MEXICO: Guerrero: R. Q. Abbott 141 (Ip); Hinton 10002 (Rf), 10005 (Rf), 11244 (Rf); Paray 1915 (Ip). Jalisco: Herb. Univ. Kans. Mex. Exped. W.57 (W—2088629); A. R. Moldenke 1823 (Rf); Pringle 4429 (Ms—30949—isotype); J. Rzedowski 15267 (Du—513631, Ip). México: Hinton 4086 (Rf); R. V. Moran 10159 (Du—498154). Morelos: Cox & Guzmán MCC.631 (Ip). Nayarit: Feddema 877 (Mi), 1343 (Mi), 2632 (Mi); R. McVaugh 15223 (Mi), 19089 (Mi); J. Rzedowski 14396 (Ip), 17864 (Ip, Mi). Sinaloa: J. Gonzalez Ortega 793 (Ip). Sonora: Arguelles s.n. [San Bernardo, 18 Octubre 1958] (Rf).

VITEX QUINATA (Lour.) F. N. Will.

Additional & emended synonymy: Vitex hetrophylla Roxb. apud Kawakami, List Pl. Formos. 85, sphalm. 1910. Vitex quinata (Lam.) F. N. Will. apud S. Sasaki, List Pl. Formos. 353, sphalm. 1928. Vitex negundo Lour. ex Crevost & Pételot, Bull. Econom. Indo-chine 37: 1294, in syn. 1934 [not V. negundo Curtis, 1832,

nor L., 1753, nor L. f., 1966, nor Noronha, 1790, nor Royle, 1919, nor Willd., 1918]. Vitex quinata Dop ex Fletcher, Kew Bull. Misc. Inf. 1938: 434, in syn. 1938. Connutia quinata Lour. apud Li, Wood. Fl. Taiwan 834, in syn. 1963. Vitex quinata Lour. ex Moldenke, Résumé Suppl. 15: 25, in syn. 1967. Vitex quinaria (Lour.) F. N. Will., in herb.

Additional & emended bibliography: Steud., Nom. Bot., ed. 1, 228. 1821; Roxb., Fl. Ind., ed. 2 [Carey], 3: 75. 1832; Hook. & Arn., Bot. Beech. Voy. 206, pl. 48. 1836; Bocq., Adansonia 3: [Rev. Verbenac.] 253. 1863; Gamble, Man. Ind. Timb., ed. 1, 296. 1881; Jacks. in Hook. f. & Jacks., Ind. Kew., pr. 1, 1: 619 (1893) and 2: 1213 & 1214. 1895; Gamble, Man. Ind. Timb., ed. 2, 539. 1902; Prain, Beng. Pl., ed. 1, 2: 832 & 833. 1903; Prain, Ind. Kew. Suppl. 3: 189. 1908; Kawakami, List Pl. Formos. 85. 1910; Dunn & Tutcher, Kew Bull. Misc. Inf. Addit. Ser. 10: 204. 1912; A. W. Hill, Ind. Kew. Suppl. 6: 219. 1926; S. Sasaki, List Pl. Formos. 353. 1928; Stapf, Ind. Lond. 6: 478 & 479. 1931; P'ei, Sinensia 2: 70 & 73. 1932; E. D. Merr., Comm. Lour. 334. 1935; Backer, Tectona 29: 686. 1936; Kanehira, Form. Trees, rev. ed., 652, fig. 608. 1936; Fletcher, Kew Bull. Misc. Inf. 1938: 432 & 434. 1938; Jacks. in Hook. f. & Jacks., Ind. Kew., pr. 2, 1: 619 (1946) and 2: 1213 & 1214. 1946; Neal, In Gard. Hawaii, ed. 1, 643. 1948; Anon., Kew Bull. Gen. Index 1929-1956, 84 & 293. 1959; Jacks. in Hook. f. & Jacks., Ind. Kew., pr. 3, 1: 619 (1960) and 2: 1213 & 1214. 1960; Moldenke, Phytologia 8: 76. 1961; Liu, Illustr. Nat. & Introd. Lign. Pl. Taiwan 2: 1230, pl. 1038. 1962; Li, Wood. Fl. Taiwan 16, 832, 834, & 973. 1963; Prain, Beng. Pl., ed. 2, 2: 621, 622, & 1012. 1963; Srinivasan & Agarwal, Bull. Bot. Surv. India 5: 68. 1963; Panigrahi, Chowdhury, Raju, & Deka, Bull. Bot. Surv. India 6: 255. 1964; Smitinand, Govt. Sarawak Sympos. Ecol. Res. Humid Trop. Veg. 41 & 43. 1965; Mukerjee, Bull. Bot. Surv. India 7: 135. 1965; Backer & Bakh., Fl. Java 2: 606. 1965; Sen & Naskar, Bull. Bot. Surv. India 7: 60. 1965; Hatusima, Mem. Fac. Agr. Kagoshima Univ. 5 (3): 16 & 47. 1966; Moldenke, Résumé Suppl. 15: 8, 9, & 25. 1967; Moldenke, Phytologia 15: 244 & 307. 1978.

Additional illustrations: Hook. & Arn., Bot. Beech. Voy. pl. 48. 1841; Kanehira, Form. Trees, rev. ed., fig. 608. 1936; Liu, Illustr. Nat. & Introd. Lign. Pl. Taiwan 2: pl. 1038. 1962.

It should be noted here that the V. negundo of Linnaeus the elder is a valid species, with the homonyms ascribed to Linnaeus the younger, to Royle, and to Willdenow as synonyms, while that accredited to Curtis is V. negundo var. heterophylla (Franch.) Rehd. and that ascribed to Noronha is V. pinnata L.

The Hooker & Arnott reference given in the bibliography above is sometime erroneously cited as "1841", but actually pages 193 to 288 and plates 40 to 59 in this work were issued in 1836.

Recent collectors describe this plant as a tree, 12—21 m. tall, the trunk 15 cm. to 2 m. in diameter, the bark grayish-brown, the immature fruit green or yellow, and the mature fruit

purplish-black to black, growing in ravines, the edges of cleared ravines, mixed forests, open moist wood-margins, and dry ground beside forests.

The corollas are described as having been "white" on Lau 153, Lei 714, and W. T. Tsang 178, "white-purplish" on Wang 33752, "blue" on Lau 16, "pink" on Taam 1532, and "yellow" on W. T. Tsang 719.

Backer & Bakhuizen van den Brink (1965) describe the species as follows: "Leaflets 3—5, pellucid dotted (by the presence of cystoliths. In dried materials the upper surface of the leaves often shows a whether or not [=more or less?] circumvallate shallow depression near each cystolith.), petioluled, oval-elliptic-obovate-oblong, mostly acuminate, herbaceous or thinly coriaceous, pubescent on the nerves when young; median one 5—13 cm by 2 1/2 - 6 cm, on a petiolule 1 1/2 -- 3 cm long, the other ones smaller, on shorter petiolules; petiole 2--10 cm. Panicles terminal and often also in the upper leaf-axils, 5--25 cm long; cymes 1/2 — 3 cm (inclusive of 2--10 mm petiole); calyx 3—4 mm, with broad teeth; corolla sordidly violet; tube 5—7 mm, inside glabrous or (from the insertion of the stamens up to the base of the lower lip) with few to many hairs; filaments glabrous or basally sparingly hairy, shortly exserted; drupe subglobose, 3/4 — 1 cm diam. Tree.....not too dry forest." They certainly meant to say "peduncle" rather than "petiole" in their description of the length of the cymes. They include V. sumatrana Miq. and V. velutina "K. & V." in the synonymy of V. quinata.

Hatusima (1966) gives the distribution of the species as "India to S. China, Formosa, Malaysia". Srinivasan & Agarwal (1963) record it from West Bengal, Assam, and East Bengal. Panigrahi and his associates (1964) refer to it as "abundant" in Orissa, but Hatusima (1966) tells us that it is "rare" on Batan Island. Mukerjee (1965) states that this tree "helps with sufficient moisture to convert a deciduous forest to evergreen".

Vernacular names recorded for it include "five-leaved chaste-tree", "hu'kham", "kaazàb", "ka wariba-nimzinboku", "kuburasi", "nõa-á", "õ-ninjin-baku", "oo-nimzinboku", "o-tin", "patt'ttu", "pò-kiu", "poorasu", "pw-kiang", and "soa-po-kiwn".

Li (1963) cites Faurie 1021, A. Henry 1182, 1182 A/B, & 1182 C, Kawai s.n., Kawakami & Mori 7, Keng 1369, Makino s.n., Matuda 359 & s.n., Oldham 384, Owatari s.n., Suzuki 20503, and E. H. Wilson 10019 & 11127 from Formosa.

Material has been misidentified and distributed in herbaria as Ardisia sp. On the other hand, the R. C. Ching 5552, O. Degener 14481, Greenwood 344a, A. Henry 1182 & 1182c, Keng K.1369, Liang 62780, Peng, Tak, & Kin s.n. [Herb. Canton Chr. Coll. 12613], Pételot 963, A. C. Smith 4307 & 6295, and F. K. Ward 37559, distributed as typical V. quinata, are actually var. puberula (H. J. Lam) Moldenke, while E. H. Wilson 11127 is the type collection of var. serrata Moldenke, Herb. Canton Chr. Coll.

12882 and E. H. Wilson 408 are V. canescens Kurz, C. Wright s.n. [Hong Kong] is V. negundo var. cannabifolia (Sieb. & Zucc.) Hand.-Mazz., and Clemens & Clemens 3394 is V. tripinnata (Lour.) Merr.

Additional citations: CHINA: Chekiang: R. C. Ching 1987 (W—1346846). Kwangsi: R. C. Ching 7309 (W—1248677). Kwangtung: C. O. Levine s.n. [Herb. Canton Chr. Coll. 10] (W—778511), s.n. [Herb. Canton Chr. Coll. 999] (W—779162), s.n. [Herb. Canton Chr. Coll. 1206] (W—1173131), s.n. [Herb. Canton Chr. Coll. 1807] (W—1428694), s.n. [Herb. Canton Chr. Coll. 1876] (W—1347890); Tsiang 1066 (W—1513168); Ying 770 (W—1513078). Yünnan: A. Henry 12638 (W—459211). HONGKONG: W. Y. Chun 5177 (Ws); Taam 1532 (W—2063819), 1846 (W—2072690). CHINESE COASTAL ISLANDS: Hainan: Chun & Tso 43954 (Bi), 44673 (W—1675422); Fung 20420 (Mi); F. C. How 70570 (Bi), 70858 (Bi); How & Chun 70248 (W—1669424); Lau 16 (W—1629005), 153 (W—1629221); Lei 66 (W—1753851), 714 (W—1654279); Liang 62069 (W—1670785); F. A. McClure 786 [Herb. Lingnan Univ. 18320] (W—1666492); W. T. Tsang 178 [Herb. Lingnan Univ. 15677] (W—1250000), 223 [Herb. Lingnan Univ. 15722] (W—1249809), 719 [Herb. Lingnan Univ. 17468] (W—1672609), 868 [Herb. Lingnan Univ. 16367] (W—1249497), 944 [Herb. Lingnan Univ. 16443] (W—1249327); Wang 33752 (W—1670257), 34267 (W—1670370). Honam: Herb. Canton Chr. Coll. 166 (W—778564). WESTERN PACIFIC ISLANDS: Mindanao: Wenzel 2523 (Mi), 2912 (Bi).

VITEX QUINATA var. PUBERULA (H. J. Lam) Moldenke

Additional synonymy: Vitex mindanaensis Merr. ex Moldenke, Résumé Suppl. 4: 21, in syn. 1962.

Additional bibliography: Thiselt.-Dyer, Ind. Kew. Suppl. 2: 194. 1904; Maun, Philip. Journ. Forest. 16: 108. 1960; Moldenke, Phytologia 8: 77—78 (1961) and 15: 244 & 307. 1967.

Merrill based his V. mindanaensis on an unnumbered collection made by B. Rafael and S. S. Ponce in Butuan Subprovince, Mindanao, Philippine Islands, in September or October, 1913 [Herb. Philip. Forest Bur. 20746], deposited in the United States National Herbarium at Washington.

Elmer describes the variety as a stocky tree, 25 feet tall, the trunk 12 inches thick, the wood moderately soft, whitish, soon discoloring to a dirty-white, odorless and tasteless, the bark thick, grayish-white, finely checked, the branches numerous above the middle, forming a dense elongated crown, the twigs ascending, greenish-brown, with elongated lighter-brown lenticels, the petioles green and ascending, the leaflets horizontally recurved, strongly conduplicate on the upper sublucid and darker-green surface, thinly coriaceous, the inflorescence erect, greenish, slightly fragrant, the corolla creamy, the upper segment purplish-streaked, the filaments whitish, and the anthers purplish-brown. Keng describes the bark as pale-gray and furrowed.

The variety has been found growing on fertile soil of open grasslands at altitudes of 15 to 1080 meters. Additional vernacular names for it are "shek wong king", "tai wong muk", and "topas".

The corollas are described as "violet" on F. K. Ward 37559. Material has been misidentified and distributed in herbaria under the names V. glabrata R. Br., V. heterophyllum Roxb., V. negundo L., V. quinata (Lour.) F. N. Will., V. pentaphylla Merr., Teijsmanniodendron coriaceum (C. B. Clarke) Kosterm., and Araliaceae.

Additional citations: CHINA: Kwangsi: R. C. Ching 5552 (W--1248671). Kwangtung: Peng, Tak, & Kin s.n. [Herb. Canton Chr. Coll. 12613] (W--1248228). Yünnan: Feng 13396 (A). CHINESE COASTAL ISLANDS: Hainan: Liang 62780, in part (W--1670920). THAILAND: Smitinand 4859 (Fg); F. K. Ward 37559 (S). INDOCHINA: Tonkin: Pételot 963 (W--1759227). MALAYA: Perak: Corner 31625 (N). WESTERN PACIFIC ISLANDS: FORMOSA: A. Henry 1182 (W--455592), 1182c (W--455593); Keng K.1369 (W--2035969, W--2035970). PHILIPPINE ISLANDS: Mindanao: Elmer 11602 (Bi, N); Rafael & Ponce s.n. [Herb. Philip. Forest Bur. 20746] (W--900566). INDONESIA: GREATER SUNDA ISLANDS: Celebes: Laleno 49 [Boschproefst. B. B. 19444] (Bi); Waturandang 619 [Boschproefst. Cel/V.385] (Bi). Sarawak: M. Jacobs 5144 (W--2377357). Sumatra: Yates 1609 (Mi). MELANESIA: YASAWA FIJI ISLANDS: Viti Levu: O. Degener 14481 (Bi); J. W. Gillespie 2953 (Bi, Bi), 4164.1 (Bi, Bi), 4691.8 (Bi); Greenwood 344a (Bi); A. C. Smith 4307 (Bi), 6295 (Bi).

VITEX QUINATA var. SERRATA Moldenke, var. nov.

Haec varietas a forma typica speciei foliolis grosse serratis recedit.

This variety differs from the typical form of the species in having its leaflet-blades coarsely serrate along the margins above the middle.

The type of the variety was collected by Ernest Henry Wilson (no. 11127) in forests along the upper Pinan River, province of Pinan, Formosa, on November 17, 1918, and is deposited in the United States National Herbarium at Washington. The collector describes the plant as a tree, to 60 feet tall, with a spread of 15 feet. The type is in full fruit, so the serrate character of the leaflets cannot be ascribed to the specimen being from a watersprout, as might otherwise be said. It was originally distributed as V. heterophylla Roxb. and annotated as V. quinata (Lour.) F. N. Will by Hui-lin Li in 1951.

Citations: WESTERN PACIFIC ISLANDS: FORMOSA: E. H. Wilson 11127 (W--1052400--type).

VITEX RADULA Mildbr.

Synonymy: Vitex robynsi DeWild., Plant. Bequaert. 5: 13--14. 1929.

Additional & emended bibliography: DeWild., Plant. Bequaert.

5: 13--14. 1929; Moldenke, Known Geogr. Distrib. Verbenac., ed. 1, 49--51 & 104. 1942; H. N. & A. L. Moldenke, Plant Life 2: 79. 1948; Moldenke, Known Geogr. Distrib. Verbenac., ed. 2, 115, 117, 120, & 202. 1949; Moldenke, Phytologia 6: 108 & 116. 1957; Moldenke, Résumé 143, 145, 148, 150, & 478. 1959; Moldenke, Phytologia 8: 78. 1961; Moldenke, Résumé Suppl. 13: 3, 5, & 7. 1966.

The binomial, Vitex radula Mildbr., appears to have been proposed first as a hyponym on July 1, 1928, and validated on May 30, 1929. The binomial, V. robynsi DeWild., was also validly published in 1929, but as yet I have not been able to ascertain the exact month or day. I am therefore tentatively reducing it to synonomy under V. radula, since the two taxa are apparently conspecific. The type of V. robynsi, as has been stated previously, was collected by my good friend, Prof. Dr. Frans Hubert Edouard Arthur Walter Robyns (no. 1913) in a shrubby savanna at Kasenga, at an altitude of about 970 meters, in the Republic of the Congo, on April 8, 1926, and is deposited in the herbarium of the Jardin Botanique de l'Etat at Brussels.

Recent collectors describe V. radula as semi-climbing or as a shrub, 3.5 m. tall, growing in rather wet or sandy soil, on shrubby or on secondary woody savannas, in deciduous forests, secondary evergreen forests, dense Brachystegia-Pterocarpus forests, or Brachystegia forests with groups of Oxytenanthera abyssinica in black sandy soil with granite boulders, at 800 to 1100 meters altitude, called "bebesuco" or "limuna-nuna", flowering in February, and fruiting from February to April and in June. The corollas are described as "white" on Barbosa 1037.

The Torre 1268, distributed as V. radula, is actually V. thyrsiflora J. G. Baker.

Additional & emended citations: CONGO LEOPOLDVILLE: Robyns 1913 (Br, Br, N--photo, Z--photo). ZAMBIA: Bredo 4008 (Br, N). PORTUGUESE EAST AFRICA: Cabo Delgado: Torre & Paiva 12005 (Ul). Manica e Sofala: Andrada 1059 (Ul); Barbosa 1037 (Ul, Z), 1583 (Ul); Torre 4340 (Rf, Ul). Niassa: Torre & Paiva 10732 (Ul), 10951 (Ul, Z).

VITEX RAPINI Beauvis.

Emended synonymy: Vitex rapinii Beauvis. ex Moldenke, Résumé 388, in syn. 1959; Guillaum., Mém. Mus. Nat. Hist. Nat. Paris B. 15: 315. 1967.

Additional bibliography: Prain, Ind. Kew. Suppl. 3: 189. 1908; Moldenke, Résumé 206, 342, 388, & 478. 1959; Moldenke, Phytologia 8: 78. 1961; Guillaum., Thorne, & Virot, Univ. Iowa Stud. Nat. Hist. 20 (7): 45. 1965; Guillaum., Mém. Mus. Nat. Hist. Nat. Paris B.15: 315. 1967.

Guillaumin, Thorne, & Vitot (1965) cite Thorne 28541 from New Caledonia. Guillaumin (1967) states that the species grows in serpentine at 900 meters altitude, and cites Baumann 8234.

VITEX RAPINIOIDES Guillaum.

Emended synonymy: Vitex rapinoides Guillaum. ex A. W. Hill, Ind. Kew. Suppl. 9: 297. 1938.

Additional & emended bibliography: A. W. Hill, Ind. Kew. Suppl. 9: 297. 1938; Moldenke, Résumé 205, 388, & 478. 1959; Moldenke, Phytologia 8: 78. 1961.

Additional citations: MELANESIA: NEW HEBRIDES: Aneityum: J. P. Wilson s.n. [Kajewski 992] (Bi—isotype). Efate: Kajewski 211 (Bi). Eromanga: Kajewski 299 (Bi).

VITEX REGNELLIANA Moldenke

Additional bibliography: E. J. Salisb., Ind. Kew. Suppl. 11: 265. 1953; Moldenke, Phytologia 6: 83, 84, 89, & 110—112. 1957; Moldenke, Résumé 112 & 478. 1959.

VITEX REHMANNI Gürke

Emended synonymy: Vitex rehmannii Gürke ex Moldenke, Alph. List Invalid Names 55, in syn. 1942; J. Hutchinson, Botanist in South. Afr. 335. 1946.

Additional bibliography: Thiselt.-Dyer, Ind. Kew. Suppl. 2: 194. 1904; Watt & Breyer-Brandwijk, Med. & Poison, Pl. S. Afr., ed. 1, 154 & 241. 1932; J. Hutchinson, Botanist in South. Afr. 335. 1946; Moldenke, Phytologia 6: 24. 1957; Moldenke, Résumé 154, 388, & 478. 1959; Moldenke, Phytologia 8: 78—79. 1961; Watt & Breyer-Brandwijk, Med. & Poison. Pl. S. Afr., ed. 2, 1055 & 1454. 1962; R. H. Compton, Journ. S. Afr. Bot. Suppl. 6: 66. 1966.

The corollas are described as "white" on Sidey 1310. Hutchinson (1946) cites his no. 2148, which, he says, had "mauve" corollas. Compton (1966) records the species from Swaziland.

Additional citations: SOUTH AFRICA: Transvaal: Schlieben 7526 (N); Sidey 1310 (S).

VITEX REHMANNI f. SUBTOMENTOSA Moldenke

Additional bibliography: Moldenke, Résumé 154, 388, & 478. 1959; Moldenke, Phytologia 8: 79. 1961.

VITEX RESINIFERA Moldenke

Bibliography: Moldenke, Phytologia 3: 446—447. 1951; Moldenke in Humbert, Fl. Madag. 174: 72, 84—86, & 273, fig. 11 (4—6). 1956; Moldenke, Phytologia 6: 114. 1957; Moldenke, Résumé 157 & 478. 1959; G. Taylor, Ind. Kew. Suppl. 12: 151. 1959.

Illustrations: Moldenke in Humbert, Fl. Madag. 174: 85, fig. 11 (4—6). 1956.

VITEX RIVULARIS Gürke

Additional bibliography: Prain, Ind. Kew. Suppl. 3: 189. 1908; F. R. Irvine, Pl. Gold Coast 438. 1930; Dalz., Useful Pl. W. Trop. Afr. 458. 1937; Aubrév., Fl. For. Cot. Iv., ed. 2, 3: 233, pl. 336, fig. 5—7. 1959; F. R. Irvine, Woody Pl. Ghana 764. 1961; Moldenke, Phytologia 8: 79. 1961; Huber in Hutchinson & Dalz., Fl. W. Trop. Afr., ed. 2, 2: 445 & 446. 1963; Moldenke, Résumé Suppl. 12: 7.

1965; Moldenke, Phytologia 15: 254 & 256. 1967.

Illustrations: Aubrév., Fl. For. Cot. Iv., ed. 2, 3: pl. 336, fig. 5—7. 1959.

Recent collectors and authors describe this plant as a forest tree, 30—75 feet tall, the stem with thin bark, often fluted, the bark whitish-green or brown, fairly smooth, papery, longitudinally furrowed, the wood soft or hard and white, the slash olive-brown, with brownish longitudinal lines; leaves digitate; leaflets 5—7, elliptic-lanceolate, long-petiolulate, 15 cm. long, 5 cm. wide, entire, acuminate at the apex, pubescent beneath, the secondaries 12 pairs; flowers small, numerous, white, lilac-tipped or tinged with purple, bluish in bud, borne in open, slender, rich, long-pedunculate, wide-spreading cymes which are dichotomously branched; fruit edible, black, ellipsoid or obovoid, 1/2 inch long, borne in an enlarged cup-shaped fruiting-calyx.

The species grows in deciduous forests, flowering in April and May, fruiting in June, July, and October. The fruit is eaten by game. Additional vernacular names recorded for it are "ash", "akwakora gyahina", "(m)bli", "m'vassa", "ntɛrowa", "ɛtwe", and "ɔtwe ntɔrowa".

Huber (1963) states that the species occurs also in French Cameroun and the Congo. The Zenker s.n. [Bipindi], distributed as V. rivularis, is actually V. longipetiolata Gürke.

Huber (1963) cites the following collections: GHANA: F. R. Irvine 951; Vigne FH.865, 895, & 1094. LIBERIA: Baldwin 6285 & 6491. IVORY COAST: Chevalier 19097. SOUTHERN NIGERIA: Jones & Onochie FHI.18760; Kennedy 910. BRITISH CAMEROONS: Mildbraed 10535.

Additional citations: CAMEROONS: Zenker 3764 (W—554189). ANGOLA: Cabinda: Monteiro & Murta 89 (UI).

VITEX ROBYNSI DeWild.

This taxon is now regarded as conspecific with V. radula Mildbr. and should therefore be removed from my list of valid and accepted taxa.

VITEX RUBRA Moldenke

Bibliography: Moldenke, Phytologia 3: 447. 1951; Moldenke in Humbert, Fl. Madag. 174: 75, 115, 117—118, & 273, fig. 17 (6—8). 1956; Moldenke, Phytologia 6: 116—117. 1957; Moldenke, Résumé 157 & 478. 1959; G. Taylor, Ind. Kew. Suppl. 12: 151. 1959.

Illustrations: Moldenke in Humbert, Fl. Madag. 174: 115, fig. 17 (6—8). 1956.

VITEX RUBRO-AURANTIACA DeWild.

Additional & emended bibliography: A. W. Hill, Ind. Kew. Suppl. 8: 249. 1933; Moldenke, Résumé 143 & 478. 1959; Moldenke, Phytologia 8: 79. 1961.

Additional citations: CONGO LEOPOLDVILLE: Louis 518 (B), 5786

(B), 6174 (B).

VITEX RUFESCENS A. L. Juss.

Additional bibliography: H.B.K., Nov. Gen. & Sp. Pl., ed. folio, 2: 200 (1817) and ed. quart., 2: 246. 1818; Pers., Sp. Pl. 3: 360. 1819; Steud., Nom. Bot., ed. 1, 888. 1821; Barnhart, Bull. Torrey Bot. Club 29: 590. 1902; Jacks. in Hook. f. & Jacks., Ind. Kew., pr. 1, 2: 1214 (1895) and pr. 2, 2: 1214. 1946; Hill & Salisb., Ind. Kew. Suppl. 10: 244. 1947; Moldenke, Phytologia 5: 430 (1956) and 6: 83. 1957; Moldenke, Résumé 112, 387, 389, & 478. 1959; Jacks. in Hook. f. & Jacks., Ind. Kew., pr. 3, 2: 1214. 1960; Moldenke, Résumé Suppl. 12: 9. 1965; Moldenke, Phytologia 15: 247. 1967.

Tavares describes this species as a tree, about 5 m. tall, with a trunk diameter of 20 cm., known as "tamanqueiro", and found growing on the grounds of the Escola Agronomia do Nordeste at Paraiba, with the comment "Cultavada?". It was misidentified and specimens distributed as V. guerkeana Hiern.

An isotype of V. perriana — Blanchet 3434 — in the herbarium of the Conservatoire et Jardin Botaniques at Geneva was photographed there by Macbride as his type photograph number 30187, while the actual type, in the herbarium of the Muséum National d'Histoire Naturelle at Paris was photographed by him as his type photograph number 39501.

It should be noted that the H.B.K. reference dates given above have been authenticated by consultation of the work by Barnhart (1902) on this subject.

Additional citations: BRAZIL: Bahia: Blanchet 3434 [Macbride photos 30187 & 39501] (W—photo, W—photo). Rio de Janeiro: H. F. Martins 209 [Herb. Cent. Pesq. Florest. 574] (Z). CULTIVATED: Brazil: Tavares 856 (W—2403810).

VITEX RUFESCENS var. ABLUDENS (Moldenke) Moldenke

Additional bibliography: Moldenke, Phytologia 6: 120—121. 1957; Moldenke, Résumé 112, 388, & 478. 1959.

VITEX SAMPSONI Hance

Additional & emended bibliography: Jacks. in Hook. f. & Jacks., Ind. Kew., pr. 1, 2: 1214. 1895; Dunn & Tutcher, Kew Bull. Misc. Inf. Addit. Ser. 10: 204. 1912; Hand.-Mazz., Ann. Hort. Gothenb. 9: 68. 1934; Jacks. in Hook. f. & Jacks., Ind. Kew., pr. 2, 2: 1214. 1946; Moldenke, Résumé 171 & 478. 1959; Jacks. in Hook. f. & Jacks., Ind. Kew., pr. 3, 2: 1214. 1960; Moldenke, Phytologia 8: 79—80. 1961.

The Levine collection, cited below, is marked "topotype".

Additional citations: CHINA: Kwangtung: C. O. Levine s.n. [Herb. Canton Chr. Coll. 746] (W—779018).

VITEX SCABRA Wall.

Additional & emended bibliography: Jacks. in Hook. f. & Jacks., Ind. Kew., pr. 1, 2: 1214 (1895) and pr. 2, 2: 1214.

1946; Moldenke, Phytologia 6: 122. 1957; Moldenke, Résumé 166 & 478. 1959; Jacks. in Hook. f. & Jacks., Ind. Kew., pr. 3, 2: 1214. 1960.

VITEX SCANDENS Moldenke

Bibliography: Moldenke, Phytologia 4: 63—64 (1952) and 6: 122. 1957; Moldenke, Résumé 202, 388, & 478. 1959; G. Taylor, Ind. Kew. Suppl. 12: 151. 1959; Moldenke, Résumé Suppl. 12: 8. 1965.

Clemens describes this plant as a scandent shrub, with flowers "dull brick purple with yellowish margin", growing at 2500 to 4500 feet altitude.

Additional citations: MELANESIA: NEW GUINEA: Northeastern New Guinea: M. S. Clemens 41775a (A).

VITEX SCHAUERIANA Moldenke

Additional bibliography: Hill & Salisb., Ind. Kew. Suppl. 10: 244. 1947; Moldenke, Phytologia 6: 123—124. 1957; Moldenke, Résumé 112, 386, & 478. 1959.

A cotype specimen of this species — Blanchet 2782 — in the herbarium of the Conservatoire et Jardin Botaniques at Geneva, was photographed there by Macbride as his type photograph number 30188, while another of the same collection, deposited in the herbarium of the Naturhistorisches Museum at Vienna, is his type photograph number 34300.

Additional citations: BRAZIL: Bahia: Blanchet 2782 [Macbride photos 30188 & 34300] (W—photo of cotype); Frões 20182 (W—2439045).

VITEX SCHLIEBENI Moldenke

Additional bibliography: Moldenke, Résumé Suppl. 1: 9. 1959; Moldenke, Biol. Abstr. 35: 1688. 1960; Moldenke, Phytologia 8: 80. 1961; Hocking, Excerpt. Bot. A.4: 592. 1962; G. Taylor, Ind. Kew. Suppl. 13: 144. 1966.

Additional citations: TANGANYIKA: Schlieben 6008 (N—isotype, W—2214711—isotype).

VITEX SCHOMBURGKIANA Schau.

Additional bibliography: Jacks. in Hook. f. & Jacks., Ind. Kew., pr. 1, 2: 1214 (1895), pr. 2, 2: 1214 (1946), and pr. 3, 2: 1214. 1960; Moldenke, Phytologia 8: 80. 1961.

The type specimen of this species — M. R. Schomburgk 421 — deposited in the herbarium of the Botanischer Garten und Museum at Berlin, was photographed there by Macbride as his type photograph number 17566, but is now destroyed.

Additional citations: BRITISH GUIANA: M. R. Schomburgk 421 [Macbride photos 17566] (W—photo of type).

VITEX SCHOMBURGKIANA var. GRANDIFLORA Moldenke

Additional bibliography: Moldenke, Phytologia 6: 126. 1957; Moldenke, Résumé 112 & 478. 1959.

VITEX SEBESIAE H. J. Lam

Additional bibliography: A. W. Hill, Ind. Kew. Suppl. 7: 252. 1929; Moldenke, Phytologia 6: 126—128. 1957; Moldenke, Résumé 198 & 478. 1959.

VITEX SECUNDIFLORA H. Hallier

Additional bibliography: A. W. Hill, Ind. Kew. Suppl. 6: 219. 1926; Moldenke, Biol. Abstr. 32: 222 & 2353. 1958; Moldenke, Résumé 191 & 478. 1959; Moldenke, Phytologia 8: 80. 1961; Hocking, Excerpt. Bot. A.5: 42. 1962.

VITEX SEINERI Gürke

Additional & emended bibliography: A. W. Hill, Ind. Kew. Suppl. 8: 249. 1933; Moldenke, Phytologia 6: 129. 1958; Moldenke, Résumé 148 & 478. 1959.

VITEX SELLOWIANA Cham.

Additional bibliography: Jacks. in Hook. f. & Jacks., Ind. Kew., pr. 1, 2: 1213 & 1214 (1895) and pr. 2, 2: 1213 & 1214. 1946; Hill & Salisb., Ind. Kew. Suppl. 10: 244. 1947; Jacks. in Hook. f. & Jacks., Ind. Kew., pr. 3, 2: 1213 & 1214. 1960; Moldenke, Phytologia 8: 80. 1961.

The type specimen of this species -- Sellow 1437 -- deposited in the herbarium of the Botanischer Garten und Museum at Berlin, was photographed there by Macbride as his type photograph number 17567, but is now destroyed.

Additional citations: BRAZIL: Rio Grande do Sul: Sellow 1437 [Macbride photos 17567] (W—photo of type).

VITEX SERETI DeWild.

Additional bibliography: Prain, Ind. Kew. Suppl. 4, pr. 1, 248 (1913) and pr. 2, 248. 1958; Moldenke, Phytologia 6: 132. 1958; Moldenke, Résumé 143 & 478. 1959.

VITEX SIAMICA F. N. Will.

Additional bibliography: Prain, Ind. Kew. Suppl. 3: 189. 1908; Fletcher, Kew Bull. Misc. Inf. 1938: 432 & 435. 1938; Anon., Kew Bull. Gen. Index 1929-1956, 293. 1959; Moldenke, Phytologia 8: 80. 1961.

Recent collectors have found this plant growing on limestone rock walls at sealevel, flowering in August.

Additional citations: THAILAND: Larsen, Smitinand, & Warncke 1238 (Ac).

VITEX SIMPLICIFOLIA Oliv.

Additional synonymy: Vitex cordata Aubrév., Fl. Forest. Soudano-Guin. 504. 1950.

Additional & emended bibliography: Gürke in Engl., Pfl. Ost-Afr. C: 339. 1895; Jacks. in Hook. f. & Jacks., Ind. Kew., pr. 1, 2: 1214. 1895; K. Schum. in Just, Bot. Jahresber. 28 (1): 497. 1902; Thiselt.-Dyer, Ind. Kew. Suppl. 2: 194. 1904; J. H. Holland,

Kew Bull. Addit. Ser. 9 [Useful Pl. Nigeria 3]: 526. 1915; Lely, Useful Trees N. Nigeria 116. 1925; Dalz., Useful Pl. W. Trop. Afr. 457. 1937; Aubrév., Fl. Forest. Soudano-Guin. 504. 1950; Moldenke, Phytologia 5: 305. 1955; Moldenke, Résumé 133, 134, 136—140, 143, 381, 383, 389, & 478. 1959; Jacks. in Hook. f. & Jacks., Ind. Kew., pr. 3, 2: 1214. 1960; F. R. Irvine, Woody Pl. Ghana 764. 1961; Moldenke, Phytologia 8: 80. 1961; Jaeger & Winkoun, Bull. Inst. Franc. Afr. Noir 24 [ser. A, no. 1]: 79. 1962; Huber in Hutchinson & Dalz., Fl. W. Trop. Afr., ed. 2, 2: 445 & 447. 1963; Moldenke, Biol. Abstr. 48: 10099. 1967; Moldenke, Phytologia 15: 100 & 232 (1967) and 16: 498. 1968.

Huber (1963) reduces V. vogelii J. G. Baker to synonymy under V. simplicifolia. I regard it as a variety.

Recent collectors and authors describe V. simplicifolia as a small tree or shrub, to 15 feet tall and with 1 foot girth, "often larger (?)", with dense pale indumentum; leaves 1- or 3-foliolate on the same tree, the leaflets 5 inches long, 4 1/2 inches wide, broadly elliptic, densely pubescent beneath when young, the secondaries 8 pairs, the petioles pubescent; flowers small; corolla greenish or mauve, tomentose, the lobes blue-purple or violet; fruit small, obovoid, violet-black, over 1/2 inch long, 3-celled, on a hard saucer-shaped fruiting-calyx or "cupped like an acorn", with a thin edible pulp, and a large 3- or 4-seeded stone.

The species is said to inhabit savannas, flowering from January to June, fruiting in March and June. The twigs are used in Northern Nigeria to make "tooth sticks" or "chew sticks". In the Ivory Coast a lotion is made from the bark to use in the treatment of skin diseases and toothache.

Additional vernacular names recorded for it are "abisa" and "nambara digali". The name, "bummere", recorded previously for the fruit, is applied also to the fruit of Hannoa undulata.

Huber (1963) cites the following collections: MALI: Aubréville 1868, Chevalier 2767, De Ganay 22. IVORY COAST: Aubréville 428, 1394, 1540, & 1967-1969. DAHOMEY: Aubréville 46d & 57d. NORTHERN NIGERIA: Barter 1644, Dalziel 176, Dent Young 206, Lely 849 & P.197, Meikle 1070, Trueblood FHI.4319. SOUTHERN NIGERIA: Barter 1096. BRITISH CAMEROONS: Latilo & Daramola FHI.34490 [this collection I regard as V. simplicifolia var. vogelii, which see]. He also comments "Also in Cameroun, Uganda and extending to Egypt and Sudan". Irvine (1961) cites Brown 2286, Kinloch 3342, Kitson 689, and Vigne 3002, 3777, & 3786 from Ghana and says "Distribution: Fr. Sudan to Cameroons and Sudan".

VITEX SIMPLICIFOLIA var. VOGELII (J. G. Baker) Pieper

Additional bibliography: K. Schum. in Just, Bot. Jahresber. 28 (1): 497. 1902; Thiselt.-Dyer, Ind. Kew. Suppl. 2: 194. 1904; Moldenke, Phytologia 8: 80—81. 1961; Huber in Hutchinson & Dalz., Fl. W. Trop. Afr., ed. 2, 2: 447. 1963.

Huber (1963) reduces this taxon to synonymy under typical V.

simplicifolia Oliv., but I am following Pieper in giving it varietal status. The Latilo & Daramola 34490, which I have previously cited as this variety, Huber cites under V. simplicifolia.

VITEX SNETHLAGIANA Huber

Bibliography: Moldenke, Known Geogr. Distrib. Verbenac., ed. 1, 39 & 104. 1942; H. N. & A. L. Moldenke, Plant Life 2: 84. 1948; Moldenke, Known Geogr. Distrib. Verbenac., ed. 2, 95 & 202. 1949; Moldenke, Phytologia 6: 136—137. 1958; Moldenke, Résumé 112 & 478. 1959; G. Taylor, Ind. Kew. Suppl. 13: 144. 1966.

VITEX SPRUCEI Briq.

Additional bibliography: Thiselt.-Dyer, Ind. Kew. Suppl. 2: 194. 1904; A. W. Hill, Ind. Kew. Suppl. 9: 298. 1938; Moldenke, Biol. Abstr. 33: 1215. 1959; Moldenke, Phytologia 8: 81. 1961; Hocking, Excerpt. Bot. A.5: 44. 1962.

The type specimen of this species -- Spruce 2767 -- deposited in the herbarium of the Conservatoire et Jardin Botaniques at Geneva, was photographed there by Macbride as his type photograph number 24705.

Prance, Pena, Forero, Ramos, & Monteiro 3938 is said to have had its corollas "white with yellow center", and these collectors describe the plant as a tree, 22 m. tall, with a trunk diameter to 45 cm.

The Murça Pires 781, distributed as V. sprucei, is not verbenaceous; it is probably something in the Bignoniaceae.

Additional citations: BRAZIL: Amazônas: Ducke 51 (W—1693056, W—1875284); Fróes 20510 (W—2439073); Prance, Pena, Forero, Ramos, & Monteiro 3938 (N, Rf); Spruce 2767 [Macbride photos 24705] (W—photo of type).

VITEX SPRUCEI var. LONGIDENTATA (Moldenke) Moldenke

Additional bibliography: Moldenke, Phytologia 6: 139—140. 1958; Moldenke, Résumé 112, 389, & 478. 1959.

Additional citations: BRAZIL: Amazônas: Fróes 21398 (W—2439613).

VITEX SPRUCEI var. VAUPESENSIS Moldenke

Additional bibliography: Moldenke, Biol. Abstr. 33: 1215. 1959; Moldenke, Phytologia 8: 81. 1961; Hocking, Excerpt. Bot. A.5: 44. 1962.

VITEX STAHELII Moldenke

Additional bibliography: E. J. Salisb., Ind. Kew. Suppl. 11: 265. 1953; Moldenke, Phytologia 8: 81. 1961.

Berti describes this plant as "Arbol de 28 m. de altura total x 102 cm., yema terminal: complanada contorno más o menos cónico. Ramitas terminales, verdosas con lenticelas alargadas y cremosas. Fruto: color morado negruzco. Semilla 1, envuelta en una pulpa cremosa, carnosa". It has been found in flower and fruit in May.

Additional citations: VENEZUELA: Bolívar: E. L. Little 17659 (Ve). Delta Amacuro: Berti 143 (N, S, Z), 163 (Ac, N); Wurdack & Monachino 39648 (N).

VITEX STELLATA Moldenke

Bibliography: Moldenke, Phytologia 3: 448. 1951; Moldenke in Humbert, Fl. Madag. 174: 76, 125, 126, & 273, fig. 19 (4—6). 1956; Moldenke, Phytologia 6: 142—143, 1958; G. Taylor, Ind. Kew. Suppl. 12: 151. 1959; Moldenke, Résumé 157 & 478. 1959.

Illustrations: Moldenke in Humbert, Fl. Madag. 174: 125, fig. 19 (4—6). 1956.

VITEX STRICKERI Vatke & Hildebr.

Additional bibliography: Jacks. in Hook. f. & Jacks., Ind. Kew., pr. 1, 2: 1214 (1895), pr. 2, 2: 1214 (1946), and pr. 3, 2: 1214. 1960; Moldenke, Phytologia 8: 81—82. 1961.

Recent collectors describe this plant as a much-branched or scrambling shrub, to 4 or 5 feet tall, with rough bark, colorless sap, and panicles of aromatic flowers, the calyx brownish-green, filaments cream, and anthers brown, growing in groups in thickets on red-brown loam, the margins of thickets in Brachystegia woodlands, or very local in Acalypha fruticosa - Acacia - Croton - Haplocoelum - Grewia similis open to closed brushland on shallow black cotton soil with lava rock pavements, to 2000 meters altitude, flowering in February. The corolla is said to have been "white" on Tanner 3420, "white tubular" on Greenway 9175, and "cream" on Drummond & Hemsley 1810.

Additional citations: UGANDA: Mearns 280 (W—630295). TANGANYIKA: Drummond & Hemsley 1810 (B); Tanner 2383 (B), 3420 (S). KENYA: Greenway 9175 (B).

VITEX STYLOSA Dop

Additional & emended bibliography: A. W. Hill, Ind. Kew. Suppl. 9: 298. 1938; Moldenke, Phytologia 6: 143—144. 1958; Moldenke, Résumé 177 & 478. 1959.

VITEX SUMATRANA Miq.

Additional bibliography: Jacks. in Hook. f. & Jacks., Ind. Kew., pr. 1, 2: 1214 (1895), pr. 2, 2: 1214 (1946), and pr. 3, 2: 1214. 1960; Moldenke, Phytologia 8: 82. 1961.

VITEX SWYNNERTONII S. Moore

Additional bibliography: Prain, Ind. Kew. Suppl. 5, pr. 1, 273 (1921) and pr. 2, 273. 1960; Moldenke, Phytologia 8: 82. 1961.

VITEX TANGENSIS Gürke

Additional & emended bibliography: Gürke in Engl., Pflanzenw. Ost-Afr. C: 339—340. 1895; K. Schum. in Just, Bot. Jahresber. 28 (1): 497. 1902; Thiselt.-Dyer, Ind. Kew. Suppl. 2: 194. 1904; Durand & Jacks., Ind. Kew. Suppl. 1, pr. 1, 457 (1906), pr. 2, 457

(1941), and pr. 3, 457. 1959; Moldenke, Phytologia 8: 82. 1961; Cuf., Bull. Jard. Bot. Brux. 32: Suppl. 797—798. 1962; Moldenke, Phytologia 15: 315 (1967) and 16: 496. 1968.

Recent collectors describe this plant as a shrub, 1.5—4 m. tall, several times or much branched from the base or near the base, many-stemmed, the bark pale gray-yellow, very finely reticulate. The corolla is described as "blue" on F. A. Mendonca 2705, "blue-lilac" on Balsinhas 242, "violet" on Torre 958, "lower lip violet" on Torre 2277, "cor de malva" on Junod 414, and "corolla-tube purple-mauve, large petal mauve, with yellow around the throat, throat purplish-mauve, the other petals white, filaments pale-mauve" on Polhill & Paulo 723.

The species has been found growing in deciduous forests, in the substratum in dense forests, and in dune forests with Afzelia quanzensis, Dalium schlechteri, Garcinia livingstonei, Strychnos sp., etc. It is said to be common in the bush around cultivated land, with Adansonia, Allophylus, Carissa, Grewia, Hoslundia, Lannea, Sterculia, Strychnos, Thespesia, etc., flowering in November and December.

Material has been misidentified and distributed in herbaria as V. amboniensis Gürke. Torre 6323 is a mixture with V. oxycuspis var. mossambicensis Moldenke. Torre 2277 is said to match well L. E. Codd 5434 in the British Museum and Kew herbaria, while F. A. Mendonca 2365 and Torre 3829 are said to match Volkens 92, the type of the species, at the British Museum. Torre 3829 is, however, described by Garcia as "intermediate" between V. amboniensis and V. tangensis. The A. Peter 39696, previously cited by me as deposited in my personal herbarium, is now in the herbarium of the Texas Research Foundation at Renner, Texas.

Additional citations: KENYA: Polhill & Paulo 723 (S). PORTUGUESE EAST AFRICA: Inhambane: Torre 3829 (Ul). Lourenço Marques: Balsinhas 242 (Ul); Junod 414 (Ul); Torre 2067 (Ul, Z), 2277 (Ul). Manica e Sofala: F. A. Mendonca 2365 (Ul), 2705 (Ul); Simão 220 (Ul); Torre 6323, in part (Rf, Ul, Ul). Mozambique: Torre 958 (Ul).

VITEX TELORAVINA J. G. Baker

Emended synonymy: Vitex teleravina J. G. Baker apud Durand & Jacks., Ind. Kew. Suppl. 1, pr. 1, 457, sphalm. 1906.

Additional & emended bibliography: Durand & Jacks., Ind. Kew. Suppl. 1, pr. 1, 457 (1906) and pr. 2, 457. 1941; Moldenke in Humbert, Fl. Madag. 174: 77, 139, 141—142, & 273, fig. 22 (8 & 9). 1956; Moldenke, Phytologia 6: 147—148. 1958; Durand & Jacks., Ind. Kew. Suppl. 1, pr. 3, 457. 1959; Moldenke, Résumé 157, 389, & 478. 1959.

Illustrations: Moldenke in Humbert, Fl. Madag. 174: 139, fig. 22 (8 & 9). 1956.

VITEX THOMASI DeWild.

Additional & emended bibliography: A. W. Hill, Ind. Kew. Suppl. 8: 249. 1933; Moldenke, Phytologia 6: 148—149. 1958; Moldenke, Résumé 143 & 478. 1959.

VITEX THOMASI f. KASAIENSIS DeWild.

Bibliography: DeWild., Contrib. Etud. Fl. Katanga Suppl. 2: 108—109. 1929; Moldenke, Phytologia 6: 149—150. 1958; Moldenke, Résumé 143 & 478. 1959.

VITEX THONNERI DeWild.

Additional & emended bibliography: A. W. Hill, Ind. Kew. Suppl. 6: 219 (1926) and 8: 249. 1933; Moldenke, Phytologia 6: 150. 1958; Moldenke, Résumé 140, 143, & 478. 1959.

VITEX THONNERI var. TIBATENSIS (Engl.) Pieper

Additional bibliography: A. W. Hill, Ind. Kew. Suppl. 8: 249. 1933; Moldenke, Phytologia 6: 151. 1958; Moldenke, Résumé 139, 389, & 478. 1959.

VITEX THORELII Dop

Additional & emended bibliography: A.W. Hill, Ind. Kew. Suppl. 9: 298. 1938; Moldenke, Phytologia 6: 151—152. 1958; Moldenke, Résumé 177 & 478. 1959.

VITEX THYRSIFLORA J. G. Baker

Additional bibliography: Durand & Jacks., Ind. Kew. Suppl. 1, pr. 1, 457. 1906; Prain, Ind. Kew. Suppl. 3: 189. 1908; I. Bailey, Ecology 1: 174—189. 1920; Bequaert, Bull. Am. Mus. Nat. Hist. 45: 333—383. 1922; A. W. Hill, Ind. Kew. Suppl. 6: 219 (1926) and 9: 297. 1938; Durand & Jacks., Ind. Kew. Suppl. 1, pr. 2, 457. 1941; Uphof, Bot. Rev. 8: 569—571. 1942; Durand & Jacks., Ind. Kew. Suppl. 1, pr. 3, 457. 1959; Moldenke, Phytologia 8: 82. 1961; Huber in Hutchinson & Dalz., Fl. W. Trop. Afr., ed. 2, 2: 445 & 446. 1963; Moldenke, Phytologia 15: 312. 1967.

Recent collectors and authors describe this plant as an undershrub, shrub, or small tree, 2 m. tall, or a sarmentose shrub to 6 m. tall, with glabrous branches, 5-foliolate leaves, and small white flowers in terminal panicles, growing in forests or open Brachystegia forests, the herbaceous layer being dominated by Digitaria and Panicum, at 280 meters altitude, flowering from January to July and in September, fruiting from July to October, and called "namepéprlr". The corolla is described as "yellow" on Torre 1268.

Bailey (1920) found this species inhabited by the ant, Viticicola tessmanni. The plant has lateral cavities or pits excavated in the woody parts of the stele of stout dry stems and branches. Furthermore, there are in stout stems exit-holes resembling those of the lateral pits subtended by them. This may be due to an inherent tendency to form hollow stems and branches. It is not known whether the ants accelerate formation of the cavities

throughout the center as has been demonstrated by Fiebrig with Cecropia. The pseudo-gall-like structures made by Viticicola are histologically very complex. The insects enter through the circular apertures in the swollen internodes. According to Bequaert (1922) this species of host has heteroplasias similar to those of Plectronia laurentii.

Dan Janzen, in a memorandum to my son, Andrew R. Moldenke, refers to the original description of V. staudtii Gürke as stating that the leaflets are glabrous on the under surface but densely covered with minute, golden-yellow glands. He continues "These glands are critical (if they are indeed glands) to understanding the myrmecophytic relationship that Viticicola has with Vitex staudtii." He speaks of discussions of this plant and its myrmecophily by Bequaert and by Bailey in Wheeler's "Ants of the Belgian Congo".

Material of V. thyrsiflora has been misidentified and distributed in herbaria as V. radula Mildbr.

Huber (1963) cites the following collections: GUINEA: Baldwin 9669; A. Chevalier 13199 & 13267; Jacques-Felix 852. SIERRA LEONE: Deighton 3747; N. W. Thomas 1692 & 1953. LIBERIA: J. T. Baldwin 6172, 9510, & 9945; Harley s.n. [Ganta]; Konneh 175. IVORY COAST: A. Chevalier 17055, 19340, & 19805. TOGO: Baumann 564. NORTHERN NIGERIA: Killick 67. SOUTHERN NIGERIA: Harrison 5; Olorunfemi FHI.38057; Rowland s.n. [W. Lagos]; Symington FHI. 5052; Talbot s.n. [Oban]. BRITISH CAMEROONS: Maitland 565 & 1577; Olorunfemi FHI.30608; Ujor FHI.29288. He comments "Extends to Congo".

Additional citations: SIERRA LEONE: N. W. Thomas 1692 (S). PORTUGUESE EAST AFRICA: Mozambique: Torre 1268 (U1); Torre & Paiva 9864 (U1).

VITEX THYRSIFLORA var. LAXIFLORA Pieper

Additional bibliography: A. W. Hill, Ind. Kew. Suppl. 7: 252. 1929; Moldenke, Phytologia 6: 153--154. 1958; Moldenke, Résumé 139, 386, & 478. 1959.

VITEX TOMENTULOSA Moldenke

Additional bibliography: A. W. Hill, Ind. Kew. Suppl. 9: 298. 1938; Anon., U. S. Dept. Agr. Bot. Subj. Index 15: 14362. 1959; Moldenke, Phytologia 8: 83. 1961.

VITEX TRICHANTHA J. G. Baker

Additional & emended bibliography: Jacks. in Hook. f. & Jacks., Ind. Kew., pr. 1, 2: 1214 (1895) and pr. 2, 2: 1214. 1946; Moldenke in Humbert, Fl. Madag. 174: 75, 120--122, & 273, fig. 18 (4--6). 1956; Moldenke, Phytologia 6: 155--156. 1958; Jacks. in Hook. f. & Jacks., Ind. Kew., pr. 3, 2: 1214. 1960.

Emended illustrations: Moldenke in Humbert, Fl. Madag. 174: 121, fig. 18 (4--6). 1956.

VITEX TRIFLORA Vahl

Additional & emended synonymy: Vitex sericea Poepp. ex Ettingsh., Blatt-Skel. Dikot. 79, pl. 32, fig. 6. 1861 [not V. sericea Poepp. ex Moldenke, 1936]. Pyrostoma ternatum G. F. W. Mey. apud Jacks. in Hook. f. & Jacks., Ind. Kew., pr. 1, 2: 667. 1895. Vitex triflora ternifolia Huber ex Stapf, Ind. Lond. 6: 479. 1931. Vitex trifolia Vahl ex Moldenke, Suppl. List Invalid Names 11, in syn. 1941 [not V. trifolia Graham, 1966, nor Hemsl., 1949, nor L., 1753, nor L. f., 1895, nor Moon, 1895, nor Sessé & Moc., 1940, nor "sensu Matsumura & Hayata", 1963].

Additional & emended bibliography: H.B.K., Nov. Gen. & Sp. Pl., ed. folio, 2: 200 (1817) and ed. quart., 2: 246. 1818; Pers., Sp. Pl. 3: 360. 1819; Steud., Nom. Bot., ed. 1, 888. 1821; Jacks. in Hook. f. & Jacks., Ind. Kew., pr. 1, 1: 447 (1893) and 2: 667 & 1214. 1895; Barnhart, Bull. Torrey Bot. Club 29: 590. 1902; Le Cointe, Amaz. Bras. III Arv. & Plant. Uteis, ed. 1, 430. 1934; Jacks. in Hook. f. & Jacks., Ind. Kew., pr. 2, 1: 447 (1946) and 2: 667 & 1214. 1946; Le Cointe, Amaz. Bras. III Arv. & Plant Uteis, ed. 2, 457. 1947; Hill & Salisb., Ind. Kew. Suppl. 10: 244. 1947; Jacks. in Hook. f. & Jacks., Ind. Kew., pr. 3, 1: 447 (1960) and 2: 667 & 1214. 1960; Moldenke, Phytologia 8: 83. 1961; Soukup, Biota 5: 137. 1964; Moldenke, Résumé Suppl. 15: 25. 1967; Moldenke, Phytologia 15: 229, 242, & 267 (1967) and 16: 495. 1968.

It should be noted here that the V. trifolia of Linnaeus the elder is a valid species, with the homonym ascribed to Linnaeus the younger as a synonym, while the V. trifolia accredited to Graham is a synonym of V. negundo L., that ascribed to Hemsley and to "sensu Matsumura & Hayata" is V. trifolia var. simplicifolia Cham., that ascribed to Moon is V. altissima L. f., and that accredited to Sessé & Mociño is V. mollis H.B.K.

LeCointe (1947) records the vernacular variant "tarumá da mata" and comments "Nas capoeiras e mata secundária. — E' a espécie mais vulgar de Amazônia....O fruto é emenágogo e diuretico; as fôlhas empregam-se contra as cistites e uretrites; a raiz é tônica e febrifuga."

The Huber (1909) reference in the bibliography of this species is dated "1907-8" by Stapf (1931), but 1909 seems to be the actual date when the pages in question appeared. It should be noted that the H.B.K. reference dates given above have been authenticated by consultation of the work by Barnhart (1902) on this subject.

The type specimen -- Herb. Vahl s.n. — deposited in the herbarium of the Universitetets Botaniske Museum at Copenhagen, was photographed there by Macbride and is his type photograph number 22779.

The corollas on Murça Pires & Cavalcante 52602 are described as having been "purple", the flowers slightly fragrant, and the plant itself "rare".

The Archer 8047 and Barbosa de Silva 155, distributed as the

typical form of V. triflora, are actually var. coriacea Huber.

Additional citations: VENEZUELA: Amazonas: Ll. Williams 15688 (Ve--8096, W--2428824). BRAZIL: Amapá: Irwin, Murça Pires, & Westra 48311 (N); Murça Pires 48560 (Mi, N); Murça Pires & Cavalcante 52602 (N, Rf); Murça Pires, Rodrigues, & Irvine 50466 (N). Amazônas: Krukoff 4704 (W--1662717), 6869 (W--1660920). Pará: Fróes 20381 (W--2439042); Killip & Smith 30598 (W--1464184); Murça Pires 51907 (N). LOCALITY OF COLLECTION UNDETERMINED: Herb. Vahl s.n. [ex India; Herb. Willdenow 11701; Macbride photos 22779] (W--photo of type).

VITEX TRIFLORA var. ANGUSTILOBA Huber

Synonymy: Vitex triflora angustiloba Huber apud Stapf, Ind. Lond. 6: 479. 1931.

Additional bibliography: Moldenke, Phytologia 6: 161--162. 1958; Moldenke, Résumé 112 & 478. 1959; Moldenke, Résumé Suppl. 15: 25. 1967.

The Huber (1909) reference in the bibliograph of this variety is dated "1907-8" by Stapf (1931), but the pages involved seem to have appear first in 1909.

VITEX TRIFLORA var. CORIACEA Huber

Synonymy: Vitex triflora coriacea Huber apud Stapf, Ind. Lond. 6: 479. 1931.

Additional bibliography: Moldenke, Phytologia 6: 162. 1958; Moldenke, Résumé 112 & 478. 1959; Moldenke, Résumé Suppl. 15: 25. 1967.

Recent collectors describe this plant as a shrub, 2 feet tall, or a large tree, known as "piquia-rana", flowering in November and December. The corollas on Archer 8047 are said to have been "lavender".

The Huber (1909) reference cited in the bibliography of this variety is dated "1907-8" by Stapf (1931), but the pages involved appear not to have been issued until 1909.

Material has been inaccurately identified and distributed in herbaria as typical V. triflora Vahl.

Additional citations: BRAZIL: Pará: Archer 8047 (N); Barbosa de Silva 155 (N).

VITEX TRIFLORA var. FLORIBUNDA Huber

Additional synonymy: Vitex triflora floribunda Huber apud Stapf, Ind. Lond. 6: 479. 1931.

Additional bibliography: Moldenke, Phytologia 6: 162--163. 1958; Moldenke, Résumé 112, 387, & 478. 1959; Moldenke, Résumé Suppl. 15: 25. 1967.

As mentioned above under the other varieties of this species, the Huber (1909) reference in the bibliography is cited as "1907-8" by Stapf (1931), but it seems that the pages involved here did not actually appear in print until 1909.

Additional citations: BRAZIL: Pará: Ducke 971 (W--1832289).

VITEX TRIFLORA var. KRAATZII Huber

Additional synonymy: Vitex triflora kraatzii Huber apud Stapf, Ind. Lond. 6: 479. 1931.

Additional bibliography: Moldenke, Phytologia 8: 83. 1961; Moldenke, Résumé Suppl. 15: 25. 1967.

The original publication of this variety by Huber (1909) is inaccurately cited by Stapf (1931) as "1907-8".

VITEX TRIFLORA var. QUINQUEFOLIOLATA Moldenke

Additional bibliography: Moldenke, Phytologia 8: 83. 1961.

The Ecuadorean collection cited below consists only of leaves and fruit and it is therefore placed here only tentatively.

Additional citations: ECUADOR: Guayas: Gilmartin 548 (W--2428412).

VITEX TRIFOLIA L., Sp. Pl., ed. 1, 638 [as "trifoliis"]. 1753 [not V. trifolia Graham, 1966, nor Hemsl., 1949, nor Moon, 1895, nor Sessé & Moc., 1940, nor Vahl, 1941, nor "sensu Matsumura & Hayata", 1963].

Additional & emended synonymy: Vitex triflora odorata, sylvestris J. Burm., Thes. Zeyl. 209--210, pl. 109. 1737. Vitex incisa Wall. apud Watt, Dict. Econ. Prod. India 6 (4): 251, in syn. 1893 [not V. incisa Bunge, 1927, nor Lam., 1788, nor Thunb., 1947]. Vitex agnus castus var. Kurz ex Watt, Dict. Econ. Prod. India 6 (4): 251, in syn. 1893. Vitex trifolia L. f. ex K. Schum., Notizbl. Bot. Gart. Berl. App. 1: 55, sphalm. 1895. Vitex trifoliolata L. apud J. Matsumura, Ind. Pl. Jap. 2 (2): 534--535. 1912. Vitex trifoliolata var. trifoliolata Schau. apud J. Matsumura, Ind. Pl. Jap. 2 (2): 534--535. 1912. Vitex trifolia α trifoliata Cham. apud Hara, Enum. Sperm. Jap. 1: 191, in syn. 1948. Vitex trifolia α trifoliolata Schau. apud Hara, Enum. Sperm. Jap. 1: 191, in syn. 1948. Vitex trifolia trifoliolata "Schau. ex Blanco" apud Stapf, Ind. Lond. 6: 479. 1931. Viiex trifolia L. ex Hosokawa, Journ. Soc. Trop. Agr. Taiwan 6: 206, sphalm. 1934.

Additional & emended bibliography: J. Burm., Thes. Zeyl. 209--210 & 229, pl. 109. 1737; J. F. Gmel. in L., Syst. Nat., ed. 13, pr. 1, 2: 962 (1789) and pr. 2, 2: 962. 1796; Horsf., Verh. Bat. Gen. 8: 104. 1816; Pers., Sp. Pl. 3: 361. 1819; Steud., Nom. Bot., ed. 1, 888. 1821; Roxb., Fl. Ind., ed. 2 [Carey], 3: 69. 1832; Schnitzl., Icon. Fam. Nat. Reg. Veg. 137. 1856; Mason, Burmah & its People, ed. 2, 413, 479, & 792. 1860; Miq., Cat. Mus. Bot. Lugd.-Bat. 70. 1870; Beddome, Forester's Man. Bot. S. Ind. 172. 1873; Gamble, Man. Ind. Timb., ed. 1, 296. 1881; Watt, Econ. Prod. India 5: 294--295. 1883; Vidal, Phan. Cuming. Philip. 134. 1885; Warb. in Engl., Bot. Jahrb. 13: 428--429. 1891; Watt, Dict. Econ. Prod. India 6 (4): 251. 1893; W. A. Tal-

bot, Syst. List Trees Shrubs Bomb. 161 & 229. 1894; Jacks. in Hook. f. & Jacks., Ind. Kew., pr. 1, 2: 1213 & 1214. 1895; K. Schum., Notizbl. Bot. Gart. Berl. App. 1: 55 (1895) and 1: 206. 1896; Anon., Notizbl. Bot. Gart. Berl. App. 1: 346. 1897; K. Schum., Notizbl. Bot. Gart. Berl. App. 2: 144—145. 1898; Anon., Notizbl. Bot. Gart. Berl. App. 2: 419. 1899; Gamble, Man. Ind. Timb., ed. 2, 539. 1902; Prain, Beng. Pl., ed. 1, 2: 832—833. 1903; C. B. Clarke in J. Schmidt, Bot. Tidsskr. 26: 173. 1904; E. D. Merr., Philip. Journ. Sci. Bot. 1, Suppl. 1: 121. 1906; Kawakami, List Pl. Formos. 85. 1910; Duthie, Fl. Upper Gang. Plain 2: 224. 1911; Craib, Kew Bull. Misc. Inf. 9: 443. 1911; Craib, Contrib. Fl. Siam Dicot. 164—165. 1912; Dunn & Tutcher, Kew Bull. Misc. Inf. Addit. Ser. 10: 204. 1912; J. Matsumura, Ind. Pl. Jap. 2 (2): 534—535. 1912; E. D. Merr., Interpret. Rumph. Herb. Amboin. 453, 524, & 594. 1917; H. J. Lam in Lam & Bakh., Bull. Jard. Bot. Buitenz., ser. 3, 3: 53. 1921; Haines, Bot. Bihar & Orissa 4: 711 & 712. 1922; Nakai, Trees & Shrubs Indig. Jap., ed. 1, 1: 350, fig. 190. 1922; H. N. Ridl., Journ. Malay Br. Roy. Asiat. Soc. 1: [Mal. For. Trees] 83. 1923; H. J. Lam in Engl., Bot. Jahrb. 59: 27, 28, & 92—93. 1924; C. J. F. Skottsberg, Medd. Göteb. Bot. Trädg. 2 [Haw. Vasc. Pl.]: 259. 1925; Gamble, Fl. Presid. Madras 2: 1101 & 1102. 1924; Mezger, Ann. Mus. Col. Marseille, sér. 4, 4: pl. 60. 1926; A. W. Hill, Ind. Kew. Suppl. 7: 252. 1929; C. A. Gardn., Enum. Pl. Austr. Occid. 3: 112. 1931; A. W. Hill, Ind. Kew. Suppl. 8: 249. 1933; Kanehira, Fl. Micrones. 343 & 457. 1933; Tu, Chinese Bot. Dict., abrdg. ed., 1337. 1933; Hosokawa, Journ. Soc. Trop. Agr. Taiwan 6: 206. 1934; Terazaki, [Illustr. Fl. Jap.] fig. 2499. 1938; Fletcher, Kew Bull. Misc. Inf. 1938: 431—433. 1938; Corner, Gard. Bull. Straits Settl. 10: 256—260. 1939; Jacks. in Hook. f. & Jacks., Ind. Kew., pr. 2, 2: 1213 & 1214. 1946; Selling, Bishop Mus. Spec. Publ. 38: 275 & 411. 1947; L. H. Bailey, Man. Cult. Pl., ed. 2, 843, 844, & 1114. 1949; W. J. Bean in Chittenden, Roy. Hort. Soc. Dict. Gard. 4: 2250. 1951; Hocking, Dict. Terms Pharmacog. 166 & 243. 1955; Kuck & Tongg, Mod. Trop. Gard. 77 & 236. 1955; Darlington & Wylie, Chromosome Atl., pr. 1, 323, 1955; Moldenke in Humbert, Fl. Madag. 174: 71, 72, 79—83, & 273, fig. 10 (5 & 6). 1956; Anon., Biol. Abstr. 30: 4370. 1958; H. St. John, Nomencl. Pl. 74. 1958; Moldenke, Biol. Abstr. 32: 2353. 1958; Anon., Kew Bull. Gen. Index 1929-1956, 293. 1959; Nath, Bot. Surv. South. Shan States 304—305. 1960; Jacks. in Hook. f. & Jacks., Ind. Kew., pr. 3, 2: 1213 & 1214. 1960; Darlington & Wylie, Chromosome Atl., pr. 2, 323. 1961; Moldenke, Phytologia 8: 83—84. 1961; Cave, Ind. Pl. Chromosome Numb. 2: 137. 1961; Deb, Bull. Bot. Surv. India 3: 315. 1961; Hocking, Excerpt. Bot. A.5: 42. 1962; Moldenke, Biol. Abstr. 37: 1062. 1962; F. R. Fosberg, Bishop Mus. Occas. Papers 23 (2): 41—42. 1962; Thothathri, Bull. Bot. Surv. India 4: 291. 1962; Hatusima, Mem. South. Indust. Sci. Inst. Kagoshima Univ. 3: 31. 1962; Van Steenis-Kruseman, Fl. Males. Bull. 3: 695 & LI. 1962; Li, Wood. Fl. Taiwan 973. 1963; Hocking, Excerpt. Bot. A.6: 534. 1963; Prain, Beng. Pl., ed. 2, 621 & 1012. 1963; Sharma & Mukhopadhyay, Journ. Genet. 58: 359,

366, 376, 379, & 539. 1963; E. E. Lord, Shrubs & Trees Austral. Gard., rev. ed., 232. 1964; Cave, Ind. Pl. Chromosome Numb. 2: 331. 1964; Menninger, Seaside Pl. 32, 154, & 155, pl. 223. 1964; Duffy, Journ. Appl. Ecol. 1: 227--228, 231, 234, 242, 243, & 248. 1964; Straatmans, Micronesica 1: 115. 1964; Backer & Bakh., Fl. Java 2: 604 & 605. 1965; J. S. Beard, Descrip. Cat. W. Austr. Pl. 93. 1965; Moldenke, Résumé Suppl. 12: 8. 1965; Hänsel, Leuckert, Rimpler, & Schaaf, Phytochem. 4: 19 & 21. 1965; Quisumbing, Govt. Sarawak Sympos. Ecol. Res. Humid Trop. Veg. 35 & 36. 1965; Bose, Handb. Shrubs 96 & 97. 1965; Malick, Bull. Bot. Surv. India 8: 55. 1966; Gaussen & al., Trav. Sect. Scient. & Tech. Inst. Franç. Pond. Hors ser. 7: 71 & 104. 1966; T. C. Whitmore, Guide Forests Brit. Solomon Isls. 206. 1966; Lourteig, Taxon 15: 28. 1966; Moldenke, Résumé Suppl. 15: 15 & 25. 1967; Sauer, Plants & Man Seychelles 102. 1967; Moldenke, Phytologia 15: 78 & 267 (1967), 15: 472 (1968), and 16: 495. 1968.

Additional & emended illustrations: Terazaki, [Illustr. Fl. Jap.], fig. 2499. 1938; Moldenke in Humbert, Fl. Madag. 174: 79, fig. 10 (5 & 6). 1956; Menninger, Seaside Pl. 154, pl. 223. 1964.

Backer & Bakhuizen van den Brink (1965) describe this plant as being a very aromatic shrub, the stem erect, not rooting from the nodes, the leaflets 1--3, those of the 2- or 3-foliolate leaves either all sessile or the median (largest) leaflet on a petiolule of less than 0.5 cm. in length, ovate-elliptic to oblong-obovate, the largest leaflet of the 2- or 3-foliolate leaves 4--9.5 cm. long and 1.7--3.7 cm. wide, the unifoliolate leaves 2--6.5 cm. long, 1.3--3.5 cm. wide, all very densely covered with white or gray hairs beneath; panicles narrow, 3.5--24 cm. long; cymes 2--6.5 cm. long (including the 2--25 mm. long peduncle), 3--15-flowered, rather dense to rather lax; calyx 3--4.5 mm. long; corolla-tube 7--8 mm. long; median segment of the lower lip 4--6 mm. in diameter. They say that the species is found in teak forests, brushwood, secondary forests, and "periodically very much desiccating localities", and is also cultivated as a hedge-plant in Java. The make the further comment that "Some specimens closely approach the next species [V. paniculata Lam.]".

The corolla is described as having been "purple" on S. Olsen 879. Bose (1965) reports the plant as "very hardy, leaves simple or 3-foliolate", best propagated by the so-called "gootie" method. The plant has been collected in fruit in January as well as during the months previously recorded by me. Cave (1961, 1964) reports the diploid chromosome number for this species as 26 and 34.

Deb (1961) says of this plant: "1ft. glabrous above, tomentose beneath, panicles white tomentose, corolla tomentose, lavender blue. Very common in valley, gregarious, in damp or moist waste land, along drains and roads or river banks" and cites his no. 128.

It should perhaps be noted here that the V. trifolia accredited to Graham is a synonym of V. negundo L., that ascribed to

Hemsley and to "sensu Matsumura & Hayata" is V. trifolia var. simplicifolia Cham., that accredited to Moon is V. altissima L.f., that of Sessé & Mociño is V. mollis H.B.K., while that ascribed to Vahl is V. triflora Vahl.

According to Lourteig (1966) the name, V. trifolia L., is based on and typified by P. Hermann 70. Mocking (1955) informs us that the leaves of this plant have a volatile oil containing cineol and methyl alcohol, and that this oil is used medicinally. Additional vernacular names recorded for the plant are "Cayenne pepper", "hamago", "kyaung banm ye-kyi-yo-ban", "lagunding dagat", "mitsuba-hamagō", "pani-sanbhalu", "shiru-fūki", and "tachi-hamago".

Lord (1964) recommends the species for planting in coastal climates in Australia. Malick (1966) reports it not so common in West Bengal, citing Biswas 35. T. C. Whitmore (1966) cites Waterhouse 60 from the Solomon Islands. Vidal (1885) cites Cuming 1493 from the Philippines.

Duffy (1964) states that "Vitex trifolia" [surely one of the varieties, not the true species!] was introduced in 1858 on Ascension Island, having been received in a consignment of 228 species of plants from the Capetown Botanic Garden, and is now widespread on the island. He also avers that beetles are a form of insect life scarce on Ascension Island, but are found on this "Vitex trifolia", as well as on Opuntia and Acacia, there.

Straatmans (1964) informs us that V. trifolia is among the tropical seashore buoyant-seed plants in the coastal community on Eua island, but it is probable that he is here actually referring to var. bicolor (Willd.) Moldenke.

The Lam (1924) reference in the bibliography of this species is often cited as "1925", but the latter is merely the title-page date for the volume; the pages cited appeared in 1924. The Blanco (1878) reference is dated "1878-80" by Stapf (1931), but the plate which concerns us here seems to have been issued in 1878. The "Basu, Ind. Med. Pl. pl. 2499" references given by me in the bibliography published in 1958 should be deleted; they are the result of errors in transcription for Terazaki, [Illustr. Fl. Jap.] fig. 2499 (1938). Prain (1903) writes the Watt references given in the bibliography above as "E. D. 5: 181", but this is actually a paragraph reference, not a page reference!

The following incomplete bibliographic references occur in the literature of V. trifolia, but have not as yet been located by me in any library consulted: Aplin, Rep. on the Shan States, Settl. Rep. Chanda app. 6; Baden Powell, Pb. Pr. 364; Boorsma, Plantenstoffen 4: 111; Cooke, Oils & Oil-seeds 81; Fleming, Med. Pl. & Drugs [Asiatic Reser. 11] 184; Gazetteer Mysore & Coorg 1: 64; Koord., Natuurk Tijdschr. v. B. 1, 48: 89 and 20: 223; Ridl., Mal. Geneesmiddeln 28; Pharm. Ind. 163; Tijdschr. v. Land- en Tuinbouw en Boschcultuur 5: 554; Waitz, Practische Waarnemingen 10.

The D. Anderson 2143, Elmer 15236, Haenke s.n. [Mariana, 1792],

Kajewski 2417, and H. E. Parks 20857, distributed as typical V. trifolia, are all var. bicolor (Willd.) Moldenke; A. A. Heller 2731, Taam 1702, M. M. Townsend s.n. [Oct. 20, 1940], and C. Wright s.n. [Hong Kong] & s.n. [Bonin Islands] are var. simplicifolia Cham.; E. H. Bryan 1315, Chapin 853, E. Y. Dawson 19825, F. R. Fosberg 11981 & 36709, K. P. Fosberg 15, J. W. Gillespie 4380, S. K. Lau 270, J. W. Moore 696, Native collector DI.149 [Herb. Roy. Forest Dept. 3567], Quayle 1281, J. F. C. Rock 2325, 2969, 7838, & s.n. [S. Kona, April 28, 1958], H. Saint John 14252 & 16573, Schiffner 2454, A. C. Smith 4559 & 6078, A. M. Stokes 1, Toroes 910, and Waterhouse 60 [Herb. Mus. Yale Sch. Forest. 22664] are all var. subtrisecta (Kuntze) Moldenke; and H. Saint John 16705 is the type collection of var. subtrisecta f. albiflora Moldenke.

Additional citations: WESTERN PACIFIC ISLANDS: PHILIPPINE ISLANDS: Mindoro: H. H. Bartlett 13707 (Mi). Papahag: S. Olsen 879 (Cp). INDONESIA: GREATER SUNDA ISLANDS: Sumatra: Yates 1480 (Mi), 1941 (Mi). MELANESIA: BISMARK ARCHIPELAGO: New Britain: Dissing 2722 (Cp, Z).

VITEX TRIFOLIA var. BICOLOR (Willd.) Moldenke

Additional synonymy: Vitex negundo var. bicolor Lam., in herb.

Additional & emended bibliography: Steud., Nom. Bot., ed. 1, 888. 1821; Bocq., Adansonia 3: [Rev. Verbenac.] 253. 1863; Watt, Dict. Econ. Prod. India 6 (4): 248. 1893; Jacks. in Hook. f. & Jacks., Ind. Kew., pr. 1, 2: 1213. 1895; H. J. Lam in Engl., Bot. Jahrb. 59: 27—28 & 93. 1924; H. J. Lam in Bakh. & Lam, Nov. Guinea 14, Bot. 1: 169. 1924; A. W. Hill, Ind. Kew. Suppl. 8: 249. 1933; Corner, Gard. Bull. Straits Settl. 10: 257. 1939; Jacks. in Hook. f. & Jacks., Ind. Kew., pr. 2, 2: 1213. 1946; Hill & Salisb., Ind. Kew. Suppl. 10: 244. 1947; Moldenke in Humbert, Fl. Madag. 174: 72, 83, & 272—273. 1956; Yuncker, Pl. Tonga 232. 1959; Jacks. in Hook. f. & Jacks., Ind. Kew., pr. 3, 2: 1213. 1960; Moldenke, Phytologia 8: 84—86. 1961; Backer & Bakh., Fl. Java 2: 605. 1965; B. C. Stone, Micronesica 2: 132. 1966; Moldenke, Phytologia 15: 306. 1967.

Backer & Bakhuizen van den Brink (1965) adopt the name, V. paniculata Lam., for this taxon, but admit that it is very frequently confused with V. negundo L. and is sometimes "difficult to be distinguished" from V. trifolia "with which it seems to hybridize." Corner (1939) says "This variety is so curiously intermediate between V. negundo and V. trifolia, that one cannot doubt that it covers their hybrids." Lam (1924) regarded Volkens 425, from Yap, as a hybrid between what he called V. negundo var. bicolor and V. trifolia var. trifoliolata. In regard to the theory that this taxon is a natural hybrid between V. negundo and V. trifolia, it is worth pointing out that it has been

collected — often abundantly — on at least seventy-five islands in the Pacific Ocean area on which V. negundo does not occur, or, at least, has never been found and is very unlikely to occur. I have no doubt that these two species do hybridize [see under V. negundo in these notes], but this taxon does not represent this hybrid. Nor do I feel that it is worthy of specific rank. As Backer and Bakhuizen van den Brink themselves admit, there are many specimens intermediate between it and the typical V. trifolia.

Recent collectors and writers describe this plant as a shrub, 6—12 feet tall, or a tree, 8—10 m. tall, with 3—5 leaflets per leaf, the petiole 2—6 cm. long, the middle leaflet on a petiolule 0.5—2 cm. long, ovate-oblong or oblong-lanceolate, 3.5—10 cm. long, 1.5—3.5 cm. wide, very acutely acuminate at the apex, the 2 adjacent leaflets (in the 5-foliolate leaves) smaller or shorter-petioluled, the outermost leaflets (in 5-foliolate leaves) smallest, sessile or subsessile; panicles pyramidal-ovoid, lax, 6—20 cm. long, the cymes distinctly forked, 2—10 cm. long (inclusive of the peduncle which is 5—40 mm. long), many-flowered, lax; calyx 1.5—3 mm. long; corolla-tube 4—5 mm. long, the median lobe of the lower lip 3—4 mm. long and 2.5—3 mm. wide. The corolla is described as having been "blue" on Janowsky 518 and "pale-lilac" on Purseglove P.5015.

The plant has been collected on coral limestone, in thickets, above beaches, on sandy beaches and adjacent localities, especially on the older parts of the beach-wall, rarely more inland. Yuncker (1959) says that it is occasional throughout Tonga and notes for its general distribution "From eastern Africa and India through Malaysia to Polynesia. Presumably the V. trifolia of Hemsley's and Burkill's list." The leaves are used as a medicine in the treatment of fever in Samoa. Additional vernacular names recorded for it are "agulundi" and "gamulega". Stone (1966) records the plant from Nukuoro in the Caroline Islands, where it is known as "kăsik".

It should be pointed out here that the Lam (1924) reference in the bibliography of this variety is often cited as "1925", but the latter date is merely the title-page date for the volume; the pages involved here appeared in the year 1924. In this work Lam cites Janowsky 518 from Dutch New Guinea, Hollrung 486, Lewandowsky 48, Nyman 210, and Schlechter 14253 from Northeastern New Guinea, Dahl 149 and Lauterbach 166 from New Britain, Kraemer s.n., Ledermann 14122, and Raymundus 178 from the Palau Islands, Kraemer s.n. and Ledermann 13531 from the Caroline Islands, and Haenke s.n. and Höfer 25 from the Mariana Islands. The Feuilleteau de Bruyn 414 which he also cites is actually f. albiflora (Kuntze) Moldenke. He notes that Lewandowsky 48 shows one 1-foliolate leaf.

The J. A. Price s.n. [May 10, 1943], distributed as var. bicolor, is actually var. variegata Moldenke.

Additional citations: TANGANYIKA: Tanner 2960 (S). ZANZIBAR: H. G. Faulkner 2389 (S). WESTERN PACIFIC ISLANDS: PHILIPPINE ISLANDS: Cagayan: Kondo & Edaño s.n. [Philip. Nat. Herb. 39032] (Bi). Luzon: Elmer 15236 (Bi). Mindanao: Elmer 11999 (Bi). Mindoro: G. T. Velasquez 11 (Bi). Naranjo: Kondo & Edaño s.n. [Philip. Nat. Herb. 38739] (Bi). Polillo: R. C. McGregor s.n. [Herb. Philip. Bur. Sci. 10270] (Bi). MARIANA ISLANDS: Guam: H. M. Mayo s.n. [Oct. 24, 1947] (Bi); P. Nelson 522 (Bi), 535 (Bi, Bi). Saipan: W. H. Lange 47 (Bi). Tinian: R. S. Cowan s.n. [April 3, 1945] (Bi); Hosokawa 7700 (Bi); Kanehira 55 (Bi); Kondo 1 (Bi), 58 (Bi). Island undetermined: Haenke s.n. [Mariana, 1792] (Bi). INDONESIA: GREATER SUNDA ISLANDS: Sarawak: Purseglove P. 5015 (N). Sumatra: Lütjeharms 4655 (Bi, Bi). MICRONESIA: CAROLINE ISLANDS: Arekalong: Takamatsu 1697 (Bi). Dublon: Takamatsu 134 (Bi). Ifaluk: Abbott & Bates 78 (Bi). Kusaei: Takamatsu 487 (Bi). Lele: Glassman 2716 (Bi). Lukunor: D. Anderson 2143 (Bi). Ponape: Takamatsu 780 (Bi). MELANESIA: NEW GUINEA: Dutch New Guinea: Aet & Idjan 348 (A). SOLOMON ISLANDS: Florida: Seale s. n. [May 23, 1903] (Bi). Guadalcanal: Kajewski 2417 (Bi). NEW HEBRIDES: Aneityum: Kajewski 801 (Bi). YASAWA FIJI ISLANDS: Fulanga: A. C. Smith 1200 (Bi). Kansavu: A. C. Smith 314 (Bi). Koro: A. C. Smith 1075 (Bi). Ovalau: J. W. Gillespie 4503 (Bi, Bi). Taveuni: J. W. Gillespie 4687 [wood no. 2145] (Bi). Vanua Levu: A. C. Smith 6622 (Bi). Viti Levu: E. H. Bryan 208 (Bi); MacDaniels 1008 (Bi); Meebold 16492 (Bi), 21385 (Bi); H. E. Parks 20800 (Bi), 20857 (Bi); Tothill & Tothill 660 (Bi). LAU FIJI ISLANDS: Thithia: E. H. Bryan 556 (Bi). TONGAN ISLANDS: Eua: H. E. Parks 16178 (Bi). Nomuka: Yuncker 15901 (Bi). Tonga: McKern 27 (Bi). Tongatabu: Yuncker 15011 (Bi). POLYNESIA: WESTERN SAMOA: Savaii: E. Christophersen 936 (Bi), 2849 (Bi). Upolu: A. J. Eames 36 (Bi). EASTERN SAMOA: Ofu: Yuncker 9566 (Bi). Safotu: Vaupel 389 (Bi). Tau: D. W. Garber 611 (Bi); Yuncker 9104 (Bi). Tutuila: W. A. Setchell 531 (Bi). NIUE: Yuncker 10041 (Bi). COOK ISLANDS: Rarotonga: Parks & Parks 22573 (Bi); G. P. Wilder 1000 (Bi). CULTIVATED: Samoan Islands: D. W. Garber 995 (Bi); G. P. Wilder 48 [248] (Bi).

VITEX TRIFOLIA var. BICOLOR f. ALBIFLORA (Kuntze) Moldenke

Synonymy: Vitex agnus-castus ß negundodes f. albiflora Kuntze, Rev. Gen. Pl. 2: 510. 1891. Vitex agnus-castus var. negundodes f. albiflora Kuntze ex Moldenke, Résumé 380, in syn. 1959. Vitex trifolia var. bicolor f. albiflora Moldenke, Phytologia 8: 86. 1961. Vitex agnus-castus var. negundoides f. albiflora Kuntze, in herb.

Bibliography: Kuntze, Rev. Gen. Pl. 2: 510. 1891; H. J. Lam in Bakh. & Lam, Nov. Guin. 14, Bot. 1: 169. 1924; Moldenke, Résumé 380. 1959; Moldenke, Phytologia 8: 86. 1961.

Collectors describe this plant as a tree, 5 m. tall, the trunk 9 cm. in diameter, the leaves white beneath, and the corolla white.

The type of the form, as originally described by me, is H. E. Parks 16178, from Eua Island in the Tongan group. However, Kuntze apparently described the taxon earlier, based on a collection made by himself in Dakkan, Bombay, India. Since he also gave the taxon form rank, it is obvious that his description is the valid one and mine, being so much later, is illegitimate. His collection, therefore, becomes the true type of the taxon.

The Feuilleteau de Bruyn 414, cited by Lam (1924), apparently belongs to this form since its corollas as described as having been white. It was collected on Schouten Island, New Guinea, but I have not as yet been able to examine it, nor Kuntze's type.

VITEX TRIFOLIA var. PURPUREA Lord, Shrubs & Trees Austral. Gard., rev. ed., 232 [as "trifolia 'purpurea'"]. 1964; Moldenke, Résumé Suppl. 15: 15. 1967.

The original description by Lord (1964) of this variety is "Vitex trifolia 'purpurea' with soft clean leaves, purple beneath". It is apparently cultivated in Australian gardens and I know nothing else about it.

VITEX TRIFOLIA var. SIMPLICIFOLIA Cham.

Additional & emended synonymy: Vitex trifolia var. unifoliata Miq., Cat. Mus. Bot. Lugd.-Bat. 70. 1870. Vitex trifolia var. unifoliata Schau. ex Kawakami, List Pl. Formos. 85. 1910. Vitex rotundifolia L. ex S. Sasaki, List Pl. Formos. 353 & 354. 1928. Vitex trifolia unifoliolata Schau. ex Stapf, Ind. Lond. 6: 479. 1931. Vitex trifolia unifoliolata "Schai. in DC." apud Worsdell, Ind. Lond. Suppl. 2: 501. 1941. Vitex trifolia ovata Mak. ex Worsdell, Ind. Lond. Suppl. 2: 501. 1941. Vitex agnus-castus η ovata (Thunb.) Kuntze ex Hara, Enum. Sperm. Jap. 1: 190, in syn. 1948. Vitex trifolia Hemsl. apud Rehd., Bibliog. Cult. Trees 585, in syn. 1949 [not V. trifolia Graham, 1966, nor L., 1753, nor L. f., 1895, nor Moon, 1895, nor Sessé & Moc., 1940, nor Vahl, 1941]. Vitex trifolia subsp. litoralis Van Steenis, Blumea 8: 516. 1957. Vitex trifolia var. unifoliata DC. ex Moldenke, Phytologia 6: 184, in syn. 1958. Vitex trifolia var. unifoliolata DC. ex Moldenke, Phytologia 6: 184, in syn. 1958. Vitex rotundifolia var. rotundifolia Mizushima ex Moldenke, Phytologia 8: 86, in syn. 1961. Vitex trifolia var. ovata Schau. ex Moldenke, Phytologia 8: 86, in syn. 1961. Vitex trifolia "sensu Matsum. & Hayata" apud Li, Wood. Fl. Taiwan 834, in syn. 1963. Vitex trifolia var. unifolia Judd, in herb. Vitex trifolia β

unifoliata Schau., in herb. Vitex trifolia var. ovovata Mak., in herb.

Additional & emended bibliography: J. F. Gmel. in L., Syst. Nat., ed. 13, pr. 1, 2: 962 (1789) and pr. 2, 2: 962. 1796; Pers., Sp. Pl. 3: 359. 1819; Steud., Nom. Bot., ed. 1, 888. 1821; Hook. & Arn., Bot. Beechey Voy. 206, pl. 47. 1836; Miq., Cat. Mus. Bot. Lugd.-Bat. 70. 1870; Jacks. in Hook. f. & Jacks., Ind. Kew., pr. 1, 2: 1214. 1895; C. B. Clarke in J. Schmidt, Bot. Tidsskr. 26: 173. 1904; E. D. Merr., Philip. Journ. Sci. Bot. 1, Suppl. 1: 121. 1906; Matsumura & Hayata, Journ. Coll. Sci. Univ. Tokyo 22: 301. 1906; Kawakami, List Pl. Formos. 85. 1910; J. Matsumura, Ind. Pl. Jap. 2 (2): 534--535. 1912; H. J. Lam in Lam & Bakh., Bull. Jard. Bot. Buitenz., ser. 3, 3: 53. 1921; Nakai, Trees & Shrubs Indig. Jap., ed. 1, 1: 350, fig. 190. 1922; H. J. Lam in Engl., Bot. Jahrb. 59: 27. 1924; H. J. Lam in Bakh. & Lam, Nov. Guin. 14, Bot. 1: 169. 1924; C. J. F. Skottsberg, Medd. Göteb. Bot. Trädg. 2 [Haw. Vasc. Pl. 1]: 259. 1925; S. Sasaki, List Pl. Formos. 353 & 354. 1928; Tu, Chinese Bot. Dict., abrdg. ed., 1337. 1933; Hosokawa, Journ. Soc. Trop. Agr. Taiwan 6: 206. 1934; Fletcher, Kew Bull. Misc. Inf. 1938: 431--433. 1938; J. Matsumura, [Bot. & Zool.] 10: 288, fig. 125. 1942; Jacks. in Hook. f. & Jacks., Ind. Kew., pr. 2, 2: 1214. 1946; Selling, Bishop Mus. Spec. Publ. 38: 275 & 411. 1947; Li & Keng, Taiwania 1 (2--4): 127. 1950; Van Steenis, Blumea 8: 516. 1957; Anon., Biol. Abstr. 30: 4370. 1958; Cave, Ind. Pl. Chromosome Numb. 1: 46. 1958; Moldenke, Biol. Abstr. 32: 2353. 1958; Anon., Kew Bull. Gen. Index 1929-1956, 293. 1959; Jacks. in Hook. f. & Jacks., Ind. Kew., pr. 3, 2: 1214. 1960; Kitamura & Okamoto, Col. Illustr. Trees & Shrubs Japan 221, pl. 65. 1960; Moldenke, Phytologia 8: 86--88. 1961; Hocking, Excerpt. Bot. A.5: 42. 1962; F. R. Fosberg, Bishop Mus. Occas. Papers 23 (2): 41--42. 1962; Nobuhara, Okada, & Fujihira, Jap. Journ. Ecol. 12: 101--103, 105, & 107. 1962; Liu, Illustr. Nat. & Introd. Lign. Pl. Taiwan 2: 1231, pl. 1039. 1962; M. J. Van Steenis-Kruseman, Fl. Males. Bull. 3: 695 & LI. 1962; Hatusima, Mem. South. Indust. Sci. Inst. Kagoshima Univ. 3 (1): 31. 1962; Li, Wood. Fl. Taiwan 832, 834, & 973. 1963; Chuang, Chao, Hu, & Kwan, Taiwania 1 (8): 54, 58, & 63, pl. 3, fig. 40. 1963; Taniguti, Amat. Herb. 24 (3): 9. 1963; Cave, Ind. Pl. Chromosome Numb. 2: 331. 1964; Neal, In Gard. Hawaii, ed. 2, 728, fig. 277. 1965; Backer & Bakh., Fl. Java 2: 604. 1965; Ohwi, Fl. Jap. 765. 1965; Hatusima, Mem. Fac. Agr. Kagoshima Univ. 5 (3): 47--48. 1966; Nobuhara, Journ. Jap. Bot. 19: 326--328, 330, 332--334, 336--338, 341--345, & 348. 1967; Moldenke, Résumé Suppl. 15: 25. 1967; Moldenke, Phytologia 15: 267 (1967), 15: 472 (1968), and 16: 495. 1968.

Additional & emended illustrations: Hook. & Arn., Bot. Beech. Voy. pl. 47. 1836; Nakai, Trees & Shrubs Indig. Jap., ed. 1, fig. 190. 1922; J. Matsumura, [Bot. & Zool.] 10: 288, fig. 125. 1942; Kitamura & Okamoto, Col. Illustr. Trees & Shrubs Japan pl. 65 [in color]. 1960; Chuang, Chao, Hu, & Kwan, Taiwania 1 (8): 63, pl. 3, fig. 40. 1963; Neal, In Gard. Hawaii, ed. 2, 728, fig. 277. 1965.

Recent collectors and writers describe this plant as a procumbent or ascending, creeping shrub, 6—30 cm. tall, or a woody trailing vine, the whole "plant with stinky odor", the main stem 1—2 m. long, often entirely buried in the sand from which only the flowering branchlets emerge, densely gray-white puberulent throughout; stems creeping, copiously rooting at the nodes, emitting many, erect, short, flowering branchlets; branches 4-angled; leaves 1-foliolate; petioles 1.5—3.5 mm. long ["cm" by error in Backer & Bakh. (1965)]; leaflet-blades herbaceous, broadly ovate or broadly elliptic to oval-elliptic-obovate, 1.5—5 cm. long, 1.3—3.5 cm. wide, obtuse to rounded at the apex, entire (or a few 2- or 3-partite), abruptly acute at the base, green and thinly puberulent above, densely grayish-puberulent beneath or densely white-tomentose especially beneath; panicles terminal, narrow, 1—9 cm. long, densely flowered, with very short branches; peduncles 1—4 cm. long; cymes 1—4-flowered, the lower ones often in the upper axils of the leaves; corolla blue, light-blue, or bluish-violet to purple-blue, purple, deep-purple, lavender, or red, about 13 mm. long, from the insertion of the stamens inside up to half the length of the lower lip densely white-hairy, silky-pubescent on the outer surface, the tube about 7 mm. long, the median segment of the lower lip about 5 mm. long; calyx greenish, silky-pubescent; style about 15 mm. long; bases of the filaments villous; fruit drupaceous, globose, dry, black, 5—7 mm. wide, the lower half enclosed by the persistent fruiting-calyx; pyrenes corky.

The corolla is described as having been "bluish-white" on F. R. Fosberg 8881, "purple" on Hurusawa 202, "blue" on H. L. Porter 3 and E. H. Wilson 10978, "deep-purple" on Ichikawa 200661, "red" on Tsang s.n. [Herb. Lingnan Univ. 16649], "lavender" on R. C. Ching 1967, "light-blue" on McClure s.n. [Herb. Lingnan Univ. 13095], and "purple-blue" on Liang 62926. Cave (1958) reports the haploid chromosome number as 16.

It should be noted here that the V. trifolia of Linnaeus the elder is a valid species, with the homonym ascribed to Linnaeus the younger as a synonym, while the V. trifolia of Graham is V. negundo L., that accredited to Moon is V. altissima L. f., that of Sessé & Mociño is V. mollis H.B.K., and that ascribed to Vahl is V. triflora Vahl.

Vitex trifolia var. simplicifolia has been collected on sandy beaches, in sandy places by the sea, on loamy seashores, and along rocky roadsides, blooming from July to September. Fosberg (1962) and Corner (1939) feel that the plant should be called V. ovata Thunb., and in this they are followed by Backer & Bakhuizen van den Brink (1965) who note "Ridley....states that he saw specimens, transplanted into the interior, develop into V. trifolia. If this statement proves correct, V. ovata has to be considered an edaphic form of V. trifolia.....I never saw any transitional form, nor were such forms ever observed by Corner."

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PROVENCHERIA

3

Mémoires de l'Herbier Louis-Marie

Faculté d'Agriculture, Université Laval

FLORA
OF THE
PRAIRIE PROVINCES

A HANDBOOK
TO THE FLORA OF THE PROVINCES OF
MANITOBA, SASKATCHEWAN AND ALBERTA

by

BERNARD BOIVIN

Herbier Louis-Marie, Université Laval

and Department of Agriculture, Ottawa

Part II

Digitatae, Dimerae, Liberae

(Continued)

2. SCLERANTHUS L. KNAWEL

Sepals fused; the tube becoming thick and hard and enclosing the utricule. Petals lacking.

1. S. ANNUUS L. -- Knawel, German Knotgrass (Gnavelle, Herbe aux alouettes) -- Leaves opposite and connate in the manner of a Caryophyll. Puberulent annual with numerous stems. Flowers green. Calyx lobes membranous-margined, slightly longer than the tube. Early to mid summer. Uncommon weed of roadsides and cultivation.-- NS-O, S-BC, (US), Eur.

A Manitoba report by Montgomery 1964 is not substantiated by any specimen at OAC or elsewhere (Montgomery in litt.).

Order 44. CHENOPODIALES

Like the Polygonales, seems to be derived from the Caryophyllales, with the fruit reduced to a 1-seeded utricule or achene. But the flowers typically 5-merous and the embryo, visible through the seed coat, is annular or spirally curled.

a. Flowers bractless, or exceptionally subtended by herbaceous bracts ..... 78. Chenopodiaceae
aa. Each flower subtended by scarious bracts .. .. 79. Amaranthaceae p. 129

78. CHENOPODIACEAE (GOOSEFOOT FAMILY)

Herbs often thickish or fleshy. Hairs often short and thick, ± subglobular. A family usually readily recognized by the curled embryo and the usually semi-fleshy and alternate leaves.

a. Fleshy herb with vestigial leaves ..... 12. Salicornia
aa. Leaves well developed.
b. Shrubby.
c. Very spiny ..... 13. Sarcobatus
cc. Not spiny.
d. Leaves flat ..... 5. Atriplex
dd. Strongly revolute ..... 7. Eurotia
bb. Annual herbs.
e. Fruit hidden between a pair of bracts.
f. Bracts free at least above the middle ..... 5. Atriplex
ff. Bracts fused to the tip and enclosing the fruit ..... 4. Spinacia
ee. Fruit not hidden.
g. Fruit flanked by a pair of fused bracts; pistillate flower without perianth ..... 6. Suckleya
gg. Pistillate flower and fruit bractless, or the bracts neither fused nor hiding the fruit.
h. Calyx much reduced and not surrounding the fruit.

i. Main leaves hastate to rhomboid-lanceolate ..... 3. Monolepis
ii. Leaves ± linear ..... 11. Corispermum
hh. Fruit surrounded by the marcescent calyx ..... Group A

Group A

Annual herbs. Fruit surrounded by the marcescent calyx. Bracts lacking or small.

a. Flowers unisexual, the staminate ones borne in a conspicuously differentiated terminal spike ..... 8. Axyris
aa. Flowers all perfect or some of them pistillate.
b. Upper leaves and bracts stiff and ending in a sharp and spiny point ..... 15. Salsola
bb. Foliage not spinescent.
c. Fruit surrounded by a continuous horizontal wing ..... 2. Cycloloma
cc. Not winged or with a discontinuous series of winged lobes.
d. Foliage glabrous or glandular or mealy.
e. Calyx thin ..... 1. Chenopodium
ee. Calyx fleshy.
f. Flowers in axillary glomerules of 3 ..... 14. Suaeda
ff. Fruits in large strawberry-like glomerules ..... 1. Chenopodium
dd. Foliage pubescent, the leaves and bracts long ciliate.
g. Inflorescence densely pubescent, including the calyx ..... 10. Bassia
gg. Calyx glabrous, or the lobes sometimes ciliate ..... 9. Kochia

1. CHENOPODIUM L. GOOSEFOOT, PIGWEED

The basic and unspecialized type of the family. Flowers bractless, perfect, ± 5-merous, with a persistent calyx enveloping the fruit.

a. Fruit a large strawberry-like glomerule.... 1. C. capitatum
aa. Fruit not or very little fleshy and the inflorescence less congested.
b. Leaves narrowly lanceolate to linear, entire or nearly so.
c. Grayish-mealy, especially on the undersurface of the leaves ..... 5. C. leptophyllum
cc. Pale green and nearly glabrous.... 4. C. subglabrum
bb. Leaves oblong-lanceolate to deltoid, mostly coarsely toothed.

d. Leaves deltoid, nearly as broad as long and ± truncate at base ..... 6. C. Fremontii
dd. Leaves ovate to oblong-lanceolate, rounded to cuneate at base.
e. Plants glabrous and green.
f. Leaves entire or essentially so ..... 9. C. polyspermum
ff. Leaves lobed.
g. Seeds mostly vertical, 0.8-1.0 mm wide ..... 3. C. rubrum
gg. Seeds horizontal, 1.4-3.0 mm wide ..... 10. C. hybridum
ee. More or less mealy-puberulent, especially in the inflorescence and undersurface of the leaves, the latter paler to whitish below.
h. Seeds mostly borne vertically, 1mm wide or less ..... 2. C. glaucum
hh. Seeds nearly all horizontal, 1 mm wide or more.
i. Early flowering, the main leaves typically ovate ..... 8. C. album
ii. Late flowering, the main leaves oblong and subentire .. .. 7. C. strictum

1. C. capitatum (L.) Asch. (Blitum capitatum L.) -- Strawberry-Blite, Indian Paint (Blette) -- Calyx becoming fleshy and bright red at maturity. Leaves triangular-hastate, coarsely dentate. Fruiting calyces aggregated in strawberry-like fruits, these partly axillary, partly in terminal leafless racemes. Early summer. Infrequent but conspicuous in disturbed or shallow soils. -- Mack-Aka, NS, NB-BC, US, (Eur).

An Alberta report of C. Bonus Henricus L. by Groh 1950 was based on H. Groh, Edson, 1935 (DAO), a sheet since reidentified to C. capitatum.

C. foliosum (Moench) Asch. was reported by Wahl 1954, page 9, as was C. virgatum (L.) Ambrosi by Aellen 1929, page 44. Both from Alberta and both based on a sheet, A.H. Brinkman 2858, Battle, woods, Aug. 28, 1927 (Aellen; DAO, photo), revised by Aellen to C. capitatum more than a quarter of a century ago. We concur.

2. C. glaucum L. var. pulchrum Aellen (var. salinum (Standley) Boivin; C. salinum Standley) -- Leaves tending to be the smallest, whitish-mealy below, nearly glabrous above. Erect to creeping and very branchy. Leaves broadly lanceolate and coarsely few-toothed. Fruit peltate or mostly erect, i.e. laterally compressed, and about 1 mm wide. Mostly after mid summer. Mostly exsiccated saline shores, often weedy. -- (K)-Mack, Aka, Q-BC, US.

In our variety the glomerules are gathered on ultimate branchlets bearing reduced leaves almost to the tip, tepals are

mostly obovate and the inflorescence is often farinose-puberulent. The eurasian var. glaucum is none too readily recognized by its flowering branchlets almost devoid of reduced leaves, except towards the base, its mostly elliptic or oblong tepals and its glabrous inflorescence. In Eastern Canada both varieties will be met with as infrequent weeds.

3. C. rubrum L. (var. humile (Hooker) Watson; C. chenopodioides (L.) Aellen; C. humile Hooker) -- Fat Hen, French Spinach--Stamens only 1-2 and the fruiting calyx reddish and slightly fleshy. Plant erect to depressed, glabrous or nearly so. Foliage thickish. Leaves ± rhombic-triangular, lobed, the lobes inclined forward. Glomerules less than 5 mm wide, rather numerous. Fruit erect, 1 mm wide or less. Mid summer. Saline shores, rarely weedy. -- sMack, Y, (NF-SPM), NS, NB-BC, US, Eur.

The basis for an Alberta report of C. ambrosioides L. by Groh 1950 seems to be the collection G.H. Turner 43, Fort Saskatchewan, garden, Aug. 4, 1937 (DAO), since revised to C. rubrum by Dr. H.C. Wahl in 1953.

Sometimes divided in two or, more rarely, in three species. Plants of more open habitats, and especially of pioneering habitats, are more or less depressed (C. humile); obviously an ecological form. More luxuriant specimens have rarely been segregated as C. chenopodioides.

4. C. subglabrum (Watson) Nelson (C. leptophyllum Nutt. var. subglabrum Watson) -- Similar to the following, but barely puberulent and thus pale green in colour. Main stem leaves usually quite glabrous, becoming slightly mealy in the inflorescence. The latter broad and diffuse, with scattered flowers. First half of summer. Rare or inconspicuous pioneer on wind eroded sand. -- (swO)-Man-S, US.

A species of eroded dunes, it is almost skeletic and thus easily overlooked. It may be much more common than herbarium sheets indicate. Thus far we have only one Manitoba record: Boivin & Laishley 13188, entre Oak Lake et Routledge, à 4 milles au nord du lac de Chênes, dune active, 4 juillet 1959 (DAO).

5. C. leptophyllum Nutt.(var. oblongifolium Watson; C. dessicatum Nelson; C. pratericola Rydb., ssp. dessicatum (Nelson) Aellen) -- Grayish-mealy, and usually virgate, annual herb of light soils. Leaves narrow and entire or with a pair of weak lobes, grayish-mealy at least below. Fruits mostly horizontal, about 1 mm wide. Around mid summer. Steppes, especially on light or wind-eroded soils. -- Y, NS, swQ-BC, US, Eur, (CA).

6. C. Fremontii Watson (C. atrovirens Rydb.) -- Mostly occuring as a native annual in dry woods. A rather gracile and stiffly erect herb. Leaves usually thin and wilting very quickly. Spikes of glomerules very remotely moniliform. Fruit horizontal, 1.2-1.5 mm wide. Early to mid summer. Dry woods; often under shrubs, especially Prunus, sometimes on shores. -- swMan-BC, US, (CA).

An extension of range to Yukon by Hultén 1950 was based on Anderson & Brown 10347, near Carcross, alkali flat, 30 July, 1946 (CAN; DAO, photo), since revised to C. rubrum.

Thicker-leaved plants are sometimes identified C. atrovirens.

7. C. STRICTUM Roth (var. glaucophyllum (Aellen) Wahl; C. glaucophyllum Aellen) -- Resembling the following, but flowering later and commonly larger. Lower leaves ovate and shallowly serrate but the middle and upper oblong and ± entire. Calyx lobes ± elliptic. Fruit 1 mm wide or slightly larger. Late summer and early fall. Waste places and disturbed soils, especially in towns. -- sQ-sS, BC, US.

Introduced plants in North America are usually distinguished as var. glaucophyllum but the soundness of the distinction is questionable. The eurasian material at hand does not conform in its reputed differences with the neogean phase. Seems likely that here many varietal identifications were made on the basis of geography rather than morphology.

Most floras do not distinguish this species but it appears to be rather widely distributed in both Canada and the U.S.A. In the field C. strictum is rather readily spotted by its preference for towns and waste-lots, its late flowering, its branching and its leaf dimorphism. C. strictum does not attract attention and does not begin to flower until late August or early September, at a time when C. album is already heavily loaded with ripe fruits and shedding them. C. strictum is also heavily branched down to the base, the many lower branches are closely set together and often nearly as long as the stem. The stem leaves are rather similar to those of C. album but the branch leaves are mostly entire and oblong-elliptic. Because of its heavy branching and size, usually a good meter tall, C. strictum does not lend itself to making good specimens and the average herbarium sheet is likely to be a mere snipping or a selected small (hence often depauperate) individual. But the later flowering time, the narrower shape of the calyx lobes and the smaller fruits should provide good diagnostic features.

8. C. album L. (f. lanceolatum (Muhl.) Aellen; C. Berlandieri Moq., var. farinosum (Ludwig) Aellen; C. Boscianum Moq.; C. dacoticum Standley; C. lanceolatum Muhl.; C. paganum Reich.; C. Zschackei Murray) -- Pigweed, Lamb's Quarters (Chou gras, Poulette grasse) -- The common middling type. Annual erect herb, ± mealy, especially on the lower leaf surfaces. Main leaves more or less ovate and coarsely toothed. Calyx lobes deltoid. Seed ± 1.5 mm wide, borne horizontally. Mostly mid summer. Common weed of disturbed soils and humanized places, seemingly native on shallow soils over rocky outcrops. -- (G), Mack-Aka, L-NF-(SPM), NS-BC, US, (CA), Eur.

Plants with larger leaves and fruits have been distinguished as C. Bushianum Aellen or C. paganum. The merit of the distinction is not clear to us.

Native plants are reputedly distinguishable (as C. Boscianum or C. Berlandieri) by their ovary wall free from the achene or by being more prominently keeled on the sepals, characters which have also been detected in a number of european specimens at hand. We are not yet satisfied that seemingly native plants

can be convicingly discriminated on these or any other characters.

9. C. POLYSPERMUM L. (var. acutifolium (Sm.) Gaudin) -- Allseed (Limoine, Poirée sauvage) -- Leaves glabrous, thin and entire, the main ones ovate to lanceolate. Seed maturing purple-red, then black, about 1 mm across, horizontal. Second half of summer. Rare town weed: Wallwort. -- NB-O, S, US, Eur.

10. C. hybridum L. var. gigantospermum (Aellen) Rouleau-- Sowbane (Pied d'oie) -- Large, thin, ovate leaves with ± 3 pairs of large teeth or lobes. Flowers mostly in terminal panicles. Fruit greenish. Mid to late summer. Infrequent in dry woods and casually weedy. -- Y, NB-BC, US.

American plants are supposed to have larger seeds, but our specimens do not conform to this pattern. However, our Canadian specimens do have black, shiny and essentially smooth seeds, while our European ones (var. hybridum) have seeds that are dull and finely but clearly rugose-reticulate.

A Saskatchewan report of C. Bonus-Henricus L. by Groh 1950 was based on two sheets of which the first, Shevkenek 127, Qu'Appelle Valley, 1938 (DAO) is now filed under C. hybridum var. gigantospermum, while the other, Carmichael 37, Regina, 1941 (DAO) has since been revised to Atriplex hortensis.

2. CYCLOLOMA Moq. WINGED PIGWEED

Calyx developing a peripheral wing at maturity. Otherwise as in Chenopodium.

1. C. atriplicifolium (Sprengel) Coulter -- Tumbleweed-- Resembling Chenopodium but lightly lanate and not mealy. Leaves ± oblanceolate, coarsely toothed. Flowers in moniliform spikes. Fruit about 3 mm across including the wing. Seed concave above, convex below. Mid to late summer. Disturbed sands: Agassiz Delta, Grande-Clairière. -- swQ-sMan, US.

We have been unable to substantiate a report from Baildon, Sask., by Russell 1944, 1954, Groh 1950 and Breitung 1959, repeated by Boivin 1966.

3. MONOLEPIS Schrader

Calyx reduced to a single sepal which thus takes on the appearance of a small bract.

1. M. Nuttalliana (R. & S.) Greene -- Povertyweed -- Rather resembling Chenopodium glaucum in general habit and leaf shape but the inflorescence much more leafy. Leaves not white below, merely slightly mealy. Fruit apiculate. Early summer. Native on saline shores, but mainly found as a weed of disturbed soils. -- Mack-Aka, Q-(O)-Man-BC, US, (CA, SA).

4. SPINACIA L. SPINACH

Resembling Atriplex but the pistillate bracteoles fused all around and forming an accessory envelope around the seed. Flowers dioecious.

1. S. OLERACEA L. -- Spinach (Epinard, Spinage) -- Fruit with 2-4 long spiny lobes. Leaves hastate to triangular, rather large. Staminate flowers in spikes of glomerules. Pistillate flowers in axillary glomerules. Early summer. Sometimes cultivated, rarely occuring as a waste ground or roadside weed. -- Mack, (Aka),Alta, (US), Eur.

5. ATRIPLEX L. ORACHE

Flowers dimorphic, the pistillate ones reduced to a naked ovary between 2 bracteoles. Staminate flowers as in Chenopodium. Pistillate bracts fused at base only.

a. Shrubby ..... 1. A. Nuttallii
aa. Annual herbs.
b. Pistillate bracteoles orbicular and entire ..... 2. A. hortensis
bb. Bracts variously shaped and cut.
c. The whole plant, and especially the leaves, more or less silvery, being densely covered by a scaly or mealy puberulence.
d. Pistillate bracteoles coarsely toothed to summit ..... 4. A. argentea
dd. Entire above the middle ..... 5. A. Powellii
cc. Leaves glabrous or lightly mealy.
e. Terminal spikes entirely staminate, the pistillate flowers borne only in inconspicuous axillary clusters....6. A. dioica
ee. Terminal spikes at least partly pistillate, except in entirely staminate plants ..... 3. A. patula

1. A. Nuttallii Watson var. Nuttallii (A. canescens AA., var. aptera AA.) -- Salt-Sage, Moundscale -- Semi-shrubby, producing numerous erect herbaceous shoots from a woody base. Foliage densely mealy-puberulent and grayish-silvery. Herbaceous shoots simple, but with numerous axillary tufts of small leaves. Dioecious. Staminate flowers in yellow, moniliform, flexuous, and bractless spikes of glomerules. Pistillate flowers in a leafy terminal spike of glomerules. Mid summer. Eroded hills and badlands, sometimes in steppes on saline soils. -- swMan-Alta, US.

Leaves mostly 0.5-1.0 cm wide and rather elliptic-lanceolate to oblong-lanceolate. Other varieties occur further south, including a var. falcata M.E. Jones with narrower and rather linear leaves.

All previous reports of A. canescens (Pursh) Nutt. and of its var. aptera (Nelson) C.L. Hitchc, from our area were based on specimens of A. Nuttallii. This remark includes the Moodie collection from Rosedale (GH; DAO, photo).

2. A. HORTENSIS L. (A. nitens Schrank) -- Orach, French Spinach (Bonne-dame, Arroche) -- Fruit larger, suborbicular,

entire, flat, ± 1 cm across. Tall, conspicuous, virgate herb. Leaves triangular, rather large, the lower remotely dentate, the upper entire, whitish-mealy below. Mid summer. Sometimes cultivated and readily spreading to waste places and railway yards.-- swMack, (Aka), Q-BC, US, Eur -- Cv. ATROSANGUINEA -- Stem leaves and fruits more or less tinged in bright red: Hoosier. -- S.

3. A. patula L. var. patula (var. hastata (L.) Gray; A. hastata L.) -- Spearscale (Belle dame, Bonne dame) -- Resembling a Chenopodium, but with about 3 main pairs of stem leaves being opposite. Diffusely branched. Leaves deltoid to lanceolate, ± dentate, the 2 lower teeth much larger. Flowers in terminal spikes which are bractless at least above the middle. Mid summer and early fall. Native in saline places and a frequent weed of towns and disturbed soils. -- (seK)-Mack, (Aka, NF)-SPM, (NS-NB)-Q-BC, US, Eur -- Var. oblanceolata (Vict.& Rouss.) Boivin (A. glabriuscula AA.) -- Terminal spikes conspicuously bracted, the bracts mostly entire and lanceolate or oblanceolate. Sea shores. -- (G, K, L)-NF, NS, NB-Q(O-nMan, US) -- Var. LITTORALIS (L.) Gray -- As var. patula, but the leaves narrower, ± linear, and entire. A coastal variation rarely appearing inland as a weed. -- (K), NS-Man, BC, (US), Eur.

As per a tradition now over 200 years old, the larger-leaved (i.e. deltoid-hastate) extreme is often segregated as A. hastata. It is not clear to us how this distinction facilitates in any way the intellectual apprehension of this polymorphic species.

4. A. argentea Nutt. -- Saltbush, Silverscale -- A whitish silvery annual with ± deltoid leaves. Very leafy. Glomerules axillary, not forming distinct spikes. First half of summer. Open saline soils. -- swMan(Melita)-swS-BC, US.

5. A. Powellii Watson -- Like the preceeding but smaller. Bracteoles entire, at least in the upper half. Upper leaves more reduced. Mid to late summer. Badlands: Steveville, Rosedale. -- sAlta, wUS.

6. A. dioica (Nutt.) Macbr. (Endolepis Suckleyi Torrey)-- Rillscale -- Staminate glomerules pinkish and forming lightly bracted terminal spikes. Pistillate glomerules inconspicuous in the lower axils. Leaves lanceolate, subacuminate, somewhat glaucous, glabrous or nearly so. Early to mid summer. Saline flats. -- swS-Alta, US.

6. SUCKLEYA Gray

Pistillate flowers as in Atriplex but the bracteoles fused laterally to the ovary instead of hiding it.

1. S. Suckleyana (Torrey) Rydb. -- Leaves flabellate and flabellately dentate. Somewhat mealy. Diffusely branched and resembling Amaranthus albus in habit. Fruit ovate-rhomboid, often with a pair of lobes on the angles, bifid at apex. Summer. Saline shores, sometimes weedy, but rather rare. -- S-seAlta, (US).

7. EUROTIA Adanson

Pistillate flowers and bracteoles much as in Suckleya. Bracteoles with a conspicuous tuft of long hair.

1. E. lanata (Pursh) Moq. -- Winter-Fat, White Sage -- Densely stellate-pubescent throughout. Semi-shrubby in the manner of Atriplex Nuttallii. Dioecious. Leaves linear, revolute. Inflorescence ± long-pilose. Early summer. Dry hills. -- swMan (Virden)-Alta, US.

8. AXYRIS L.

Staminate flowers in a terminal, naked spike of glomerules. Pistillate flowers solitary, axillary. Otherwise resembling Chenopodium.

1. A. AMARANTHOIDES L. -- Russian Pigweed -- Terminal spike conspicuously differenciated, yellowish, and elongate. Other spikes much smaller and terminating the branches. Lightly to densely stellate-puberulent throughout. Leaves lanceolate. Calyx membranous. Mid summer. Frequent weed in disturbed soils, invading native habitats in shaded places. -- swMack, (NS)-PEI, Q-BC, US, Eur.

At times seemingly native, but the earliest Canadian collection goes back only to 1886.

9. KOCHIA Roth

As Chenopodium, but the mature calyx developing a peripheral wing or ridge, yet this character not obvious in our only species. Not mealy-pubescent.

1. K. SCOPARIA (L.) Roth (K. trichophila Hort.) -- Summer-Cypress, Burning Bush (Petits soldats, Petits Pins) -- Very branchy and very leafy annual. Densely puberulent with tufts of long hairs in the inflorescence. Leaves linear. Bracts very long-ciliate. Calyx glabrous. The whole plant often turning red in the fall. Late summer. Cultivated ornamental, frequent weed of streets, roadsides and waste places. -- NS, sQ-BC, (US), Eur.

The weed is perhaps distinct from the cultivated ornamental, but we know not how to differentiate them clearly.

10. BASSIA All.

As Kochia, but the mature calyx developing 5 spirally coiled horns. However most herbarium specimens are collected too early when this character is not yet readily observed.

1. B. HYSSOPIFOLIA (Pallas) Ktze.-- Rather similar to Kochia and easily confused with it, but not so branchy and the calyx as densely pilose as any other part of the inflorescence. Bracts lacking the long, spreading cilia of Kochia. After mid summer. Infrequent weed of railways and roadsides in alkaline areas. -- swS-BC, US, CA, (Eur).

11. CORISPERMUM L.

Flower much reduced, with only 1-(2) stamens and the calyx reduced to 1 sepal.

1. C. hyssopifolium L. var. hyssopifolium (C. marginale Rydb.; C. simplicissimum Lunell) -- Bud-Seed, Tick-Seed -- Flowers not in glomerules, but solitary in the axil of large bracts. Very branchy and glabrous to stellate-pubescent, not mealy. Inflorescence a terminal spike, rather dense and the bracts hiding the fruits. Seed discoid, with a peripheral wing 0.3-0.6 mm wide. Mid summer. Loose sands. -- Mack-(Y-Aka), Q-Alta, US, (CA), Eur -- Var. rubricaule Hooker (C. nitidum Kit.) -- Spikes not so dense. Bracts smaller, 1-3 mm wide, mostly narrower than the fruits. -- wO-S-(Alta-BC), US, Eur -- Var. emarginatum (Rydb.) Boivin (C. orientale Lam. var. emarginatum (Rydb.) Macbr.; C. villosum Rydb.) -- Seed fairly large, 3-4 mm long, and merely sharp-margined, without a marginal wing. -- swQ-Alta-(BC, US, Eur).

Within our range our three varieties present themselves like mere extremes of variations, but in Eurasia their ranges appear to be highly individualized.

12. SALICORNIA L. GLASSWORT, SAMPHIRE

Fleshy plants with vestigial leaves. Flowers in 3's and more or less embedded in a depression of the next internode above. Calyx fleshy. Stamens only 1-(2).

1. S. europaea L. var. prona (Lunell) Boivin (S. rubra Nelson) -- Sand-Fire, Glasswort (Corail, Passe-pierre) -- Small herb reduced to its fleshy stem and branches, often turning red in late summer. Annual. Internodes swollen into joints. Each joint with a membranous-margined collar at the upper end. Flowers inconspicuous, in terminal spikes of opposite glomerules. Mid summer. Saline shores. -- sMack-Y-(Aka), Man-BC, US.

All the inland material belongs to our variety in which the stem internodes pass abruptly into the much shorter inflorescence internodes, the latter usually 1.5-2.5 mm long. Uppermost stem internode generally more than twice longer than the lowermost inflorescence internode. In the East Coast and Old World var. europea the spike is less strongly contrasted and its internodes are mostly (2)-4-(5) mm long; the uppermost stem internode usually less than twice as long as the adjacent spike internode.

13. SARCOBATUS Nees GRAESEWOOD

Staminate flowers in catkins which show a marked similarity to the spikes of Equisetum, each flower being reduced to 3 stamens and a stipitate, peltate scale. Pistillate flower solitary, axillary. Fruit with a broad horizontal and circular wing.

1. S. vermiculatus (Hooker) Torrey -- Greasewood, Pulpy Thorn -- Very spiny shrub growing in large colonies. Young branches pale to whitish. Leaves fleshy, linear, alternate above to opposite or verticillate below. Early summer. Highly alkaline flats at the bottom of the major coulées. -- swS-seAltaseBC, US.

14. SUAEDA Forsk. SEA BLITE

Flowers in axillary glomerules of 3. Calyx fleshy. Otherwise resembling Chenopodium.

1. S. maritima (L.) Dum. var. maritima -- Seablite (Blanchette, Salanguet) -- Annual herb with a strong tendency to turn dirty black during the second half of summer. Very branchy. Leaves linear, fleshy. Bracts much as the leaves, 1.0-1.5 mm wide, oblong to linear, of uniform width, but shorter than the leaves. Mid summer to early fall. Seashores. -- (Mack-Y)-Aka, NS-Q, nMan, wBC, US, Eur -- Var. americana (Pers.) Boivin (S. depressa (Pursh) Watson; S. erecta (Watson) Nelson) -- Bracts more sharply differenciated from the leaves. Lower leaves ± 1mm wide, linear of uniform width. Bracts much shorter, 1.5-3.0 mm wide, at the base, ovate to narrowly triangular-lanceolate, gradually narrowed from the base. Alkaline shores, sometimes weedy. -- seK-Y, (NF), NS-BC, US.

The more southern S. intermedia Watson has reported from Alberta by Hitchcock 1964, but this may have been only a lapsus calami as we have been unable to substantiate this report. There was no justifying sheet at WTU in 1967 and there was no specimen under that name in any of the herbaria visited. A systematic review of all the Saskatchewan and Alberta sheets of Suaeda at DAO in 1967 failed to turn up any S. intermedia masquerading under another name.

15. SALSOLA L. SALTWORT

Flowers as in Chenopodium, but with 2 bracts. Fruit developing a circular horizontal wing as in Cycloloma and Sarcobatus.

1. S. KALI L. var. TENUIFOLIA Tausch (S. pestifer Nelson) -- Russian Thistle (Chardon de Russie) -- Annual herb at first soft and fleshy, soon hardening into a bundle of horribly spinescent foliage. Very branchy. First leaves filiform, and soft, the later ones and the bracts shorter and ending into a whitish, stiff and very sharp point. Flower axillary, solitary, subtended by 3 bracts, i.e., the foliage bract and the 2 floral bracts. Mid summer to frost. Very common weed of bare or disturbed soils, seemingly native on eroded dunes. -- NS-BC, US, Eur.

Typical var. Kali is native along the East Coast and in the Old World. Its leaves are shorter, the main ones not over 3 cm and usually not over 2 cm; they are also as thick, stiff, and spinescent as the shorter and later leaves.

79. AMARANTHACEAE (AMARANTH FAMILY)

Each flower subtended by a scarious bract and 2 scarious bracteoles. Otherwise similar to the Chenopodiaceae.

1. AMARANTHUS L. AMARANTH

The basic genus of the family, with alternate leaves and the calyx present.

a. Spiny in the leaf axils ..... 6. A. spinosus
aa. Not spiny.
  b. Flowers in small axillary inflorescences.
    c. Seed about 1.5 mm wide ..... 4. A. blitoides
    cc. Smaller, slightly less than 1 mm wide.
      d. Bracts and bracteoles 2-3 mm long...3. A. albus
      dd. Shorter, less than 2 mm long .. .. 5. A. californicus
  bb. Terminal inflorescences present, larger and conspicuous.
    e. Spike-like inflorescences lax and moniliform, at least in the lower half .. .. 7. A. tuberculatus
    ee. Spike or panicle dense throughout or essentially so.
      f. Bracts 2-3 mm long, only slightly longer than the calyx ..... 1. A. hybridus
      ff. Bracts 3-8 mm long, much exceeding the calyx ..... 2. A. retroflexus

1. A. HYBRIDUS L. var. HYBRIDUS (A. cruentus AA.; A. dubius Mart.) -- Pilewort, Pigweed (Brède de Malabar) -- Glomerules in numerous, narrow, elongate spikes, usually less than 1cm wide. Flowers and bracts small, otherwise similar to the following. Inflorescence green. Late summer. Sometimes cultivated and casually escaped: Winnipeg. -- Q-Man, (US, CA), SA, Eur, (Afr, Oc) -- Var. CRUENTUS (L.) Moq. (var. hypochondriacus (L.) Bailey; A. paniculatus L.) -- Prince's Feather, Love-Lies-Bleeding (Cannes, Cordelière) -- Inflorescence red. Fort Saskatchewan -- Q-O, cAlta-(BC, US).

Our only sheet of var. cruentus was reported as var. hypochondriacus by Groh 1949.

2. A. RETROFLEXUS L. var. RETROFLEXUS -- Red Root, Pigweed (Herbe grasse) -- The taproot commonly reddish. A stiffly erect annual with large oval leaves and a dense greenish panicle. Villous, especially above. Calyx lobes obtuse or rounded, commonly erose, often mucronate. Mid summer. Common weed of open soils and cultivation. -- Mack, (Aka, NS-NB)-Q-O-(Man)-S-BC, US, (CA), Eur, (Afr) -- Var. PSEUDORETROFLEXUS (Thell.) Boivin (var. Powellii (Watson) Boivin; A. Powellii Watson) -- Calyx lobes acute to acuminate. Not so densely villous, sometimes nearly glabrous. Inflorescences tending to be less thick and not quite so dense. Native further south, but only a rare weed with us: Melfort, Lethbridge. -- PEI, O, cS-BC, US, (CA, SA, Eur).

Var. pseudoretroflexus (Thell.) stat. n., A. chlorostachys W. var. pseudoretroflexus Thell., Viertelj. Nat. Ges. Zürich 52: 443, 1907.

3. A. albus L. var. albus -- Tumbleweed (Fleur de jalousie) -- A bushy tumbleweed resembling the following, but the leaves gradually decreasing in size from the base up. Branchy with a well defined main axis which is more or less erect. Glabrous or sparsely puberulent. Mid summer to early fall. Sandy soils, sometimes weedy. -- NS-BC, US, Eur.

The more southern var. pubescens (Uline & Bray) Fern. is viscid-puberulent.

4. A. BLITOIDES Watson (A. graecizans AA.) -- Matweed -- A carpet weed with the leaves conspicuously dimegueth. Stem usually indistinct, but the many branches more or less spread out flat on the ground. Leaves obovate, usually retuse, those of the main branches all about the same size, commonly 2-5 cm long including the petiole, those of the secondary branches only half as large. Summer. Common weed, tolerates tramping, prefers bare soils. -- (Aka), swQ-BC, US.

5. A. CALIFORNICUS (Moq.) Watson -- Similar to the preceeding, but generally smaller. Leaves only half as large. Seeds small, like those of A. albus. Mid to late summer. Rare roadside weed: Cypress Hills, Calgary, Herronton, Manyberries. -- swS-sAlta, wUS.

6. A. SPINOSUS L. -- Careless Weed (Epinard rouge, Epinard épineux) -- Most leaf axils bearing a pair of sharp spines about 1 cm long. Erect annual. Leaves ovate. Spikes thin and elongate. Mid to late summer. Rare and evanescent weed, collected once at Fort Garry. -- swO-sMan, US, Eur.

7. A. tuberculatus (Moq.) Sauer --(A. tamariscinus Nutt.; Acnida tamariscina (Nutt.) Wood) -- Dioecious. Erect annual. Leaves narrowly ovate to lanceolate. Glomerules in numerous, very thin, elongate and moniliform spikes. Mid summer. Sandy shores: Souris River. -- swQ-O-(sMan), US.

Order 45. PRIMULALES

Calyx and corolla fused. Stamens opposite the petals. Flower regular. In nearly all other groups the stamens are either more numerous than the corolla lobes or alternate with them.

a. Style 1 ..... 80. Primulaceae
aa. Styles 5 ..... 81. Plumbaginaceae

80. PRIMULACEAE (PRIMROSE FAMILY)

Herbs with opposite or verticillate leaves and a dry fruit.

a. Leaves all basal except sometimes for an involucre subtending the inflorescence.
b. Flower solitary ..... 2. Douglasia
bb. Flowers in an umbel.
c. Corolla lobes elongate, sharply reflexed ..... 4. Dodecatheon

cc. Lobes ascending to spreading.
d. Calyx shorter than the tube of the corolla ..... 1. Primula
dd. Calyx as long or longer ..... 3. Androsace
aa. Stem leafy.
e. Upper leaves alternate ..... 9. Centunculus
ee. All leaves opposite or verticillate.
f. Flowers nearly sessile in the axils ..... 7. Glaux
ff. Flowers pedicellate.
g. Leaves borne in a single verticil ..... 6. Trientalis
gg. Leaves borne at more than one node.
h. Corolla yellow ..... 5. Lysimachia
hh. Brick-red ..... 8. Anagallis

1. PRIMULA L. PRIMROSE, COWSLIP

Flowers 5-merous in an umbell. Leaves all basal. Stamens borne on the upper third of the cylindrical corolla tube. Corolla lobes bilobed.

a. Yellowish or whitish farinose on the calyces and lower leaf surfaces ..... 2. P. incana
aa. Green or only slightly farinose.
b. Leaves entire ..... 4. P. egaliksensis
bb. Leaves dentate or crenate; flowers larger.
c. Pedicels many times longer than the bracts ..... 1. P. mistassinica
cc. Not more than twice as long at flowering time ..... 3. P. stricta

1. P. mistassinica Mx. var. mistassinica (P. MacCalliana Wieg.) -- Bird's Eye, Primrose -- Small and usually less than 12 cm high. Leaves denticulate, mostly obovate. Bracts 2-6mm long, flat at base. Pedicels up to 3 cm long. Flowers white to mauve, commonly 1 cm across. Late spring and early summer. Bogs, shores and wet rocks. -- K-Mack-(Y-Aka, L)-NF-(SPM), NS, NB-BC, US, (eEur).

The leaves are green in our variety, but yellowish farinose below in var. intercedens (Fern.) Boivin, a plant similarly small, yellowish farinose on the calices, magnilacustrine in its distribution.

P. borealis Duby, a minor segregate of P. mistassinica, was reported from as far north as Banks Island by Hultén 1948, Anderson 1949 and Simmons, "A Survey of the Phytogeography of the Arctic Archipelago, Lunds Un. Arskr. 19: 1-183. 1913," but this has never been confirmed and may have been based on a specimen of P. stricta, the only Primula species otherwise known to occur in the Franklin District. Hence the restricted range accepted above.

2. P. incana M.E. Jones (P. farinosa AA.) -- Larger and the calyces and lower leaf surfaces densely farinose. Mostly

2-4 dm high. Leaves dentate, oblanceolate. Early summer. Marshy places. -- (Mack-Aka, nwQ), Man-Alta-(BC), wUS.

3. P. stricta Horn. -- Somewhat coarser than P. mistassinica, but the flowers smaller. Mostly 1-3 dm high. Leaves obovate to lanceolate. Bracts saccate at base. Flowers somewhat less than 1 cm across. Early summer. Wet places in arctic and subarctic habitats. -- (G-F)-K-Mack-(Y-Aka, L), Q-Man, (Alta-BC, wUS), Eur.

4. P. egaliksensis Wormsk. -- Resembles P. mistassinica, but the leaves entire and broadly obovate to spatulate. Flowers less than 1 cm across. Early summer. Arctic shores and marshes. -- (G), sK-(Mack-Y)-Aka, (L)-NF, Q-nMan, (Alta)-BC.

2. DOUGLASIA Lindley

Flowers as in Primula, but the corolla lobes are entire.

1. D. montana Gray -- Cushion-forming perennial with the general presentation of Silene acaulis. Leaves thick, ciliate. Peduncle stellate-pubescent. Flower pink to white. Early summer. High alpine on rocky ridges and scree slopes: Waterton. -- swAlta, wUS.

Reported by Hitchcock 1959 as "Waterton Lakes, B.C.," an obvious lapsus calami for "Waterton Lakes, Alta". The B.C. report by Taylor 1966 may be based on the above lapsus, as there was no corresponding B.C. specimen at UBC in 1966.

Douglasia nivalis Lindley is known to occur only in the mountains of the state of Washington except that the type collection is supposed to come from the Canadian Rockies, hence the frequent reports from Alberta and B.C. Lindley describes the type locality as follows in Edin. Bot. Reg. 22: 1886. 1836: "Upon his journey across the rocky mountains in April 1827, in latitude 50°N., longitude 118°W., at an estimated elevation of 12,000 feet above the level of the sea, the attention of Mr. Douglas was attracted by a brilliant purple patch amidst the surrounding snow..."

Part of the journal kept by Douglas was published in the Comp. Bot. Mag. vol. 2 of 1836. We learn from it that in the spring of 1827 Douglas went up the Columbia to the junction of Canot-Tourné river. On April 28 he left the Columbia to strike east. On May 1st he climbs Mount Brown (alt. 9156 ft.) to which he assigns an altitude of 16 - 17000 ft. By May 3rd he has crossed the height of land and he is now going down the Athabaska. There is no suggestion of Douglasia among the plants mentioned in his journal for these few days.

Considering that Douglasia nivalis has never been collected again in the Rockies either of Canada or of the U.S.A., and despite the circumstancially detailed report by Lindley, we are of the opinion that as long as Lindley's report remains unconfirmed, we must assume an error of locality and date and that the type of Douglasia must have been collected within the state of Washington where Douglas was collecting in 1826 and where the plant has been collected repeatedly since.

3. ANDROSACE L.

Rather similar to Primula, but the corolla tube shorter, constricted at the mouth and more or less dilated by the ovary.

a. Perennial with the flowers much longer than the calyx ..... 3. A. Chamaejasme
aa. Annual with small flowers.
b. Involucral bracts sessile, lanceolate to linear ..... 1. A. septentrionalis
bb. Bracts subpetiolate, spatulate or obovate ..... 2. A. occidentalis

1. A. septentrionalis L. (var. diffusa (Small) Knuth, var. puberulenta (Rydb.) Knuth, var. subumbellata Nelson; A. puberulenta Rydb.) -- Like the following, but the bracts narrower and broadest at the base. Late spring and early summer. Dry places. -- (G-Aka), NF, Q-(O)-Man-BC, (wUS), Eur.

2. A. occidentalis Pursh -- Inconspicuous annual consisting mainly of a very leafy rosette and thin and wiry stems and pedicels. Stems usually many. Involucral bracts broadest above the middle. Pedicels rather long and uneven. Corolla shorter than the calyx. Second half of spring. Light and loose soils, sometimes weedy. -- (wO)-Man-BC, US.

3. A. Chamaejasme Host -- Flowers white with a yellow eye. Stoloniferous perennial with solitary scapes. Villous. Pedicels rather short, not much longer than the bracts. Late spring to mid summer. Rocky slopes, montane or alpine. -- swF, Mack-Aka, swAlta-(eBC, nwUS, Eur).

4. DODECATHEON L. AMERICAN COWSLIP

Flower very showy and rather unusual, resembling an arrowhead, with the conspicuous stamens in the point and the long reflexed petals as the ears.

a. Foliage glandular-pubescent ..... 1. D. conjugens
aa. Foliage glabrous ..... 2. D. pulchellum

1. D. conjugens Greene var. Beamishii Boivin (var. viscidum AA.; D. cylindrocarpum AA.; D. pubescens Rydb.) -- Flower showy, with a rather unusual arrangement of successive colour rings. The corolla lobes are bluish-purple; while the tube is whitish; the connectives form a yellowish ring and the anthers are bluish black below, paler to whitish above. Leaves oblanceolate. Corolla lobes 10-25 mm long. Fruit 13-22 mm long, circumcissile near the top. Spring and early summer. Montane prairies: Cypress Hills and Rockies. -- swS-seBC, nwUS -- F. lacteum Boivin -- Flowers white. -- swAlta.

Var. Beamishii nom. n., D. pubescens Rydb., Mem. N.Y. Bot. Gard. 1: 306. 1900. Var. Beamishii is glandular-pubescent, but otherwise not different from the more western and glabrous typical variety. Miss K.I. Beamish is a student of Dodecatheon and herbarium curator at the University of British Columbia.

Our variety has also been called var. viridum but it has been pointed out that the type of the latter name is apparently the hybrid D. conjugens X Cusickii. See Bull. Torr. Bot. Club 62: 361, 1935.

F. lacteum f.n. floribus albis. Type: D.K. Norris 19, Pasque Mtn., 40 miles almost due north of Coleman; open grassy-rocky slope; flowers white, rare, alt. 7500', July 8, 1956 (DAO).

2. D. pulchellum (Raf.) Merr. var. pulchellum (D. Maccia AA.; D. pauciflorum (Durand) Greene; D. radicatum Greene; D. salinum Nelson) -- Shooting Star -- Similar, but glabrous and the flower generally smaller. Corolla lobes 5-14 mm long. Fruit 8-14 mm long, opening by longitudinal slits. Mid spring to early summer. Wet places on saline soils. -- Mack-Aka, sMan-BC, US, (CA).

Many authors have expressed doubts as to the exact identity of D. pauciflorum and D. radicatum. Fortunately, as pointed out by Merrill, Journ. Arn. Arb. 29: 212. 1948, an earlier name is available: Eximia pulchella Raf., Aut. Bot. 185. 1840. This is based on an excellent illustration and description by Hooker, Curt. Bot. Mag. 64: 3622. 1837 so that the interpretation of Rafinesque's name presents no difficulty. Four other varieties occur to the west and south of us. These and the typical phase are as follows.

Var. pulchellum -- Normally 1-3-(4) dm high. Herbage glabrous. Leaves oblanceolate and gradually attenuate at base. Filaments yellow.

Var. Watsonii (Tid) stat. n., D. Watsonii Tid., Proc. Biol. Soc. Wash. 36: 183. 1923 -- Smaller than the first and generally 2-10 cm high. Known in Canada only on Mt. Arrowsmith in Vancouver Island. A map of the full range of this and other varieties is given by Thompson 1953.

Var. album (Suksd.) stat. n., D. Cusickii Greene var. album Suksd., Werdenda 1: 30. 1927; D. Cusickii Greene, Erythea 3: 37. 1895 -- Like the first but the herbage glandular-puberulent, especially the inflorescence. Known from south-central B.C. and the northwestern U.S.

Var. alaskanum (Hultén) stat. n., D. macrocarpum (Gray) Knuth var. alaskanum Hultén, Fl. Aka, Yuk. 3: 1289. 1948 -- Leaves broadest towards the base, ovate to ovate-lanceolate, abruptly rounded to a petiole clearly set off from the limb. Occurs along the coast from southern Alaska to northwestern Oregon.

Var. monanthum (Greene) stat. n., D. pauciflorum (Durand) Greene var. monanthum, Pittonia 2: 73. 1890. Differs from var. radicatum by its purple filaments. This would seem to be widely distributed in Canada according to a map by Thompson 1953, page 117, but on closer inspection it appears that the symbols for D. radicatum ssp. radicatum and ssp. monanthum have been interchanged and that the latter entity does not occur in Canada.

5. LYSIMACHIA L. LOOSESTRIFE

A middling type with stamens opposite the petals. Flowers yellow. Herbs with opposite or verticillate leaves.

a. Not flowering, but bulbiferous in the axils ..... 1. L. terrestris
aa. Floriferous.
b. Flowers in racemes.
c. Raceme open, terminal ..... 1. L. terrestris
cc. Raceme dense, axillary ..... 2. L. thyrsiflora
bb. Flowers axillary or in terminal cymules.
d. Leaves narrowly linear and sessile ..... 5. L. quadriflora
dd. Broader and petiolate.
e. Leaves ciliate, ± ovate ..... 3. L. ciliata
ee. Not ciliate and narrower ..... 4. L. hybrida

1. L. terrestris (L.) BSP. -- Sterile and usually simple stems with reddish axillary bulblets. Much less common than the flowering type, not yet collected from Manitoba. -- L-(NF, NS-PEI)-NB-O, US -- F. florifera Boivin -- Swamp-Candles, Bog-Loosestrife -- Sepals, petals and fruit with dark purple lines or dots. With one or more terminal racemes of long-pedicelled flowers. Summer. Lake shores. -- L-SPM, NS-seMan, US.

Both forms appear to have essentially the same distribution, but the typical bulbiferous phase was not represented from Manitoba among the many specimens examined from loans and during inventories or revisions. Because this sterile phase is much less conspicuous, its lack of representation from our area may be due only to lack of collecting.

2. L. thyrsiflora L. (Naumbergia thyrsiflora (L.) Reich.) -- Tufted Loosestrife (Corneille en bouquet) -- Leaves, stem and flowers abundantly and finely purple-dotted. No terminal raceme, but the simple stem bearing 2-8 axillary racemes on long peduncles. Pedicels shorter than the flowers. Early summer. Freshwater shores. -- Mack-(Y)-Aka, NS-BC, US, Eur.

3. L. ciliata L. (Steironema ciliatum (L.) Raf.) -- A common and conspicuous yellow-flowered herb with a variable floral arrangement, but usually with some flowers solitary in the axil of opposite leaves while others are in terminal cymules of 4-6 flowers subtended by a verticil of 4 leaves. Long stoloniferous and without basal rosettes. Leaves mostly 3-5 cm wide. Peduncle (2)-4-(6) cm long. Mid summer. Light woods and wetter prairie spots. -- NS-BC, US.

Gleason 1952 would extend the range to Yukon, but we found no corresponding specimen at NY in 1965.

4. L. hybrida Mx. (Steironema hybridum (Mx.) Raf.; S. lanceolatum (Walter) Gray var. hybridum (Mx.) Gray) -- Readily confused with the preceeding, but the leaves not ciliate and narrower. Not stoloniferous, but producing basal rosettes. Leaves 0.5-2.0 cm wide, ± lanceolate, usually verticillate on the last

2-3 nodes. Flowers all or mostly verticillate. Mid summer. Wet meadows. -- swQ-wAlta, US.

5. L. quadriflora Sims (L. longifolia Pursh; Steironema quadriflorum (Sims) Hitchc.) -- Leaves linear and sessile. Tufted with rosettes, the basal leaves much smaller and obovate to elliptic. Leaf and flower arrangement much as in the last two. Mid summer. Chernozem prairies, rare: Kleefeld. -- swO-seMan, US.

6. TRIENTALIS L. CHICKWEED WINTERGREEN

Flower usually 7-merous.

a. Leaves rhomboid-lanceolate, acute to subacuminate at tip ..... 1. T. borealis
aa. Leaves oblanceolate to obovate, obtusish to rounded at tip ..... 2. T. europaea

1. T. borealis Raf. (T. americana Pursh) -- Star-Flower-- Leaves all or mostly in a single terminal verticil. Other leaves, if any, very much reduced and alternate. Larger leaves usually over 5 cm long. Flowers white, terminal, usually two. Early summer. Frequent in forests. -- (seK), L-SPM, NS-neBC, neUS.

2. T. europaea L. (var. arctica Fischer) -- Similar, but the leaves broadest near the tip and usually less than 5 cm long. Stem leaves usually present and not so much reduced, nearly as large as the smaller ones of the terminal verticil. -- Mack-(Y)-Aka, nwAlta-BC, (nwUS), Eur.

Quite variable as to leaf size and there is a strong tendency to smaller leaves (var. arctica) in America. But this is only a matter of frequency as the range of variation appears to be essentially the same on both sides of the Pacific. It seems difficult to implement here a distinction that would not be either artificial or based primarily on the locus of collection.

A report of T. latifolia Hooker from Alberta by Hitchcock 1959 and Boivin 1966 may have been due to a lapsus calami as there was no corresponding specimen at WTU in 1967.

7. GLAUX L. SEA MILKWORT

Corolla lacking, the calyx somewhat petaloid.

1. G. maritima L. var. angustifolia Boivin -- Black Saltwort (Herbe au lait) -- Leaves very finely punctate in slightly darker green. Small perennial herb with milky juice. Somewhat fleshy. Leaves mostly around 1 cm long, lanceolate, entire. Calyx, marcescent, the lobes pinkish with white margins. Early summer. Wettish alkaline soils. -- sMack-sY, sMan-sBC, US.

It is primarily by its narrower leaves that our inland variety is distinguished from either the east coast (var. obtusifolia Fern.) or the west coast (var. macrophylla Boivin) vicariants.

8. ANAGALLIS L. PIMPERNEL

Sepals free.

1. A. ARVENSIS L. -- Pimpernel, Scarlet Pimpernel (Mouron, Mouron rouge) -- Flower brick-red. Rather similar to Stellaria media in general presentation. Foliage obscurely punctate in purple. Leaves ovate, sessile. Peduncle becoming sharply recurved in fruit. Summer. Rare garden weed: Lacombe. -- (G, NF)-SPM, NS-(PEI-NB)-Q-O, Alta-BC, US, Eur.

9. CENTUNCULUS L. CHAFFWEED

Flowers insignificant, 4-merous. Leaves mostly alternate.

1. C. minimus L. -- Chaffweed -- Capsule whitish with a brown equatorial line. Small annual with obovate leaves, the lowermost opposite. (Mid summer?). Marshy places in the prairie. Rare or inconspicuous. -- NS, S-BC, US, (CA), Eur.

We have checked specimens (DAO) from Mortlach, Long Lake, Cory and Empress. We also know of a report from Reed Lake (CAN).

81. PLUMBAGINACEAE (LEADWORT FAMILY)

Plants with the stamens opposite the petals and otherwise generally similar to the Primulaceae but the styles 5 and the leaves (and branching) alternate or basal.

a. Flowers in a branched inflorescence ..... 1. Limonium
aa. In a dense head ..... 2. Statice

1. LIMONIUM L. SEA-LAVENDER

Petals free or nearly so. Each flower tightly wrapped in (2)-3 scarious bracts. Calyx petaloid.

1. L. VULGARE Miller -- Sea-Lavender (Saladelle) -- Flowers in a corymb of secund spikes. Leaves all basal, broadly oblanceolate, fairly large. Branching somewhat dichotomous, the branches trigonous and winged. Calyx white with 5 thick and green nerves. Corolla pink. Mid summer. Cultivated and rarely spreading around old cemeteries: Big Muddy. -- sO, scS, Eur.

Both collections examined (REG, TRT) belonged to the white-flowered cv. Album.

2. ARMERIA W.

Scapose herbs with the flowers in a globose head.

1. A. maritima (Miller) W. var. interior (Raup) Lawr. (Statice interior Raup) -- Thrift, Sea-Pink (Gazon d'Espagne, Herbe à sept têtes) -- Head subtended by numerous membranous bracts, the lowest one being reflexed and tubular. Rosette leaves numerous, marcescent and narrowly linear. Head interspersed by numerous bracts. Early summer. Dunes of lake Athabaska. -- (Mack), nwS.

A variable type to be organized into geographical varieties only with some difficulty. Our present understanding of the Canadian variations may be summarized in the following key:

a. Calyx glabrous ..... var. interior
aa. Pubescent at least along the nerves.
b. Outer involucral bracts triangular-lanceolate, ± acute at tip, and as long or longer than the inner ones -- Vancouver ..... var. californica (Boiss.) Lawr.
bb. Broader, rounded at tip and shorter.
c. Outer involucral bracts less than half as long as the inner -- Arctic regions -- .....var. sibirica (Turcz.) Lawr.
cc. Not quite so short, hence less strongly imbricated.
d. Less than 2 dm high; calyx pubescent on both the nerves and the internerves. -- Arctic-alpine .. .. var. labradorica (Wallr.)Lawr.
dd. Usually taller; calyx pubescent on the main nerves, glabrous on the internerves. -- West Coast .. .. var. purpurea (Mert. & Koch) Lawr.

Order 46. LYTHRALES

Ovary inferior, but the petals free or lacking. Petals borne on the summit of a calyx tube.

a. Flower without perianth, reduced to a single stamen or ovary or both.
b. Fruit an achene; leaves verticillate...Hippuris, p. 140
bb. Fruit a diachene; leaves opposite .. .. 85. Callitrichaceae, p. 146
aa. Flower normal or much less reduced.
c. Petals more than 4, usually 6... 82. Lythraceae, p. 138
cc. Petals (3)-4, rarely lacking.
d. Fruit an achene. Aquatics .. .. 83. Halorrhagidaceae, p. 139
dd. Fruit a capsule. Terrestrial plants ..... 84. Onagraceae, p. 140

82. LYTHRACEAE (LOOSESTRIFE FAMILY)

Like the Onagraceae, but the floral parts usually more numerous and the hypantnium (or calyx tube) free from the ovary.

1. LYTHRUM L.

Petals usually 6, free and borne on the summit of the elongate hypanthium.

1. L. SALICARIA L. (var. gracilior Turcz., var. tomentosum (Miller) DC.) -- Purple Losestrife (Salicaire, Roupie de

coq d'Inde) -- Showy species of shores and ditches with a terminal inflorescence of magenta flowers. Coarse perennial with opposite lanceolate leaves. Inflorescence a raceme of opposite glomerules. Mainly late summer. Sometimes cultivated and spreading readily to freshwater habitats. -- NF, NS-sMan, swAlta-BC, US, Eur.

83. HALORRHAGIDACEAE (WATER MILFOIL FAMILY)

Aquatic plants with a rather small or somewhat reduced flower, similar to the Onagraceae, but the fruit indehiscent.

a. Leaves finely divided ..... 1. Myriophyllum
aa. Leaves entire ..... 2. Hippuris

1. MYRIOPHYLLUM L. WATER MILFOIL

Submerged aquatics with verticillate pectinate leaves.

a. Flowers and bracts all or mostly alternate .. .. 1. M. alterniflorum
aa. Verticillate and the leaves longer.
  b. Inflorescence bracts closely pectinate to entire, many times shorter than the leaves .. .. 2. M. spicatum
  bb. Bracts remotely lobed and at least half as long as the leaves ..... 3. M. pinnatum

1. M. alterniflorum DC. -- Leaves smaller than in the following, (5)-8-10-(12) mm long. Fruit deeply 4-lobed, the lobes rounded and smooth on the back. Second half of summer. Shallow waters, becoming sterile in deeper waters. -- G, (Mack, Aka), NF-SPM, NS, NB-nMan-nS, US, Eur, (Afr).

We know of only 3 collections (CAN; DAO, photo) from our area: Cochrane river, Reindeer Lake and lake Axis. The last is not typical, the leaves being part alternate like the inflorescence bracts.

2. M. spicatum L. (M. exalbescens Fern.; M. verticillatum L., var. pectinatum Wallr.) -- Water-Milfoil (Volant d'eau)-- A common submerged aquatic with verticillate and pectinately divided leaves. Leaves (1)-2-(3) cm long. Flowers inconspicuous, verticillate in a moniliform and emersed spike. Fruit shallowly 4-lobed, the lobes rounded and sometimes smooth or more commonly somewhat verrucose. Mid to late summer. Common submerged herb in shallow to deeper water. -- G-(F)-K-Aka, (L-SPM), NS-BC, US, (SA), Eur, Afr.

We are not convinced that the neogean plants are separable from the paleogean ones except on a statistical basis.

3. M. pinnatum (Walter) BSP. -- Usually with some of the leaves or flowers alternate, the others verticillate. Leaves 1-2 cm long, the lobes few and rather short, passing gradually into the not very reduced bracts. Fruit deeply 4-lobed, the lobes squarish, with 2 tuberculate ridges on the back and 3 concave sides. Late summer. Submerged in sloughs, rare:

Wordsworth, Mortlach. -- sS, US, (CA).
We have checked only the Wordsworth collection.

2. HIPPURIS L. MARE'S TAIL

Palustrine and simple herbs with verticillate and entire leaves. Flowers insignificant. Perianth lacking, the ovary enclosed by the overgrown hypanthium. Stamen only 1 or none.

a. Leaves verticillate in 4's ..... 2. H. tetraphylla
aa. More numerous and narrower ..... 1. H. vulgaris

1. H. vulgaris L. -- Bottle-Brush, Mare's Tail (Queue de cheval, Pesse d'eau) -- Common herb of shallow waters with simple stems and verticillate leaves. Stem fleshy. Leaves in 6's - 10's, entire, 1-3 cm long, acute or acutish, 1-3 mm wide. Early summer. Forming large colonies on muddy shores and shallow waters. -- G-Aka, L-SPM, NS-BC, US, (SA), Eur, (Afr).

In so far as our two species are shore plants, emerged and submerged forms are part of the normal variation of each species and we have made no attempt at distinguishing them, even if the submerged forms can be strikingly different. They have already received names: f. fluviatilis (Coss. & Germ.) Glueck for the first, f. lacunarum Dut. & Lep. for the second.

2. H. tetraphylla L. f. -- Leaves 0.5-1.0-(1.5) cm long, broader, thickish and verticillate in 4's-(6's), oblong-lanceolate and obtuse or rounded at tip. Second half of summer. Maritime shores. -- (F-K)-Mack-(Y)-Aka, (L), Q-nMan, (BC), Eur.

84. ONAGRACEAE (EVENING-PRIMROSE FAMILY)

Flower 4-merous, of free parts, but the ovary inferior, being enclosed in a long-tubular hypanthium.

A Manitoba report of Isnardia palustris L. (= Ludwigia palustris (L.) Ell.) is undoubtedly incorrect as pointed out by Scoggan 1957 and the Saskatchewan reports by Hooker 1832 and Macoun 1883 are probably equally unjustified.

a. Fruit catchy, covered with hooked hairs ..... 6. Circaea
aa. Not catchy.
b. Fruit short, indehiscent ..... 5. Gaura
bb. Elongate, a dehiscent capsule.
c. Seeds with a pappus ..... 1. Epilobium
cc. No pappus.
d. Capsule bilocular, opening by 2 valves ..... 4. Gayophytum
dd. 4-locular and opening by 4 valves.
e. Petals entire to merely emarginate ..... 3. Oenothera
ee. Petals conspicuously bilobed .. .. 2. Boisduvalia

1. EPILOBIUM L. WILLOW-HERB

Seed with a pappus of capillary bristles. Otherwise as in Oenothera.

a. Petals large, at least 1 cm long.
  b. Flowers numerous, subtended by small bracts ..... 1. E. angustifolium
  bb. Flowers few in a leafy inflorescence...2. E. latifolium
aa. Petals smaller.
  c. Leaves linear.
    d. Annual; fruit 2-3 cm long ..... 3. E. paniculatum
    dd. Perennial with longer fruits ..... 4. E. palustre
  cc. Leaves lanceolate to ovate.
    e. Low plant with usually ovate to elliptic leaves ..... 6. E. alpinum
    ee. Taller, the leaves mostly lanceolate ..... 5. E. ciliatum

1. E. angustifolium L. (var. intermedium AA., var. macrophyllum (Hausskn.) Fern., var. platyphyllum (Daniels) Fern.; Chamaenerion spicatum (Lam.) S.F. Gray) -- Fireweed, Pink Tops (Lilas de montagne, Bouquets rouges) -- Showy virgate herb with one large terminal raceme of spreading magenta flowers. Stoloniferous, commonly 1 m high. Leaves ± lanceolate, thin, paler and somewhat rugose below. Bracts mostly about as long as the pedicels. Flower buds reflexed; flowers spreading; fruits slightly ascending. Mid to late summer. Open places, often very abundant after a fire.--G-(F)-K-Aka, L-SPM, NS-BC, US, Eur -- F. albiflorum (Dum.) Hausskn. -- Flowers white, including the sepals. -- Mack-Aka, L-NF, NS-BC, US, Eur -- F. spectabile (Simmons) Fern. -- Petals white, but the sepals purple. -- Aka, NS, Q, Man-S-(Alta), Eur.

2. E. latifolium L. -- River-Beauty -- Similar to the above but smaller and somewhat fleshy. Only 1-4 dm high. Leaves rhomboid to lanceolate, rather thickish, the lateral nerves inconspicuous. Bracts large and leaf-like, mostly at least as long as the buds. Flowers (and buds) 2-3-(12), erect. Fruit erect. Mid summer. Arctic and alpine habitats, especially wet gravels. -- G-Aka, L-NF, Q-(nO)-nMan, swAlta-BC, US, Eur.

3. E. paniculatum Nutt. (f. adenocladon Hausskn.; var. subulatum (Hausskn.) Fern.; E. adenocladon (Hausskn.) Rydb.)-- The bark usually exfoliating on the lower part of the stem. Annual, usually diffusely branched. Leaves linear, conduplicate, falcate. Fruit attenuate at both ends, mostly falcate. Mid summer. Shores of sloughs and disturbed soils. -- swQ-CB, US.

4. E. palustre L. var. palustre (var. grammadophyllum Hausskn.; var. monticola AA., var. oliganthum (Mx.) Fern.; E. davuricum Fischer; E. densum Raf.; E. leptophyllum Raf.; E. lineare AA.; E. molle Torrey; E. oliganthum Mx.; E. strictum Muhl.; E. wyomingense Nelson) -- Resembling the next, but the leaves narrowly linear and the flowers usually white. Glabrous to grayish pubescent. Leaves less than 5 mm wide. Perennial by thin, fragile stolons. Fruit 3-7 cm long. Mid summer. Swampy ground. -- (G-F)-K-Mack-(Y-Aka), L-SPM, NS-BC, US, Eur.

Somewhat variable and subjected to much splitting. We have accepted the consolidation proposed by Hitchcock 1961 as

it seems realistic. The next two species are also the result of similar consolidation procedures.

On the east coast there is a var. sabulonense (Fern.) Boivin with larger flowers, the petals 8-10 mm long.

5. E. ciliatum Raf. var. ciliatum (E. adenocaulon Hausskn., var. perplexans Trel.; E. americanum Hausskn.; E. Drummondii Hausskn.; E. glandulosum Lehm., var. adenocaulon (Hausskn.) Fern., var. cardiophyllum Fern., var. Macounii (Trel.) C.L. Hitchc., var. occidentale (Trel.)Fern., var. tenue (Trel.) C.L. Hitchc.; E. leptocarpum Hausskn., var. Macounii Trel.; E. saximontanum Hausskn.; E. scalare Fern.; E. Steckerianum Fern.; E. Watsonii Barbey) -- A common middling type, 2-8 dm high. Perennial by fragile stolons. Leaves 0.5-2.0 cm wide, lanceolate, denticulate. Fruits and flowers erect, the latter usually pinkish or mauve. First half of summer. Wet ground. -- (Mack)-Y-(Aka), L-NF-(SPM, NS-PEI)-NB-BC, US, (Eur).

The absence of pappus characterizes an eastern endemic, var. ecomosum (Fassett) Boivin, known only from the estuary of the Saint Lawrence.

Earlier reports by Hooker 1832 and Macoun 1883 of E. coloratum Muhl. were based on specimens which, according to Macoun 1894, were mostly revised by Trelease to E. adenocaulon. Considering the absence of E. coloratum from Western Canada, a simultaneous report by Macoun 1894 of the hybrid E. coloratum X adenocaulon from Little Slave Lake cannot be rated as anything but highly improbable.

6. E. alpinum L. (var. albiflorum (Suksd.) C.L. Hitchc., var. clavatum (Trel.) C.L. Hitchc., var. gracillimum (Trel.) C. L. Hitchc., var. lactiflorum (Hausskn.) C.L. Hitchc., var. nutans (Horn.) Hooker; E. anagallidifolium Lam.; E. glaberrimum Barbey var. fastigiatum (Nutt.) Trel.; E. Hornemannii Rchb.; E. lactiflorum Hausskn.; E. platyphyllum Rydb.) -- Like the preceeding but smaller and perennial by rooting decumbent bases or superficial stolons. Only 1-2-(4) dm high. Leaves ovate to narrowly oblong, rather few and commonly only 3-4 pairs to a stem. Flowers few, usually pinkish or mauve. Mainly mid summer. Cold mountain springs. -- (G-F)-K-(Mack-Y)-Aka, L-(NF, NS), Q, Alta-BC, US, (Eur).

Re E. minutum Lindley reported for northern Alberta by Macoun 1883, see comment about Rosa nutkana p. 69, part I.

2. BOISDUVALIA Spach

Petals bilobed, otherwise as in Oenothera.

1. B. glabella (Nutt.) Walpers -- Inconspicuous annual. 1-2 dm high, usually decumbent and ± branched from the base. Herbage more or less hirsute. Leaves narrowly lanceolate below to broadly lanceolate above. Fruit often curved, somewhat shorter than its leaf-like bract. Mid summer. Bare alkaline clays, rare. -- swS-BC, US, (SA).

A collection of B. densiflora (Lindley) Watson labelled M.O. Malte, Alberta, Lethbridge, Aug. 27, 1911 (CAN; DAO, photo)

was mentioned by P. Raven in Brittonia 17: 250. 1965 and was the basis for the Alberta entry in Boivin 1966. The accuracy of the locality on the label was questioned by Raven and his doubts proved to be fully justified. We did not locate Malte's field records for that year, but a checking of other herbarium sheets at DAO showed that in late August 1911 Malte was collecting in British Columbia, not in Alberta. A similar check by Miss H. Harkness at the National Museum neatly confirmed and completed our sampling. The consolidated samplings provide us with the following spot-check on Malte's 1911 itinerary:

Aug. 7-8, 1911	-- Fernie, B.C.
Aug. 11	Nelson, B.C.
Aug. 15	Salmon Arm, B.C.
Aug. 16	Kamloops, B.C.
Aug. 20-21	Vancouver, B.C.
Aug. 24	Victoria, Cedar Hill, B.C.
Aug. 27	New Westminster, B.C.
Aug. 31	Summerland, B.C.
Sept. 3	Banff, Alta.
Sept. 5-6	Calgary, Alta.

In all likelihood the collection labelled Lethbridge came from the vicinity of Victoria, B.C., the only area where B. densiflora is known to occur in Canada.

3. OENOTHERA L. EVENING-PRIMROSE

A basic type, 4-merous and the perianth of free parts, but the ovary inferior.

A very heterogeneous genus comprising 15 subgenera many of which are rated as distinct genera by various authors. We have found the treatment by P.A. Munz, N. Am. Fl. II, 5: 79-177.1965 to be the most practical solution, while being intellectually as satisfactory as any other arrangement known to us.

a. Stemless or the stem rather short, overtopped by the basal leaves.
  b. Flowers very large, white ..... 8. O. caespitosa
  bb Smaller and yellow.
    c. Petals 1-2 cm long ..... 7. O. flava
    cc. Shorter, 6-10 mm long ..... 9. O. breviflora
aa. Stem much taller than the rosette leaves.
  d. Petals white, fading purplish ..... 2. O. Nuttallii
  dd. Petals yellow.
    e. Petals 1-3 mm long ..... 6. O. andina
    ee. Petals 5 mm long or more.
      f. Ovary and capsule rounded on the angles.
        g. A low shrub ..... 3. O. serrulata
        gg. Biennial herb ..... 1. O. biennis
      ff. Ovary and fruit winged or crested on the angles.

h. Petals 5-9 mm long ..... 5. O. perennis
hh. Larger, 10-25 mm ..... 4. O. fruticosa

1. O. biennis L. var. biennis -- Evening-Primrose, Candlestick (Herbe aux ânes, Mâche rouge) -- Large yellow flowers in the shape of a maltese cross. Biennial herb, green, more or less pubescent. Leaves lanceolate, entire to remotely denticulate. Flower borne at the end of a long thin tube, termed hypanthium, longer than the ovary and enclosing it. Mid to late summer. Pioneer in open soils. -- (NF, NS-NB)-Q-(O-Man)-S-BC, US, (Eur) -- F. muricata (L.) Boivin (O. muricata L.; O. parviflora L.) -- Pubescence partly of stiff hairs with a red and inflated base. -- (NF, NS-NB)-Q-O-(Man-BC, US) -- Var. canescens T. & G. (var. hirsutissima Gray; O. strigosa (Rydb.) Mack. & Bush) -- More pubescent, grayish or whitish hairy, especially in the inflorescence. Muricate hairs none or few. -- (NS-O)-Man-Alta-(BC), US, (CA).

In the east it has been minutisected into umpteen microspecies as the result of genetic studies. Fortunately our local populations have remained completely outside these developments towards the miniaturization of the species concept.

2. O. Nuttallii Sweet (O. pallida AA.; Anogra Nuttallii (Sweet) Nelson) -- Stem bone-white. Tufted perennial. Leaves linear. Flowers large and showy, opening white in late afternoon, fading pink, drying reddish blue. Mid summer. Scattered tufts on sandy soils. -- O-BC, US.

3. O. serrulata Nutt. (Meriolix serrulata (Nutt.) Walp.-- Shrubby in the lower half. Leaves lanceolate to linear, conspicuously serrate, tending to be conduplicate and falcate. Fruit linear. Summer. Prairie on sandy or gravelly soils. -- (C)-Man-Alta, US.

4. O. FRUTICOSA L. -- (var. linearis (Mx.) Watson) -- Sundrops -- Leaves alternate, becoming congested in the inflorescence. Tufted perennial. Fruit ellipsoid, stipitate. Early summer. Rare weed of gravelly soils: Bird's Hill. -- (sMan), eUS.

5. O. perennis L. (O. pumila L.) -- Sundrops -- Fruit conspicuously stipitate. Generally similar to the preceeding,but the flowers smaller and the inflorescence racemose. Early summer. Prairies on gravelly soils, rare: Teulon. -- NF-(SPM), NS-O-(Man, swBC, eUS).

6. O. andina Nutt. var. andina -- Small annual with minute flowers. Around 1 dm high and very branchy. Fruit largest at the base and gradually tapered. Early summer. Light soils, rare: Pend-d'Oreille. -- sAlta-(sBC), wUS.

In var. Hilgardii (Greene) Munz from the state of Washington the petals are about twice longer.

7. O. flava (Nelson) Garrett (Lavauxia flava Nelson) -- Similar to the following but generally smaller and the flower yellow when fresh. Pubescence somewhat shorter and less dense. Petals 1-2 cm long, fading purplish. Anthers 4-8 mm long. Hy-

panthium and sepals finely glandular. Capsule slightly hirsute and finely glandular, the angles not verrucose and not particularly sinuous. Early summer. Steppes and eroded hillsides. -- sS-sAlta, (US, CA).

8. O. caespitosa Nutt. var. caespitosa (var. montana (Nutt.) Durand; Pachylophus caespitosus (Nutt.) Raim.; P. montanus (Nutt.) Nelson) -- Showy perennial with huge white flowers fading pink or red. Stemless with rosette leaves resembling those of a Taraxacum. Petals 2.5-4.5 cm long. Anthers 8-13 mm long. Hypanthium and sepals strigose. Capsule strigose or glabrescent, strongly sinuose-verrucose on the angles. Early summer. Bare clays and badlands, local. -- sS-sAlta, wUS -- Var. psammophila (Nels. & Macbr.) Munz -- Stem present, about 1 dm long. More restricted: Cardston. -- swAlta, nwUS.

Var. montana is apparently only a less common glabrous extreme, sporadic in the range of the typical pubescent phase.

9. O. breviflora T. & G. (O. brevifolia sphalm.; Taraxia breviflora (T. & G.) Nutt.) -- Like the previous 2 but the leaves more deeply divided, lyrately pinnatipartite, and the flowers smaller. Puberulent throughout, including the sepals, hypanthium and capsule, the latter merely rounded on the angles. Petals yellow, 6-10 mm long, fading reddish. Anthers less than 1 mm long. Early summer. Saline clay flats, rare. -- swS-sAlta-sBC, US.

4. GAYOPHYTUM Jussieu

Capsule bilocular and opening by 2 valves. Otherwise as in Oenothera.

1. G. humile Juss. (G. racemosum T. & G.) -- Capsule deeply sulcate on both faces. Inconspicuous and small annual, somewhat puberulent. Leaves linear. Capsules linear. Mid summer. Disturbed sandy ground, rare: Mt. Glendown. -- swAlta, wUS, (SA).

Closely related to, and none to clearly distinct from, the more western G. ramosissimum Nutt.

5. GAURA L. BUTTERFLY WEED

Fruit short and indehiscent. Otherwise as in Oenothera.

1. G. coccinea (Nutt.) Pursh var. coccinea -- Fruit rhomboid. Tufted perennial with decumbent stems and terminal racemes. Herbage pubescent and tending to be grayish, especially in the inflorescence. Flowers pinkish in bud, darkening and fading deep scarlet. Early to mid summer. Common on hillsides, dry prairies, roadsides, etc. -- O-Alta-(BC), US -- Var. glabra (Lehm.) T. & G. (G. glabra Lehm.) -- Glabrous or nearly so. Less frequent and of more restricted distribution. -- S-Alta, US.

6. CIRCAEA L. ENCHANTER'S NIGHTSHADE

Floral partsin 2's. Fruit catchy by hooked hairs.

a. Fruit broadly oblanceolate ..... 1. C. alpina

aa. Broadly obovoid ..... 2. C. quadrisulcata

1. C. alpina L. (C. pacifica Asch. & Magnus) -- A delicate forest species with small catchy fruits in terminal racemes. 1-4 dm high. Leaves broad, ovate, remotely denticulate. Raceme minutely and obscurely bracteolate, the bractlets mostly 0.1-0.3 mm long. Flowers small, white. Petals ± 1 mm long. Fruit ± 1 mm wide, not ridged. Early to mid summer. Common in damp forests. -- (Mack), Aka, L-SPM, NS-BC, US, Eur -- Var. pacifica (Asch. & Magnus) M.E. Jones -- Raceme bractless except sometimes the lowermost 1-(3) flowers. Rockies. -- swAlta -BC, wUS.

Specimens of var. pacifica will commonly exhibit a number of other characters such as being taller and having leaves not cordate at base and less saliently toothed. Distinctions based on these additional characters have proved rather unsatisfactory as a certain proportion (about one in ten) of more eastern specimens will also exhibit these same features in a sporadic fashion. We have therefore shifted the emphasis entirely to the presence or absence of bractlets in the inflorescence, a character more clearly restricted in its geography.

2. C. quadrisulcata (Max.) Franch. & Sav. var. canadensis (L.) Hara -- Rachis of the raceme purplish at the base of each pedicel. Like the preceeding, but larger throughout. 3-8 dm high. Petals ± 2 mm long. Fruit 2-3 mm wide, with 6-10 longitudinal ridges. Summer. Alluvial woods on the Coteau de Prairie. -- (NF), NS, NB-sMan, US.

In our variety the flowers are reputedly less brightly coloured and less pubescent than the typical east-asiatic plant.

85. CALLITRICHACEAE (WATER-STARWORT FAMILY)

Flower insignificant, without perianth and reduced to an ovary or a single stamen.

1. CALLITRICHE L. WATER STARWORT

Submerged aquatics with submerged flowers.

a. Leaves all alike; fruit larger .....2. C. hermaphroditica

aa. Leaves usually dimorphic; fruit smaller.....1. C. palustris

1. C. palustris L. (C. heterophylla AA.; C. verna L.) -- Submerged aquatic with opposite and entire leaves, the latter usually dimorphic. Submerged leaves filiform, 1-nerved and usually about 2 cm long. Floating leaves smaller, ± spatulate, 3-nerved, the nerves reticulate. Fruit longer than broad, 1.0-1.5 mm long, shallowly sulcate, the angles very sharp to narrowly winged. Summer. Common submerged aquatic. -- (G), K-Aka, L-SPM, NS-BC, US, (SA), Eur.

We have examined and revised to C. palustris two (DAO, MT) of the three Manitoba collections listed as C. heterophylla Pursh by Löve 1959. The other collection was not seen.

Macoun 1890 also reports C. heterophylla from the Moose Jaw Creek but there are no Saskatchewan specimens filed under that name to-day at CAN and the original collection has presumably been revised since to some other species, possibly C. palustris.

2. C. hermaphroditica L. (C. anceps AA.; C. autumnalis L.) -- (Etoile d'eau) -- All leaves similar and narrowly linear, mostly around 1 cm long. Fruit 1.2-1.5-(2.0) mm wide, as wide as or slightly wider than long, deeply sulcate nearly to the central axis, being divided into 4 flat lobes. Summer. Slow moving water. -- (G), Mack-(Y)-Aka, (L-NF), NB-BC, US, Eur.

Order 47. SAXIFRAGALES

Resembling the Rosales, with free petals and fused sepals, but the carpels more or less united and the flower typically perigynous.

a. Carpels (4)-5; mostly fleshy plants .....86. Crassulaceae
aa. Carpels 2 ..... 87. Saxifragaceae

86. CRASSULACEAE (ORPINE FAMILY)

Differs from the Saxifragaceae by its more numerous carpels that are only slightly united at base.

a. Flowers showy ..... 1. Sedum
aa. Flowers greenish, without petals ..... 2. Penthorum

1. SEDUM L. STONE-CROP

Fleshy herbs of dry and rocky habitats with showy flowers like those of Saxifraga, but the carpels more numerous.

a. Leaves mostly opposite or verticillate ..... 5. S. Rosea
aa. Leaves alternate.
b. Leaves very thick and less than 3 mm wide.
c. Stem leaves less than 5 mm long ..... 1. S. acre
cc. Longer, mostly around 1 cm long.
d. Leaves narrowed at base ..... 6. S. lanceolatum
dd. Conspicuously larger at base ..
..... 7. S. stenopetalum
bb. Leaves flat and at least 5 mm wide.
e. Flowers reddish ..... 4. S. Telephium
ee. Yellow.
f. Leaves spatulate, dentate above the middle only ..... 2. S. hybridum
ff. Lanceolate, serrate their whole length ..... 3. S. Aïzoön

1. S. ACRE L. -- Mountain-Moss, Love-Entangle (Gazon d'or, Petite joubarbe) -- The whole plant yellowish-green and forming a carpet less than 1 dm high. Leaves small and short, closely imbricated, not falling off in drying. Flowers yellow, few. Early summer. Cultivated and rarely escaped in dry or rocky places: Pointe-du-Bois, Ft. Qu'Appelle, Ma-Me-O. -- (G, NF-SPM), NS-BC, US, Eur.

2. S. HYBRIDUM L. -- Leaves 5-12 mm wide, short-spatulate, dentate only in the upper half. About 2 dm high. Yellow flowers in a terminal cyme. Early summer. Cultivated and rarely

escaping to roadsides and rocky places: Pointe-du-Bois, Fort Saskatchewan. -- Q, sMan, cAlta, Eur.

3. S. AIZOON L. -- Leaves 3-10 cm long, lanceolate, serrate their whole length. Plant 2-6 dm high. Flowers yellow in a cyme. Early summer. Cultivated and rarely escaped to roadsides: Ma-Me-O. -- cAlta, Eur.

It was also reported for Saskatoon by Russell 1944, and Breitung 1957, but the justifying collection is likely to be only a cultivated specimen as it is labelled R.C. Russell, Saskatoon, "U", garden, June 29, 1932 (SASK; DAO, photo). Further, it was later revised to S. Telephium.

4. S. TELEPHIUM L. -- Live-Forever, Orpine (Grassette, Chou au lièvre) -- Flowers reddish in a dense terminal corymb. Stem 4-7 dm high. Leaves ± elliptic, rather large and very fleshy, coarsely dentate, often densely punctate in purple. Mid summer. Cultivated and rarely escaped to roadsides; reported from The Pas. -- (NF), NS-O-(Man), BC, US, Eur.

5. S. Rosea (L.) Scop. var. integrifolium (Raf.) Berger (S. Roseum sphalm.) -- Aaron's Rod, Midsummer-Men (Millegraine, Racine de Rose) -- Leaves partly alternate, partly opposite or verticillate, entire, ovate to lanceolate. 1-3 dm high. Inflorescence small, purplish-black. Early summer. Rocky alpine habitats. -- Mack-Aka, Alta-BC, US, (Eur).

In the more eastern var. Rosea the fruits are paler, pink to red, and the leaves are commonly dentate.

6. S. lanceolatum Torrey (S. stenopetalum AA.) -- Flowering stems arising from a dense carpet of sterile shoots. Leaves linear, those of the sterile shoots crowded and persisting in the herbarium, the stem leaves not so crowded and falling off in drying. Flowers yellow in a terminal cyme. Early summer. Rolling montane prairies, from the Coteau Boisé westward. -- Y-(Aka), swS-BC, US.

7. S. stenopetalum Pursh (S. Douglasii Hooker) -- Similar but bulbiferous in the upper half of the stem. Leaves drying whitish and abundantly rusty-spotted. Bulblets axillary, foliaceous. Early summer. Rocky places at mid altitudes: Waterton. -- swAlta-sBC, wUS.

2. PENTHORUM L. DITCH-STONE-CROP

Petals lacking and the plant not fleshy.

1. P. sedoides L. -- Perennial herb arising from a creeping base. Leaves lanceolate, serrate. Inflorescence glandular, terminal. Flowers in secund cymes. Filaments 10, persistent in fruit. Calyx lobes small and discrete. Mid summer. Shores and ditches, rare. -- NB-seMan, US.

87. SAXIFRAGACEAE (SAXIFRAGE FAMILY)

Like the Crassulaceae, but the ovary typically reduced to 2 carpels.

a. Petals lacking ..... 10. Chrysosplenium
aa. Petals present.
b. Stamens alternating with staminodia; carpels 4; leaves entire ..... 11. Parnassia
bb. Staminodia lacking; carpels usually 2.
c. Petals trifid to pectinate.
d. Styles 3; leaves palmatipartite .. .. 7. Lithophragma
dd. Styles 2; leaves shallowly to deeply bilobed ..... 8. Mitella
cc. Petals entire.
e. Inflorescence a simple raceme... 9. Conimitella
ee. More branched and not a raceme.
f. Stamens 5.
g. Ovary bilocular; inflorescence cymose ..... 2. Suksdorfia
gg. Unilocular; inflorescence spicate to narrowly paniculate ..... 6. Heuchera
ff. Stamens 10.
h. Petals filiform, resembling the filaments of the stamens ..... 5. Tiarella
hh. Petals broader and more obvious.
i. Carpels completely fused; styles partly fused....4. Telesonix
ii. At least the styles free.
j. Carpels mostly completely free..1. Leptarrhena
jj. Carpels fused ventrally for the lower half or so ..... 3. Saxifraga

1. LEPTARRHENA Br.

As Saxifraga but the carpels nearly free to the base and the calyx barely adnate to the base of the ovary.

1. L. pyrolifolia (D. Don) Br. -- Rather resembling Saxifraga rhomboidea, etc., but the stem typically bearing one large leaf which is ± cordate at base. Basal leaves oblong, thickish, serrate, the nerves impressed above. Inflorescence densely glandular in red. Flowers marcescent. Petals white, narrow and inconspicuous, ± linear. Early summer. Along creeks and shores. -- Y-Aka, swAlta-BC, US.

2. SUKSDORFIA Gray

Stem arising from a tuft of bulblets. Stamens only 5 and the inflorescence cymose; otherwise as in Saxifraga.

a. Flowers 1-3-(7) ..... 2. S. violacea
aa. More numerous ..... 1. S. ranunculifolia

1. S. ranunculifolia (Hooker) Engler (Hemieva ranunculifolia (Hooker) Raf.) -- Stem arising from a cluster of rusty-coloured bulblets. 1-3 dm high and glandular-pubescent. Leaves palmatipartite. Flowers white, usually with a deep red center. Late spring and early summer. Wet rocky places in the mountains: Waterton -- (swAlta)-BC, US.

2. S. violacea Gray -- A delicate herb resembling many Saxifraga, but the petals pink to drying violet; they are white or yellow, sometimes red, in Saxifraga, except S. oppositifolia. Stem simple, 1-3 dm high, with few and inconspicuous basal bulblets. Herbage glandular-pubescent. Leaves mostly cauline, alternate and palmatilobed to palmatifid. Flowers few or single. Petals rather showy, oblanceolate, sometimes nearly white. Late spring and early summer. Wet rocky banks and cliffs in the mountains;rare: Carbondale River. -- swAlta-BC, US.

3. SAXIFRAGA L. SAXIFRAGA

The basic type of the family and a readily recognized genus by its ovary obviously composed of two carpels that are fused ventrally below the middle, but quite free in the upper half, the two styles conspicuously distinct. Stamens 10.

a. Leaves opposite ..... 16. S. oppositifolia
aa. Leaves alternate or all basal.
  b. Stem leafless below the inflorescence ..... Group A
  bb. Stem leafy ..... Group B

Group A

Foliage mainly basal, the stem leafless, but the branches of the inflorescence often subtended by ± reduced leaves.

a. Leaves subcordate to deeply cordate at base.
  b. Many of the flowers replaced by clusters of bulblets ..... 2. S. Mertensiana
  bb. Not bulbiferous ..... 1. S. punctata
aa. Leaves broadly to narrowly cuneate at base.
  c. Sepals sharply reflexed and pendent.
    d. Glabrous or slightly puberulent above ..... 3. S. Lyallii
    dd. Abundantly glandular-pubescent throughout ..... 6. S. ferruginea
  cc. Sepals ascending to more or less spreading.
    e. Petals 2-4 mm long ..... 4. S. occidentalis
    ee. More elongate, 4.0-4.5 mm long...5. S. virginiensis

Group B

Stem with few to many leaves below the inflorescence.

a. Leaves trifid to palmately lobed.
  b. Bulbiferous in the upper axils ..... 10. S. cernua
  bb. Not bulbiferous.
    c. Leaf lobes ligulate ..... 12. S. cespitosa

cc. Ovate to rounded ..... 11. S. rivularis
aa. Leaves 3-toothed to entire.
d. Flowers white; petals punctate or not.
e. Leaves soft, with a rounded tip....9. S. adscendens
ee. Leaves stiff, prickly pointed.
f. Leaves entire ..... 13. S. bronchialis
ff. 3-toothed at apex ..... 14. S. tricuspidata
dd. Yellow-flowered, the petals not punctate.
g. Conspicuously long stoloniferous ..
..... 8. S. flagellaris
gg. Not stoloniferous.
h. Leaves all alike, all sessile...15. S. aizoides
hh. Basal leaves petiolate ..... 7. S. Hirculus

1. S. punctata L. var. Porsildiana (Calder & Savile) Boivin (S. aestivalis AA.; S. arguta AA.) -- Leaves deeply reniform and flabellately lobed. Scapose, villous, stoloniferous. Flowers white with a red center. Filaments thin. Early summer. Wet cliffs near timberline: Rockies. -- K-(Mack)-Y, swAlta-BC.

Four other intergrading varieties occur in Canada, of which one may mention var. arguta (D. Don) Engl. & Irmsch. (including ssp. pacifica Hultén), with glabrous and larger leaves, the main ones 2.5-7.5 cm wide, occurring from southern Alaska to northwestern B.C. This was also cited for Yukon as ssp. pacifica in Bot. Not. 109: 192. 1956,but the justifying collection, N.J. Freeman, Quill Creek, 1953 (WIN; DAO, photo), has since been revised to var. Porsildiana.

2. S. Mertensiana Bong.-- Cocoa-Nuts -- Flowers partly replaced by clusters of pinky bulblets. Scapose,reddish glandular-pubescent. Leaves orbicular, deeply cordate, palmately lobed, the lobes 3-toothed. Inflorescence very open. Flowers white with conspicuously clavate filaments. Early summer. Dripping cliffs in the mountains: Waterton. -- sAka, swAlta-BC, wUS.

3. S. Lyallii Engler var. Lyallii -- Leaves spatulate, coarsely toothed in the upper half. Scapose and mostly around 1 dm high. Inflorescence ± racemose. Petals white to red tinged. Sepals deep red. Filaments clavate. Early summer. Alpine brooks and late snow patches. Rockies. -- swAlta-sBC, (US) -- Var. Hultenii Calder & Savile -- Taller plant, 1-3 dm high, with larger basal leaves, broadly obovate to flabelliform. Inflorescence paniculate. -- Y-Aka, swAlta-BC, US -- Var. laxa Engler (S. Lyallii X S. odontoloma AA.) -- Also taller, 2-4 dm high and the basal leaves orbicular, broadly cuneate to subtruncate at base. Inflorescence paniculate. Sometimes reputed a hybrid, but one parent is missing over much of the range. -- (swAlta)-sBC, (US).

4. S. occidentalis Watson var. occidentalis (S. nivalis AA.; S. rhomboidea AA.; S. rufidula (Small) Macoun; Micranthes rhomboidea AA.) -- Quite like the following, but the inflorescence more congested and the flowers smaller. Herbage commonly reddish glandular-puberulent. Petals obovate to oblong. First

half of summer. Dry montane prairies on slopes: Cypress and Rockies. -- (seAka), swS-swAlta-sBC, wUS.

Further south there occurs a number of rather weak variations, of which var. idahoensis (Piper) C.L. Hitchc. has strongly clavate filaments and var. latipetiolata C.L. Hitchc. has a short and broadly winged petiole.

S. rhomboidea Greene is a Colorado and Wyoming species with a semi-inferior ovary, while in our S. occidentalis the ovary is almost completely superior. All Canadian specimens met with under S. rhomboidea have been studied and revised to C. occidentalis.

5. S. virginiensis Mx. -- Everlasting, Sweet Wilson (Passe-pierre) -- Leaves typically rhomboid-ovate and serrate. Scapose, commonly 1-2 dm high, mostly glandular-villous. Petals oblanceolate. Mid spring. Open sandy or rocky places where it may be quite conspicuous at flowering time. -- NB-seMan, US.

6. S. ferruginea Graham -- Leaves rather large, commonly 3-10 cm long, cuneate-oblanceolate and remotely serrate above the middle only. Inflorescence diffuse. Flowers white. Petals unguiculate, lanceolate. First half of summer. Wet shaded rocks, at the middle altitudes: Waterton. -- (nwMack), sAka, (swAlta)-BC, US -- F. Vreelandii (Small) St. John & Thayer (var. Macounii Engler & Irmscher) -- Flowers partly replaced by green leafy bulblets, their leaves obovate to spatulate. -- (sAka), swAlta-BC, US.

7. S. Hirculus L. -- (Faux-ciste) -- Flower yellow, usually solitary. Rufous-villous above. Stem leaves numerous, sessile, narrowly linear, the basal ones lanceolate, with a petiole about as long as the blade. Petals ± 1 cm long. Mid summer. Wet arctic tundra. -- G-Aka, nQ-nMan, wUS, Eur.

The many reports, new and old, from Saskatchewan, Alberta and B.C., are not substantiated by any specimen that we could locate and were presumably based on old misidentifications or were speculative additions.

8. S. flagellaris W. var. flagellaris -- Spider-Plant -- Producing ± 6 conspicuous superficial stolons. Stem leafy, solitary, with 1 to a few yellow flowers. Herbage ± glandular-pubescent. Stolons filiform, naked, about 1 dm long, rooting at tip. Mid summer. High alpine on polygons or solifluction soils: Rockies. -- wMack-Aka, swAlta-nBC, US, Eur.

The glandulosity is clear to light brown in ours but the glands are purple black in the arctic var. platysepala Trautv.

9. S. adscendens L. var. oregonensis (Raf.) Breitung -- Leaves mostly 3-toothed or 3-lobed, but soft and not spinescent. Biennial, less than 1 dm high, glandular-puberulent throughout. Flowers white. Mid summer. Talus slopes and permafrost soils at high altitudes. -- sY-seAka, swAlta-BC, wUS.

The typical eurasian phase is generally larger, with larger flowers and larger stem leaves.

10. S. cernua L. -- With clusters of fleshy, deep purple bulblets in the axils of the upper leaves. Glandular-villous. Leaves palmatilobed, the lower ones on very long petioles.

Flower white, typically single and terminal. Mid summer. Wet cliffs and mountain summits. -- (G)-F-Aka, L, Q, swAlta-BC, US, Eur.

11. S. rivularis L. -- Similar to the preceeding, but not bulbiferous and the few flowers usually on very long pedicels, commonly longer than half the height of the plant. Leaves (3)-5-(7) lobed, not bulbiferous. Petals white. Early summer. Crevices of outcrops in arctic regions and in the mountains. -- G-Aka, L-NF, Q, nMan, swAlta-BC, US, (Eur).

12. S. cespitosa L. (var. groenlandica (L.) Pursh; var. minima Blank.) -- Leaves digitately lobed, the lobes ligulate. Glandular-puberulent, forming dense cushions, the stems about 1 dm high. Leaves cut into 3-(5) lobes. Flower white, often single. First half of summer. Alpine shale slopes and arctic gravels. -- G-Aka, L-NF, Q, nMan, swAlta-seBC, US, Eur.

13. S. bronchialis L. var. austromontana (Wiegand) G.N. Jones -- Forming dense cushions of entire, stiff and spinescent leaves. Leaves marcescent, stiffly ciliate. Stem thin, glandular puberulent. Petals 5.0-6.5 mm long, not unguiculate, white, with about 6 deep-red dots. Early to mid summer. Rocky alpine meadows. -- swAlta-BC, US.

Replaced to the northwest by a var. purpureomaculata Hultén with unguiculate and somewhat larger petals, typically 7-8 mm long.

14. S. tricuspidata Rottb. (Leptasea tricuspidata (Rottb.) Haw.) -- Leaves fleshy, 3-toothed at apex, the teeth spiny. Carpet forming perennial, similar to the preceeding. Leaves ligulate, stiffly ciliate. Flowers white, the petals with 10-15 magenta dots. Early summer. Rocky outcrops in northern regions. -- G-Aka, nL, nQ-BC.

15. S. aïzoïdes L. -- Yellow-flowered carpet-making perennial. Stem densely puberulent, 1 dm high or less. Leaves all alike, sessile, narrowly lanceolate,marcescent, slightly fleshy. Mid summer. Alpine and arctic gravels and other loose soils.-- G-Mack-(Y) L-NF, NS, Q-(nO)-nMan, swAlta-eBC, US, Eur.

16. S. oppositifolia L. -- Mayflower -- Leaves opposite; flowers purple. Densely leafy carpet-making perennial. Leaves obovate, long ciliate, marcescent, turning blackish. Flowers solitary at the end of the branches. Early summer. Exposed rocky or gravelly places in arctic or alpine regions. -- G-Aka, L-NF, Q, nMan, swAlta-BC, US, Eur.

Reports of S. Aizoön Jacq. from Saskatchewan by many authors are probably based on the distribution given by Hooker 1832. The latter mention may have been based on collections from the Great Slave Lake or possibly the Great Bear Lake.

4. TELESONIX Raf.

Differs from Saxifraga in the carpels being fused ventrally their whole length and the styles often partly fused.

1. T. Jamesii (Torrey) Raf. var. heucheriformis (Rydb.) Bacigalupi (Boykinia heucheriformis (Rydb.) Ros.) -- With the

general habit of a Heuchera, but the flowers reddish and the pubescence also often reddish, especially near the base of the flower. Glandular-pubescent throughout, 1-7 dm high. Leaves orbicular, lobed and dentate, cordate at base. Calyx ± reddish. Early summer. Rock crevices at the Hot Springs of Roche Miette. -- swAlta-(BC), US.

In ours the petals are obovate to spatulate and mostly 3 mm long. The typical phase, restricted to the Rockies of Colorado, is somewhat larger flowered, the petals 3-5 mm long and somewhat larger, broadly obovate to suborbicular.

5. TIARELLA L. FALSE MITREWORT

Flower slightly irregular. Upper calyx lobe somewhat longer than the others. Carpels unequal in size the lower one often becoming as much as twice as long as the 1-(2) upper ones in fruit.

a. Leaves simple ..... 1. T. unifoliata
aa. Trifoliate ..... 2. T. trifoliata

1. T. unifoliata Hooker (f. trisecta Lakala) -- Petals insignificant, about as narrow as the filaments of the anthers. Glandular-puberulent perennial, the leaves mostly basal, trilobed to tripartite, the lobes irregularly crenate-dentate. Flowers white in a narrow panicle. Early summer. Mountain woods in the Rockies and Swan Hills. -- Aka, Alta-BC, nwUS.

More deeply lobed specimens have been called now a mere form, f. trisecta, now as an interspecific hybrid to T. trifoliata. The last assumption seems rather improbable since the form was originally described from the albertan Rockies, an area where one of the postulated parents is not known to occur.

2. T. trifoliata L. -- Similar, but the leaves trifoliate. Tending to be taller and more abundantly flowered. Early summer. Wetter coniferous forests, rare: Whitecourt. -- sAka, wcAlta-BC, nwUS.

6. HEUCHERA L. ALUM-ROOT

Stamens only 5 as in Suksdorfia, but the carpels fused into a unilocular ovary. Otherwise as in Saxifraga. Flower often somewhat asymetrical.

a. Calyx 2-4 mm long, including the semi-inferior ovary.
b. Leaf-teeth acute ..... 1. H. glabra
bb. Leaves broader, their teeth broadly rounded ..... 4. H. parvifolia
aa. Flowers larger, the calyx 5-12 mm long.
c. Stamens included in the calyx ..... 2. H. cylindrica
cc. Stamens exserted; leaves and flowers larger ..... 3. H. Richardsonii

1. H. glabra W. -- Pedicels recurved, mostly longer than the flowers. Leaves sharply dentate, at least one well developed

leaf borne on the stem or subtending the lowest branch. Panicule open, sometimes secund. Mid summer. River cliffs, rare: Mt. Edith Cavell. -- sAka, swAlta-BC, US.

2. H. cylindrica Douglas var. glabella (T. & G.) Wheelock (var. septentrionalis R., B. & L.) -- Petals linear, included and inconspicuous, but the calyx lobes yellowish. Scapose perennial 3-6 dm high. Leaves broadly ovate, lobed, the lobes crenate. Inflorescence a narrow racemiform panicle. Late spring to mid summer. Open rocky slopes in the mountains. -- swAlta-sBC, wUS.

Petioles glabrous or somewhat glandular-puberulent, never hirsute. The typical phase occurs west of us and is readily recognized by the dense and mixed pubescence of the petioles, partly long hirsute, partly glandular-puberulent.

3. H. Richardsonii Br. var. Richardsonii (var. hispidior R., B. & L.; H. hispida AA.) -- Alum-Root -- Much like the preceeding, but the calyx strongly asymetrical and the stamens exserted. Calyx barely petaloid. Petals pink, spatulate, about as long as the calyx lobes. Early summer. Common on rolling prairie. -- Mack, O-sMan-neBC, US.

In ours the capsule is included, the stamens barely exserted and the petals are merely papillose. We have submerged var. hispidior as being a mere sporadic extreme of pubescence. Further south one may find var. Grayana R., B. & L. (including var. affinis R., B. & L., a smaller-flowered extreme) with a somewhat exserted capsule, more strongly exserted stamens and petals at once glandular and papillose.

4. H. parvifolia Nutt. var. dissecta M.E. Jones (H. flabellifolia Rydb.) -- Flowers small and the white petals exserted as in H. glabra, but the panicle narrow and racemiform. Generally smaller, the leaves only 1-3 cm wide. Late spring to early summer. Foothill prairies. -- (swS)-swAlta-(seBC), US.

7. LITHOPHRAGMA Nutt.

Petals conspicuously and digitately lobed. The gender of this genus was discussed in Taxon 12: 208. 1963.

a. Bulbiferous in the upper axils ..... 1. L. glabrum
aa. Not bulbiferous ..... 2. L. parviflorum

1. L. glabrum Nutt. ramulosum (Suksd.) Boivin (L. bulbiferum Rydb.; L. tenellum AA.) -- Lower flowers replaced by clusters of deep-purple fleshy bulblets. Otherwise, quite like the following. Calyx campanulate, elongating up to 5 mm in fruit. Petals somewhat smaller, mostly trifid. Late spring. Prairies near springs: Cypress Hills and Rockies. -- swS-swAlta-BC, US.

The more restricted var. glabrum from the western United States lacks any bulblets.

2. L. parviflorum (Hooker) Nutt. -- Leaves palmatipartite. Flowers few, in a terminal raceme. Calyx more elongate, cuneate at base, elongating to 6-10 mm in fruit and becoming somewhat tubular. Petals white, mostly 5-lobed. Early summer. Moist montane prairies. -- swAlta-BC, US.

8. MITELLA L. MITREWORT, BISHOP'S CAP

Petals trifid to pectinately divided into filiform segments. Styles 2.

a. Petals digitately trifid, white ..... 4. M. trifida
aa. Petals pectinate.
b. Pedicels 1-2 mm long; petioles villous with long rufous hairs ..... 3. M. Breweri
bb. Longer; pubescence white.
c. Stamens 10; leaves broadly rounded at tip ..... 1. M. nuda
cc. Stamens 5; leaves obtuse at tip; larger plant .....2. M. pentandra

1. M. nuda L. -- Small delicate forest herb with yellowish-petals pectinately divided. Smaller, 1-(2) dm nigh. Leaves smaller, 1-3-(5) cm wide, suborbicular, deeply cordate, ± crenate. Stamens 10. Seeds black, small,but conspicuous on the cup-like fruit wall. Early summer. Common forest species. -- (K)-Mack-Y-(Aka), L-SPM, NS-BC, US, (Eur).

2. M. pentandra Hooker -- Stamens only 5 and opposite the greenish petals. Leaves broadly cordate, shallowly lobed, the lobes crenate. Summer. Wetter spots in montane and subalpine forests and meadows. -- Y-Aka, wAlta-BC, US.

3. M. Breweri Gray -- Much as in the preceeding, but the leaves broader and reniform and the stamens opposite the calyx lobes. Leaves merely crenate or sometimes weakly lobed. Mid summer. Wetter areas in the upper montane zone in Waterton. -- swAlta-BC, US.

4. M. trifida Graham (M. violacea Rydb.) -- Calyx lobes whitish and the trifid petals white. Stamens 5, opposite the calyx lobes. Leaves more like those of M. pentandra. First half of summer. Mountain springs and wet cliffs. -- (swAlta)-BC, US.

9. CONIMITELLA Rydb.

Differs from Mitella by its entire petals and almost completely inferior ovary.

1. C. Williamsii (D.C. Eaton) Rydb. -- Bracts petaloid, white and pink, 1-2 mm long and fimbriate. Herbage densely glandular-puberulent. Leaves reniform, all basal. Scape rather long, bearing only 5-10 subsessile flowers. Petals white, narrowly oblanceolate, 4-5 mm long including a claw nearly as long as the blade. Calyx lobes ± 1 mm long, petaloid, white and pink. Early summer. Rich montane forests: Crownest Forest. -- swAlta, wUS.

10. CHRYSOSPLENIUM L. GOLDEN SAXIFRAGE

Petals lacking. Carpels 2, united into a unilocular ovary, the two styles far removed to opposite sides of the ovary. Stamens marcescent and present even in fruit.

1. C. alternifolium L. var. tetrandrum (Th. Fries) Lund (C. americanum AA.; C. tetrandrum Th. Fries) --(Cresson doré, Cresson de roche) -- Small erect herb, usually less than 1 dm high, with reniform and crenate leaves. Most leaves and flowers clustered near the top of the plant. Sepals all alike, green, erect. Stamens 4, opposite the sepals. Early summer. Wet shaded places. -- (G)-F-K-(Mack-Y)-Aka, (L), Q-(O)-Man-BC, wUS, (Eur) -- Var. iowense (Rydb.) Boivin (C. iowense Rydb.) -- Sepals of two sizes, the outer ones somewhat wider. Sepals yellowish-green, recurved at tip. Stamens 5 to 8, the additional ones alternating with the sepals. -- swMack, sMan-sAlta, (ncUS, Eur).

Var. iowense is very close to var. sibiricum Ser., the main distinction of the latter being that the stamens are always in 8's.

11. PARNASSIA L. GRASS OF PARNASSUS

With 5 clusters of staminodia, each cluster borne on a flabellate base. Carpels 4. Herbs with entire leaves and a single terminal flower. Stem scapose or unifoliate.

a. Leaves reniform ..... 4. P. fimbriata
aa. Leaves ovate, longer than broad.
  b. Petals small, about as large and as long as the sepals ..... 1. P. Kotzebuei
  bb. Much larger, at least twice broader than the sepals.
    c. Stem leafless ..... 3. P. glauca
    cc. Stem unifoliate ..... 2. P. palustris

1. P. Kotzebuei Cham. var. Kotzebuei -- Smaller, usually around 1 dm high. Stem leafless. Flower small, the petals elliptic-lanceolate and about as long as the calyx lobes. Before mid summer. Wetter alpine and arctic meadows. -- (G-F)-K-Aka, L-NF, Q-(nO)-nMan-(nS)-Alta-BC, US, (Eur).

A dwarf var. pumila Hitchc. & Ownbey with much reduced staminodia has been described from a limited area in the Okanagan Valley.

2. P. palustris L. var. tenuis Wahl. (var. neogaea Fern.; P. multiseta (Led.) Fern.) -- Grass of Parnassus, White Buttercups (Fleur du Parnasse) -- Tufted herb, each stem bearing a single smaller, cordate and sessile leaf towards the lower third. Stem usually 2-4 dm high. Leaves ovate, broadly rounded to cordate at base. Petals about 1½ times as long as the sepals. Staminodia cluster typically with more than 10 segments. Mid to late summer. Wet meadows and marshy places. -- K-(Mack)-Y-Aka, (L-NF), Q-BC, US,(Eur) -- Var. montanensis (Fern. & Rydb.) C.L. Hitchc. (P. montanensis Rydb. & Fern.) -- Somewhat smaller. Petals only slightly longer than the calyx lobes. Staminodia with less than 10 segments. Not always clearly distinct. -- (Y), Alta-(seBC, US) -- Var. parviflora (DC.) Boivin (P. parviflora DC.) -- Still smaller. Typically 1-2 dm high. Stem

and basal leaves usually cuneate or rounded at base. Petals less than 1 cm long. Staminodia with less than 10 segments. -- (Mack-Aka, L)-NF, NS-PEI, Q-nMan-seBC, US.

The inclusion of P. montanensis in Saskatchewan lists by Russell 1954 and Breitung 1957 is credited to Raup 1936. However the latter gives only three localities, two of them, Calumet and Shelter Point, being in Alberta while Great Slave Lake is in Mackenzie District. There was no Saskatchewan sheet at GH in 1965.

3. P. glauca Raf. (P. americana Munl.; P. caroliniana AA.) -- Flowering Plantain -- Leaves all basal, broadly ovate to elliptic, rounded at base. Calyx lobes short, only 3-5 mm long. Petals 10-18 mm long, more than twice as long as the calyx lobes. Staminodia mostly with 3 coarse and reddish segments. Late summer. Wetter prairies. -- NF, NB-cS, US.

Canadian reports of the southern P. caroliniana Mx. are generally based on specimens of P. glauca, but Gardner's 1946 reports for Churchill and Labrador are undoubtedly based on something else still. The corresponding specimens could not be found at DAO or QFA in 1965 and 1966.

4. P. fimbriata Konig var. fimbriata -- Petals coarsely fimbriate on each side in the lower half. Leaves broader than long, reniform and deeply cordate. Stem leaf small, borne towards the middle. Mid summer. Brooksides and springs near timberline. -- (swMack)-Y-Aka, swAlta-BC, US.

The staminodia are short, stubby and not capitate in our variety, but they are longer, thinner and capitate in two other varieties from the western U.S.

Order 48. SARRACENIALES

Carnivorous and capturing insects in a variety of ways. A primitive type of flower with the parts mostly in 5's and free, except for the fused carpels.

a. Inflorescence a raceme ..... 88. Droseraceae
aa. Flower solitary ..... 89. Sarraceniaceae

88. DROSERACEAE (SUNDEW FAMILY)

Single genus with us. Styles 3-5. Insects trapped by hair-like processes.

1. DROSERA L. SUNDEW

Leaves covered with coarse hair-like processes, capitate, glutinous and in which the insects become trapped to be eventually digested. Herbs with the leaves all basal and flowers in a raceme borne on a scape.

a. Leaves linear, the limb ± 2 mm wide ..... 2. D. linearis
aa. Broader.
b. Leaves ± obdeltoid, slightly broader than long ..... 3. D. rotundifolia
bb. Leaves obovate to broadly oblanceolate... 1. D. anglica

1. D. anglica Hudson (D. intermedia AA.) -- Leaves 1-3 cm long, 2.5-4.0 mm wide, narrowly obovate to narrowly oblanceolate, elongating in age. Mid summer. Northern bogs, usually in wetter and pioneer habitats. -- Mack-Aka, L-NF, Q-BC, US, Eur, (Oc).

Sometimes treated as the hybrid of D. linearis X rotundifolia but the Canadian distribution of D. anglica extends much further north than that of D. linearis and the solution of hybridity does not seem very plausible.

2. D. linearis Goldie -- Leaves 2-4-(6) cm long, 2-(3) mm wide, long linear, erect. Mid summer. Bogs, rare. -- NF, Q-S-(Alta)-BC, US.

3. D. rotundifolia L. var. rotundifolia -- Dewgrass, Eyebright (Herbe à la goutte, Petit Saint-Sacrement) -- Leaves wider and more spreading, more or less obdeltoid to suborbicular, (5)-8-10-(12) mm wide and usually slightly wider than long. Early to mid summer. Sphagnum hummocks in bogs. -- G, seK-Aka, L-SPM, NS-BC, US, Eur.

89. SARRACENIACEAE PITCHER-PLANT FAMILY

Insects trapped in hollowed out petioles half-filled with digestive liquids. Stamens numerous. Style 1.

1. SARRACENIA L. SIDE-SADDLE FLOWER

Style unusually large, shaped like an umbrella, and wider than the ovary or fruit, which it covers.

1. S. purpurea L. var. purpurea -- Indian Pipe, Frog's Trousers (Sabot, Cochon de pelé) -- A single, large, drooping, deep red flower on a long scape, arising from a rosette of leaves half-buried in Sphagnum. These shaped like "horns of plenty", and half full of water. Sepals 2.5-4.0 cm long. First half of summer. Sphagnum bogs. -- L-SPM, NS-neAlta,US -- Var. ripicola Boivin -- More superficial, the rhizome very short or indistinct, the whole plant not buried in moss. Sepals shorter, 1.5-2.2 cm long. Wet terraces and shores, rare: Nipawin and Prince Albert. -- cO, cS.

The only Alberta collection seen was from Anzac (ALTA; DAO, photo). It is made up of 3 separate leaves only and its varietal determination remains tentative.

Order 49. UMBELLALES

Related to the Araliales. Carpels 2, maturing into a dry fruit which splits into a pair of achene-like fruits. Achenes borne on a central structure termed carpophore. Single family.

90. UMBELLIFERAE (PARSLEY FAMILY)

Flowers in umbels and the ovary inferior. Flowers 5-merous, the perianth parts free, but the sepals much reduced. Flowers typically unisexual. Generic characters in this family are often rather obscurely technical.

a. Flowers in blueish heads; foliage spinescent... 2. Eryngium
aa. Flowers in umbels.
b. Leaves digitately compound ..... 1. Sanicula
bb. Not digitate, although sometimes trifoliate.
c. Leaves divided progressively into numerous small and rather narrow ultimate segments ..... Group A
cc. Leaves simple or divided into fairly well defined leaflets.
d. Stem leaves simple to trifoliate ..... Group B
dd. Leaflets more numerous ..... Group C

Group A

Leaves deeply and progressively divided into many and rather narrow segments; leaflets not obvious or poorly defined.

a. Flowers mostly replaced by bulblets ..... 9. Cicuta
aa. Not bulbiferous.
b. Involucre of large and pectinately dissected bracts ..... 22. Daucus
bb. Bracts much smaller and little if at all dissected, or even lacking.
c. Umbell simple and few flowered ..... 3. Scandix
cc. Compound and the flowers very numerous.
d. Leaves all basal, or at least the lower pair opposite.
e. Fruit not winged, but finely tuberculate ..... 6. Musineon
ee. Fruit winged, not tuberculate.
f. Fruit winged along the marginal nerves only ..... 19. Lomatium
ff. Conspicuously winged along both the marginal and dorsal nerves ..... 18. Cymopterus
dd. Stem leaves all alternate, sometimes opposite in the inflorescence.
g. Segments very few (mostly 5), very narrow and very long.. 13. Perideridia
gg. Segments much more numerous and shorter.
h. Stem with irregularly scattered purple blotches.... 5. Conium
hh. Stem not maculate.
i. Native perennial; fruit very flat ..... 19. Lomatium
ii. Annual or biennial weeds; fruit slightly compressed.
j. Flowers white; the shorter pedicels shorter than the fruit ..... 11. Carum

jj. Yellowish-green; all pedicels many times as long as the fruit .. .. 15. Anethum

Group B

Leaves simple, entire or merely dentate to lobed or trifoliate, the leaflets rather broad.

a. Leaves entire ..... 7. Bupleurum
aa. Serrate to trifoliate.
b. Leaflets huge, at least 1 dm wide ..... 21. Heracleum
bb. Much smaller or the leaf simple.
c. Flowers yellow; primary rays of the umbel nearly uniform in length ..... 8. Zizia
cc. Flowers white; umbel rays very uneven ..... 10. Cryptotaenia

Group C

Leaves compound, the leaflets more than 3 and all or most of them discrete and well defined.

a. Leaves pinnate.
b. Leaflets ± linear ..... 14. Sium
bb. Leaflets ± oblong ..... 20. Pastinaca
aa. Leaves ternately divided.
c. Leaflets not serrate, but entire or with a few lobes.
d. Stem tall and leafy ..... 17. Levisticum
dd. Stem short, the leaves all basal or near basal ..... 19. Lomatium
cc. Finely to deeply serrate.
e. Fruit strongly flattened dorsally and winged ..... 16. Angelica
ee. Fruit slightly flattened laterally, wingless.
f. Leaves symetrically divided into (3) or 9 leaflets ..... 12. Aegopodium
ff. Central segment more divided than the lateral ones, the leaflets commonly 5 or 15 or 21, etc.
g. Fruit over 1 cm long, usually setose-strigose..... 4. Osmorhiza
gg. Fruit glabrous, much shorter.
h. Flowers yellow, the central pistillate one subsessile .... 8. Zizia
hh. White and all pedicelled .... 9. Cicuta

1. SANICULA L. SANICLE

Fruit catchy, being covered with numerous hooked prickles. Calyx nearly as large as the corolla.

1. S. marilandica L. (S. marylandica sphalm.) -- Snake-Root, Black Snake-Root -- Common deciduous forest species with digitate leaves. Leaflets 5, obovate to oblanceolate, sessile, serrate, the larger 2 often bifid to bipartite. Stem simple, the branching of the inflorescence tending to be opposite. Early summer. Nearly ubiquitous in deciduous woods. -- NF-SPM, NS-BC, US, (SA).

2. ERYNGIUM L.

Flowers in dense heads, much simulating a Composite. Fruit densely covered with membranous scales.

1. E. PLANUM L. -- (Herbe aux serpents) -- Stiff herb, bluish above. Foliage spiny-toothed. Leaves alternate, but the main branches of the inflorescence verticillate. Heads with a spinescent involucre. Flowers bluish. Mid summer. Casual escape from cultivation. -- Q-O, S-BC, (US, Eur).

3. SCANDIX L.

Body of the fruit prolonged into a much longer cylindrical beak.

1. S. PECTEN-VENERIS L. -- Venus' Comb, Lady's Comb (Peigne de Vénus, Aiguille de berger) -- Fruit longest, 4-7 cm long. Annual with the leaves finely dissected into very numerous and narrow segments. Umbels simple, of less than 10 flowers and subtended by an involucre of ± connate bracts. Flowers white. Fruit scabrous. Carpophore needle-like. Late spring to mid summer. Rare weed: Golburn. -- O, S, BC, US, (SA), Eur, (Afr, Oc).

4. OSMORHIZA Raf. SWEET CICELY

Except for one atypical species, fruit catchy by appressed and acicular hairs, especially numerous towards the base, the latter prolonged into a sharp and fairly long point.

a. Flowers yellowish or greenish; fruit glabrous ..... 1. O. occidentalis
aa. Flowers white or pink; fruit coarsely strigose.
b. Involucre and involucels lacking ..... 2. O. chilensis
bb. Involucre and involucels present ..... 3. O. aristata

1. O. occidentalis (Nutt.) Torrey -- Atypical, the blackish achenes linear, glabrous, and devoid of a sharp basal beak. Main leaves typically with 15 or 21 leaflets, the latter lanceolate to elliptic-lanceolate, puberulent. Involucre and involucels lacking. Fruit 12-18 mm long, longer than its pedicel. Late spring. Open woods and rocky slopes at lower altitudes. -- swAlta-seBC, wUS.

2. O. chilensis H. & A. var. chilensis (O. brevipes (C. & R.) Suksd.; O. divaricata (Britton) Suksd.) -- Usually with one

stem leaf below the inflorescence, of 9 leaflets, the latter triangular-lanceolate, serrate above, gradually more deeply cut below. Flowers white. Fruits (1.5)-2.0-(2.5) cm long, all or mostly longer than their pedicel, the latter 0.5-2.0 cm long and widely divergent. Early summer. Woods. -- sAka, NF, NS, NB-O, swS-BC, US, (SA) -- Var. purpurea (C. & R.) Boivin (O. purpurea (C. & R.) Suksd.) -- Flowers pink or at least with a pink center, rarely white. Fruit shorter, (0.8)-1.0-(1.5) cm, stubbier at tip, shorter than its pedicel. -- sAka, swAlta-BC, nwUS -- Var. cupressimontana Boivin (O. depauperate Phil.; O. obtusa (C. & R.) Fern.) -- Flowers white. Fruits not so short, ± 1.5 cm long, yet all or most of them shorter than their pedicel, the latter (1)-2-3 cm long. Stem usually leafless below the inflorescence, the lower leaf of the latter usually with 9 leaflets. -- seK, sAka, (sL-NF), NS, (NB)-Q-BC, US, (SA).

3. O. aristata (Thunb.) Mak. & Yabe var. brevistylis (DC.) Boivin (O. Claytonii (Mx.) C.B. Clarke) -- Sweet Jarvil -- Commonly with one stem leaf of ± 27 leaflets, the latter as in O. chilensis. Herbage villous. Flowers white. Pedicels mostly 0.5-1.0 cm in fruit. Fruit ± 1.5 cm long. Styles 0.5-2.0 mm long. Late spring. Poplar woods at Moon Lake in Riding Mountain -- NF, NS-sMan, US -- Var. longistylis (Torrey) Boivin (O. longistylis (Torrey) DC.). -- Anise-Root, Paregoric-Root -- Stem glabrous, the foliage glabrous to villous. Styles longer, 2.0-3.5 mm long. Oak bluffs and galerie-forests. -- NS, NB-Alta, US.

Reports of var. brevistylis (= O. Claytonii) from western Canada appear to be all based on specimens with the longer styles and lesser pubescence typical of var. longistylis. Except for the Riding Mountain and perhaps also for the Cypress Hill reports. The Macoun collection (QK; DAO, photo) from the Cypress Hills was typical indeed of var. brevistylis, but in the absence of later confirmation, we are inclined to suspect the possibility of mixed labels.

Our two varieties are not sharply disjunct morphologically and consequently a number of intermediate types based on unusual associations of diagnostic characters have been described and named. Specimens with styles of intermediate size are not uncommon and one is then left with pubescence as the only usable distinction. Further the asiatic O. aristata is more or less intermediate between our two types, the herbage being villous (as var. brevistylis) but the beak rather longish (like var. longistylis) or not infrequently intermediate in size. However, var. aristata is best distinguished by its commonly longer pedicels, these being 1-2-(3) cm long in fruit while they are usually about 0.5 cm long in our two american varieties, sometimes longer, but never averaging more than 1 cm on any plant.

The rank of variety seems most appropriate for these intergrading and morphologically overlapping taxa. The varietal rank also reflects most obviously their undeniable and very close affinity.

Var. brevistylis (DC.) stat. n., O. brevistylis DC., Prod. 4: 232. 1830; Urospermum aristatum (Thunb.) Ktze. var. brevistyle (DC) Ktze., Rev. Gen. 1: 270. 1891; Osmorhiza Claytonii (Mx.) C.B. Clarke.

Var. longistylis (Torrey) stat. n., Myrrnis longistylis Torrey, Fl. U.S. 310. 1824; Urospermum aristatum (Thunb.) Ktze. var. longistyle (Torrey) Ktze., Rev. Gen. 1: 270. 1891.

5. CONIUM L. POISON HEMLOCK

Ribs of the fruit proeminent and strongly sinuous. Carpophore not becoming bifid. Stylopodium very broad. Otherwise the fruit resembles Cicuta.

1. C. MACULATUM L. -- Poison Hemlock (Ciguë d'Europe) -- Stem sparsely to densely and irregularly purple-blotched. Leaves divided into very numerous small segments, the main ones alternate, becoming opposite in the inflorescence. Bracts of the involucre (and involucels) broadly margined, tending to be fused and usually reflexed. Early to mid summer. Established along roadsides at Maclean. -- NS, Q-O, S, swBC, US, Eur.

6. MUSINEON Raf.

Rather resembling Lomatium, but the fruits wingless and only slightly compressed laterally.

1. M. divaricatum (Pursh) Nutt. (var. Hookeri T. & G.; M. trachyspermum Nutt.) -- Conspicuous in early spring on dry hillsides, a low herb with an umbel of yellow flowers and at least one pair of opposite leaves. With a deeply buried taproot and much dissected leaves. Puberulent to scabrous, especially the stem and inflorescence. Up to 2 dm high. First half of spring. Hillsides. -- swMan-sAlta, US.

7. BUPLEURUM L. THOROUGH-WAX

Fruit resembling the preceeding but smooth and the stylopodium especially broad.

1. B. americanum C. & R. -- Leaves simple, entire, linear-lanceolate. Involucre and involucels rather large and conspicuous. Flowers pale yellow with the stylopodia forming a conspicuous brown center. Fruits (and ovary) strongly glaucous, rather bluish. Mid summer. Gravelly and rocky prairies: Waterton. -- nwMack-Aka, swAlta-seBC, nwUS.

The inclusion of B.C. in the distribution is based solely on a collection by Dawson at the head of the Kootenay River in 1871 (CAN). This has never been confirmed and we have also come to appreciate that the geographical data on Dawson's labels are accurate only within a rather broad margin of approximation. It could be that Dawson's collection came from the Alberta side.

8. ZIZIA W. D. J. Koch ALEXANDERS

Fruit slightly compressed laterally as in the last few genera, but the stylopodium wanting. Each umbellule of pistillate flowers shows a central flower sessile or nearly so.

a. Basal and lower leaves simple, the middle and upper trifoliate ..... 1. Z. aptera
aa. Basal and stem leaves biternate, with 9-11 leaflets ..... 2. Z. aurea

1. Z. aptera (Gray) Fern. (Z. cordata AA.) -- Alexanders -- A common yellow-flowered herb conspicuous in early summer in ditches and other wettish places. Basal and lower leaves cordate, crenately serrate. Leaflets ovate to lanceolate, serrate. Leaves thickish. Early summer. Chernozem prairies and wetter places. -- swY, swQ-BC, US.

The recent extension of range to Yukon by Boivin 1966 was based on L. Fournier, Haines Junction, 25 juillet 1958 (QFA; DAO, photo).

2. Z. aurea (L.) W.D.J. Koch (Thaspium barbinode AA.) -- Golden Alexanders, Meadow-Parsnip -- Similar, the leaves thinner and more divided, mostly with 9 or 11 leaflets. Often taller, 5-10 dm high. Leaflets rhomboid to lanceolate, serrate. Early summer. Galerie-forests, Oak islands and low chernozems. -- NS, NB-sMan, US.

Despite numerous Saskatchewan reports of Z. aurea, all of the 4 or 5 collections found under that name in various herbaria turned out to belong to Z. aptera. All Manitoba specimens under Thaspium barbinode (Mx.) Nutt. at CAN and DAO also proved to be Z. aurea.

9. CICUTA L. WATER-HEMLOCK

A middling type with small, slightly compressed and wingless fruit. Flowers white. Involucre much reduced or absent. Base of stem slightly bulbous and fistulous with numerous cross-plates. Very poisonous plants.

a. Flowers mostly replaced by clusters of bulblets ..... 1. C. bulbifera
aa. Not bulbiferous.
b. Fruit depressed globose ..... 2. C. mackenzieana
bb. Ovoid; leaflets broader ..... 3. C. maculata

1. C. bulbifera L. -- A rather sparse herb with at least one terminal white umbel and numerous bulblets scattered along the branches. Annual or perennial, 5-12 dm high. Foliage dissected to filiform segments, about 1 mm wide and entire or sometimes very remotely serrate. Fruit infrequent, suborbicular, about 1.5 mm long and about as wide. Second half of summer. Swampy ground or snores. -- sMack, L-NF, NS-BC, US.

2. C. mackenzieana Raup -- Like a narrow-leaved form of the following. Tuberous roots poorly developed or lacking.

Rather thick-stemmed for its sparse foliage and tending to be fastigiate in habit. Leaflets linear-elongate, about 10-15 times as long as broad, usually less than 5 mm wide. Fruit broadly orbicular, 2.0-2.5 mm long, as wide or wider than long. Mid summer. Marshes and bogs northward; mainly subarctic in distribution. -- Mack-Aka, wcQ-neBC.

3. C. maculata L. var. angustifolia Hooker (C. Douglasii AA.; C. occidentalis Greene) -- Cowbane, Beaver-Poison (Carotte à Moreau) -- A tall herb with flattish, white umbels, conspicuous around most sloughs just before mid summer. Some of the rootlets tuberous; base of the stem enlarging, becoming fleshy and tuberous towards the end of the season. Commonly about 1 m high. Leaflets narrowly lanceolate, (0.5)-1.0-(1.5) cm wide, about 4-6 times as long as wide, most of the lateral nerves ending at the bottom of the sinuses. Fruit 2.5-3.0 mm wide and somewhat narrower. Mid summer of somewhat earlier. Open marshy places. -- swMack-sY, wQ-neBC, US -- Var. maculata -- Leaflets broader, 1-3 cm wide, ovate to lanceolate, 2-4 times as long as large. Fruit a bit longer, 3-4 mm long. Prairie Côteau at Notre-Dame-de-Lourdes. -- NS-sMan, (eUS).

10. CRYPTOTAENIA DC. HONEWORT

Fruit elongate as in Osmorhiza, but glabrous and not prolonged into a sharp point at base. Involucre lacking.

1. C. canadensis (L.) DC. var. canadensis -- Honewort (Cerfeuil sauvage) -- Leaves trifoliate, the leaflets doubly serrate. Inflorescence vaguely paniculate. Flowers white. Pedicels very conspicuously uneven in length. First half of summer. Rare in alluvial woods: Portage, Morden. -- NB-sMan, US, (Eur).

The Far Eastern var. japonica (Hassk.) Makino has more open umbels subtended by better developed involucres and involucels, each of 2-5 bractlets.

11. CARUM L. CARAWAY

Closely related to the preceeding. Involucre typically of a single bract which is often lobed. Fruit slightly compressed laterally.

1. C. CARVI L. -- Caraway (Anis, Anis bâtard) -- Leaves pinnately dissected into numerous small and linear segments. Annual. Terminal umbel usually overtopped by the lateral ones by fruiting time. Flowers white. First half of summer. Often cultivated and a casual escape to roadsides, shores, shelterbelts, etc. -- G, NF-(SPM), NS-Q-(O)-Man-Alta-(BC), US, Eur -- F. RHODOCHRANTHUM A.H. Moore -- Flowers pink. Infrequent. -- NS, Q, Man-Alta.

12. AEGOPODIUM L.

Fruit without oil tubes, merely dark green between the thin nerves.

1. A. PODOGRARIA L. -- Goutweed, Ground-Elder (Herbe aux goutteux, Petite Angélique) -- Main leaves with 9 leaflets, the lateral ones strongly asymetrical. Stoloniferous perennial. Leaflets ovate to oblong, often broadly margined in white. Flowers white. Styles rather long, pendent in fruit. Early summer. Cultivated and sometimes spreading out of control: Morden. -- NF, NS, NB-sMan, BC, neUS, Eur.

13. PERIDERIDIA **Reichenbach** SQUAW-ROOT

A segregate of Carum, perhaps mainly based on habit.

1. P. Gairdneri (H. & A.) Mathias (Atenia montana (Blank.) Rydb.) -- Squaw-Root -- Foliage unusually sparse; main leaves about 1 dm long and divided into a few (mostly 5-7) remote leaflets, these very narrow, 1-(3) mm wide, very long, and usually deciduous by fruiting time. Perennial from a cluster of tuberous roots. Flowers white. Mid summer. Submontane prairies, mainly in draws and around bluffs. -- swS-BC, US.

14. SIUM L. WATER-PARSNIP

Leaves pinnate, otherwise much as in Cicuta.

1. S. suave Walter (S. cicutifolium Schrank) -- Leaves pinnate; otherwise quite similar to Cicuta maculata with which it often grows. Reputedly perennial. Leaflets linear, 1 cm wide or less, finely dissected when submerged. Involucre of numerous lanceolate and reflexed bracts. Flowers white. All summer. Common around sloughs and on marshy shores. -- sMack, (Aka), NF, NS-BC, (US, Eur).

15. ANETHUM L.

In this and the following genera the fruit is dorsally compressed, hence each achene is as wide as the whole fruit. Fruit strongly flattened and narrowly winged marginally. Involucre and involucels lacking.

1. A. GRAVEOLENS L. -- Dill (Fenouil, Aneth) -- Stem pale, finely striate longitudinally in white and green. Resembles Carum Carvi, but the flowers yellow and the pedicels nearly uniform in length. Annual. Leaves finely divided into linear to filiform segments. Inflorescence most often becoming glandular-punctate first in deep green, then in black. Mid to late summer. Waste places. -- Q-Alta, US, Eur.

16. ANGELICA L. ANGELICA

Fruit as in Anethum; leaflets broad and distinct; flowers usually white. Involucre usually lacking. Involucels small.

a. Flowers yellow; involucral bracts about as long as the peduncles ..... 3. A. Dawsonii
aa. Flowers white to pinkish; involucre lacking.

b. Leaf rachis straight, its branches ascending ..... 2. A. arguta
bb. Leaf rachis geniculate, its branches widely spreading to reflexed ..... 1. A. genuflexa

1. A. genuflexa Nutt. var. genuflexa -- Primary divisions of the leaf rachis about equally spreading from the petiole and more or less radiating from its tip. Coarse perennial often 1 m tall. Involucels of filiform bracts nearly as long as the pedicels. Inflorescence densely puberulent, but the fruit becoming nearly glabrous, with a deep green centre and whitish wings. Mid summer. Low spots in semi-open forest. -- (sAka), cAlta-BC, (wUS).

Stem glabrous and the leaflets eciliate. Involucels shorter than the pedicels. In the Far Eastern vicariant var. multinervis (Koïdz.) Hiroë (including A. refracta F. Schmidt) the stem is puberulent above, the leaflets ciliate and the involucel longer than the pedicels.

2. A. arguta Nutt. (A. Lyallii Watson) -- Resembles the above, but quite glabrous and slightly glaucous, or slightly scabrous. Subterminal leaflets often proximally adnate in the manner of the following. Involucels lacking or much reduced. Mid summer. Mountane forests, rare: Rockies. -- swAlta-seBC, wUS.

3. A. Dawsonii Watson -- Mountain-Parsnip -- Involucre conspicuous, of bracts mostly 2-3 cm long, their margins laciniate and their base ± petiolate. Less than 1 m nigh and glabrous. Leaflets 9-15, the intermediate ones often sessile and cuneate on the distal side, broadly adnate to the rachis on the proximal side. Umbel solitary, on a rather elongate peduncle 2-4 dm long. Late spring. Rare in wettish montane woods: Waterton. -- swAlta-seBC, (nwUS).

17. LEVISTICUM Hill

Fruit as in Anethum; leaflets broad and distinct; flowers yellow. Involucre present.

1. L. OFFICINALE W.D.J. Koch -- Lovage (Herbe à cochons, Céleri bâtard) -- Leaflets lanceolate and entire to rhomboid and few-toothed or few-lobed towards the middle. Coarse perennial about 1 m high. Involucre of broadly membranous bracts. Involucels of broadly membranous and fused bractlets. Early summer. Sometimes planted and long persisting to slowly spreading around abandoned homesteads: Langham. -- NS, Q-O, S, (US), Eur.

18. CYMOPTERUS Raf.

Each achene with 4 broad wings, otherwise similar to Lomatium.

1. C. acaulis (Pursh) Raf. (Cymopteris acaulis sphalm.)-- Low herb with habit of Musineon and Lomatium, but the leaves all basal, the inflorescence more congested, the flowers white and the fruits with more wings. Perennial with a deeply buried fleshy taproot connected to the rosette by a thin and fragile pseudoscape. Leaves much dissected into linear lobes. Inflorescence congested, ± puberulent. Involucre lacking. Involucels palmatifid, the tips of the lobes overtopping the white to pinkish flowers. Pedicels of the pistillate flowers very short, shorter than the ovary and partly adnate to the involucel. Early to mid spring. Dry hills, mainly along the major coulées. -- swMan-sAlta, US.

Previous reports of Cymopterus montanus (Nutt.) T. & G. were discussed by Scoggan 1957. The only herbarium sheet located was N. Criddle 1033, Aweme, prairie sèche, 24 mai 1909 (MT; DAO, photo) and it turned out to be the rare Lomatium orientale.

19. LOMATIUM Raf.

Rather polymorphic. Typically low herbs with a taproot, the fruit dorsally flattened and winged around the edge. No involucre. Fruit nearly always at least as long as its pedicel.

a. Leaf divided into well defined leaflets...7. L. triternatum
aa. Leaf finely divided into numerous small ultimate segments.
  b. Ovary and fruit densely puberulent.
    c. Involucel simple and palmately lobed .. .. 2. L. foeniculaceum
    cc. Involucel of several free and slender bractlets ..... 5. L. Sandbergii
  bb. Glabrous.
    d. Bractlets broadly oblanceolate ..... 1. L. Coüs
    dd. Narrowly lanceolate, broadest nearer the base.
      e. Stem glabrous ..... 6. L. dissectum
      ee. Densely puberulent.
        f. Stem with at least one pair of opposite leaves near the base .. .. 4. L. macrocarpum
        ff. Stem with a single leaf in the lower half, or sometimes the leaves more numerous and alternate, rarely all basal ..... 3. L. orientale

1. L. Coüs (Watson) C. & R. (L. montanum C. & R.) -- Cous (Cahous)-- Taproot with a subglobular enlargement. Commmonly glabrous. Leaves usually all basal. Flowers yellow. Primary branches of the inflorescence few and very uneven in fruit. Early spring. Dry hillsides, rare: Cypress Hills. -- swS, nwUS.

2. L. foeniculaceum (Nutt.) C. & R. var. foeniculaceum (L. daucifolium AA.; L. villosum Raf.; Cogswellia villosa (Raf.) Schultes) -- (Racine biscuit) -- Short villous throughout. Leaves all basal very finely divided, about quadripinnatipartite into very numerous and narrow ultimate segments. Scape about 1 dm nigh. Bractlets fused into a strongly asymetrical involucel, the latter peltate, palmatilobed and broadly membranous along the edges. Flowers yellow. Early to mid spring. Dry hills along major coulées. -- swMan-sAlta-(neBC), US.

There are a number of more southern varieties such as var. fimbriatum (Theobald) stat. n., ssp. fimbriatum Theobald, Brittonia 18: 15, 1966, with pubescent petals. Also var. inyoense (Math. & Const.) stat. n., L. inyoense Math. & Const., El Aliso 3: 120, 1955 in which the umbels are reduced to a single pedicel.

3. L. orientale C.& R. (Cogswellia orientalis (C. & R.) M.E. Jones) -- Quite similar to the above, the leaves not quite so deeply divided, the herbage puberulent, but the pedicels and fruit glabrous. Stem nearly always bearing one leaf in the lower half. Flowers white. Early spring. Steppes on the bluffs of the Souris, rare: Minto, Aweme, Bienfait. -- swMan-seS, US.

Peucedanum nudicaule (Pursh) Nutt. as used by older authors and, presumably, by Macoun 1890, usually refers to specimens of Lomatium orientale.

4. L. macrocarpum (H. & A.) C. & R. var. macrocarpum (Cogswellia macrocarpa (H. & A.) M.E. Jones) -- The stout stem typically bearing one pair of opposite leaves near the base. Stem 1-3 dm high. Herbage lightly to densely villous tomentose. Bractlets fused near the base. Flowers white. Fruit largest, narrowly oblong, 8-13 mm long. Spring. Steppes and hillsides, mainly along coulées. -- swMan-BC, US.

The more southern var. ellipticum (T.& G.) Jepson has longer peduncles and fruits.

5. L. Sandbergii C. & R. -- Resembles L. foeniculaceum but merely scabrous puberulent and the leaves smaller, the limb 5 cm long or less. Stem more or less clearly leafy near the base, the leaves alternate. Flowers yellow. Bractlets free, few, narrowly elongate, the larger ones often digitate at tip. Mid summer. Shale slides above timberline. Waterton. -- swAlta-seBC, nwUS.

6. L. dissectum (Nutt.) Math. & Const. var. multifidum (Nutt.) Math. & Const. (Leptotaenia multifida Nutt.) -- Tallest, 6-15 dm high and the leaves most divided, tripinnate to quadripinnate with the segments pinnatifid to bipinnatipartite. Stem leafy, the leaves alternate, puberulent below, much less densely so to glabrous above, the plant otherwise glabrous or nearly so. Involucels strongly reflexed. Flowers yellow or purplish. Fruit elliptic, 1 cm long or less, nearly sessile or at least longer than its pedicel. (Early spring?). Sheltered montane prairies. -- swS-swAlta-sBC, nwUS.

In the more western typical phase the leaf is less finely dissected, the ultimate segments often over 2 mm wide, and the fruit is always subsessile.

7. L. triternatum (Pursh) C. & R. var. triternatum (L. nudicaule AA.; L. simplex AA., var. leptophyllum (Hooker) Mathias) -- With (3)-9-15-(35) distinct leaflets, entire, narrowly lanceolate to long linear. Stem leafless, thickened below the umbel. At least the stem, and usually the whole plant including the fruits, finely puberulent. Flowers yellow. Late spring to early summer. Low ground in regions of steppe. -- sAlta-sBC, nwUS.

The more western var. platycarpum (Torrey) Boivin is known in Canada only from the Okanagan valley. It has a larger fruit, the wings being about as wide as the body, and a less variable leaf, the narrowly linear leaflets being nearly always 9-15 in number.

Despite many Alberta reports of L. nudicaule (Pursh) C. &R., only one collection was found under that name: A.H. Brinkman 3005, near Beaver Creek, June 4, 1928 (NY; DAO, photo). It turned out to be L. triternatum.

20. PASTINACA L. PARSNIP

Fruit flattened and marginally winged in the manner of Lomatium. Involucre and involucels lacking.

1. P. SATIVA L. -- Parsnip (Panais sauvage) -- Leaves pinnately divided into a few broad leaflets. Strongly scented herb. Stem 1-2 m high, fistulose, polygonal rather than cylindric. Leaflets irregularly serrate, toothed and lobed. Flowers yellow. Mid summer. Cultivated and occasionally escaped, sometimes in great abundance. -- Y-Aka, NF-SPM, NS-BC, US, Eur.

21. HERACLEUM L. COW-PARSNIP

Peripheral flowers larger; the petals bifid. Fruit similar to Lomatium.

1. H. lanatum Mx. -- Wild Parsnip, Cow-Parsnip (Cigüe) -- Leaves trifoliate, the huge leaflets 1-4 dm wide. A huge herb in many ways, leaves, stem, umbels, etc. Biennial, 1-2 m high, the herbage copiously villous. Flowers white. Early summer. Wetter woods, usually semi-open, and frequently in the peripheral shrubbery. -- seK-Aka, L-SPM, NS-BC, nUS, (eEur).

22. DAUCUS L. CARROT

Fruit densely covered with bristles borne in rows along the nerves of the achene. Peripheral flowers larger and irregular.

1. D. CAROTA L. -- Wild Carrot, Queen-Anne's Lace (Carotte sauvage) -- Umbel with a conspicuous involucre of bracts about as long as the rays and pectinately dissected. Coarsely hirsute biennial with finely dissected leaves. Umbels strikingly contracted after flowering and until the maturity of the fruits. Flowers white, the central one often pinkish. Mid summer. Wild progenitor of the cultivated carrot, occuring with us only as a rare roadside weed: Brandon, Indian Head. --

L, NS-S, BC, US, Eur.

Foeniculum vulgare Miller was mentioned for Colinton, Alberta, by Groh 1947, but there is no corresponding specimen under that name at DAO and in 1950 Groh now mentions the species only for B.C. Presumably the original sheet was in the interval revised to something else.

REVIEW

Otto & Isa Degener

Bernhard Zepernick of Berlin, Germany, in Baessler-Arch. Beitr. Völkerk. Bd. 15: 329-365. 1967, deals with "Bemerkungen zur Färberei der Polynesier" or, roughly translated, "Remarks about Polynesian Dye Plants". The article deals with about 100 species, giving their correct scientific names (without authorities) and indicating when necessary the synonyms used by about 60 authors in over 90 articles. The commonest dyes are gained from Curcuma longa, Aleurites moluccana and Morinda citrifolia. The author describes the plants used for certain dyes (blue and green are rare), in what island groups they are used, on what materials, and their vernacular names. The reviewers wish to alert the reader that Solanum nigrum was native in Polynesia long before the coming of the Caucasian explorers, and that Ricinus communis is a common, naturalized weed. Two endemic species of Rubus exist in the Hawaiian Islands and hence the name of one should not be a synonym of the other. Mr. Zepernick, with aid of five tables, has given us in less than 50 pages what the usual author might give us in a booklet of 150 or more. The study is of general interest to botanists as well as anthropologists dealing with the islands of the Pacific.

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NOTES ON NEW AND NOTEWORTHY PLANTS. L

Harold N. Moldenke

CITHAREXYLUM HIRTELLUM var. GUATEMALENSE Moldenke, var. nov.

Haec varietas a forma typica speciei laminis foliorum subtus in reticulo venulorum parcissime setulosis recedit.

This variety differs from the typical form of the species in having the vein and veinlet reticulation on the lower leaf-surface very sparsely setulose with whitish, stiff, straight, unbranched, sharp-pointed, spreading hairs, and the lamina itself glabrate.

The type of the variety was collected by Julian Alfred Steyermark (no. 41818) along the Río Yameja, at about 50 meters altitude, Cerro San Gil, Izabal, Guatemala, on December 24, 1941, and is deposited in the Britton Herbarium at the New York Botanical Garden.

LYSIMACHIA QUADRIFOLIA f. RUBESCENS Moldenke, f. nov.

Haec forma a forma typica speciei caulibus foliisque in statu

juvenile plusminusve rubris recedit.

This form differs from the typical form of the species in having the upper portions of its stems and all the upper leaves, or sometimes the entire plant, red when young.

The type of the form was collected by Alma Lance Moldenke and Harold Norman Moldenke (no. 24355) on an open roadbank at Moose Meadow, Tolland County, Connecticut, on May 31, 1968, and is deposited in the herbarium of the Botanisk Institut at Aarhus Universitet, Aarhus, Denmark. This form sometimes grows in very extensive purestand colonies, while at other times it is interspersed with the typical green form of the species in precisely the same environmental conditions of soil, drainage, exposure to sunlight, etc. The type where the entire plant is red from top to base was not collected, but occurred in purestand colonies on roadbanks only a few miles from where the type specimens were gathered.

There is another form of the species known, L. quadrifolia f. variegata (Peck) House, in which the tips of the petals are orange. It is described in Bull. N. Y. State Mus. 47: 157 (1894) and 254: 559 (1924).

PRIVA LAPPULACEA f. ALBIFLORA Moldenke, f. nov.

Haec forma a forma typica speciei corollis albis recedit.

This form differs from the typical form of the species in having white corollas.

The type of the form was collected by Walter H. Lewis, Jr., John Duncan Dwyer, T. S. Elias, and K. R. Robertson (no. 926) at the edge of a river and adjacent rainforest and railway, Changuinola to 5 miles south at the junction of Río Changuinola and Río Terebe, at an altitude of 100 to 200 feet, Bocas del Toro, Panama, between December 17 and 19, 1966, and is deposited in the herbarium of the Missouri Botanical Garden at St. Louis.

SVIDA CONTROVERSA (Hemsl.) Moldenke, comb. nov.

Cornus controversa Hemsl. in Curtis, Bot. Mag. 135 [ser. 4, 5]: pl. 8261. 1909; Kew Bull. Misc. Inf. 1909: 331. 1909.

XYLOSTEON MORROWI (A. Gray) Moldenke, comb. nov.

Lonicera morrowi A. Gray in Perry, Narr. Exped. Chin. Jap. 2: 313. 1856.

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ADDITIONAL NOTES ON THE GENUS VITEX. IX

Harold N. Moldenke

VITEX TRIFOLIA var. SIMPLICIFOLIA Cham.

Additional bibliography: Moldenke, Phytologia 17: 11--13, 45,

47, 50, & 54--56. 1968.

Van Steenis (1957) prefers to regard this plant as a subspecies, which he calls V. trifolia subsp. litoralis. He comments that the plant was considered as a valid species by Thunberg and by Blanco, later as a variety by Chamisso, Schauer, Makino, Ridley, and Bentham. "This evaluation as a variety has been maintained by later monographers (Lam & Bakhuizen van den Brink, Merrill, and Moldenke). Backer....., Corner....., and following him Backer & Meeuse.....have again treated it as a good, distinct species. And Corner has taken great pains to give arguments for this view. Contrary to Ridley.....who suggested to have seen it change into normal V. trifolia after transplantation to Singapore, Corner maintains that it maintains its habit and characters in cultivation and is no mere phenotype. He transplanted ten specimens to the Botanic Gardens, Singapore, where he also had living shrubs of V. trifolia and V. negundo, and has found that they retain their habit. As to the constancy of that character there remains hence little doubt, though additional experiments in raising inland plants from seed of the prostrate form and crossing it with V. trifolia are still a desideratum. In addition Corner assumes to have found differences with V. trifolia in the corolla, fruiting calyx, and the fruit. I have tried to verify these differences with many sheets preserved at Leyden but I cannot corroborate these statements. The fruits of V. trifolia and V. ovata offer no differences in size, shape, and internal tissue structure. That the inflorescences of V. ovata are smaller than the average size in V. trifolia I deem not significant, as they are borne on small side-branches. The only characteristics holding are vegetative in nature, viz the typical prostrate, rooting, runner-like branches, and the obovate, small, simple leaves, and geographic: its exclusive growth on the sandy beach."

Ohwi (1965) gives the distribution of the variety as "Honshu, Shikoku, Kyushu. — Korea, Bonins, Ryukyus, Formosa to se. Asia, Pacific Islands, and Australia." Bryan says that on Johnston Island it was "planted by man or introduced by some other means since 1923". Taniguti (1963) records it from Hemizima Island, Japan, while Hatusima (1962) records it from the Amami Islands in the Ryukyu Archipelago.

Nobuhara (1967) tells us that "The shorter the distance to the coast line, the less the cover of Canavalia and the more, to some extent, that of Vitex rotundifolia expands." Nobuhara, Okada, & Fujihira (1962) report that our plant has average tolerability toward salt spray from typhoons. Wilson found is common on Quelpart Island, while Chiao refers to it as a "rare bush along seashore" in Shantung and Ching describes it as "a low dense sand-binding shrubby perennial herb on active sand, up to 1 1/2 ft. tall" in Chekiang.

A letter to me from Berta Čerin, dated April 29, 1962, announces that she plans to study the chemical constituents of this plant.

Additional vernacular names recorded for the plant are "hái-po-

kiu", "hamagō", "hamagō", "hama-gō" ["hama" = the sea], "hama-sikimi", "kolokolo-kahakai", "mosquito sage", "peh-po-kiu", "pohinahina", "polinalina", "simple-leaf chaste-tree", "simple-leaf shrub chaste-tree", and "taiwan-hamagō".

The Lam (1924) reference given in the bibliography of this plant is often dated "1925", but the latter date is merely the title-page date for the volume; the page involved actually was issued in 1924. Van Steenis (1957) gives the date of publication of Bentham's name (1870) for this taxon as "1876". Hara (1948) cites Merrill's Enum. Philip. Pl. (1923) as page "347" in error. The Hooker & Arnott (1836) references in the bibliography and list of illustrations listed previously are sometimes dated "1841" but pages 193 to 288 and plates 40 to 59 of this work were actually issued in 1836.

Lam (1924) cites Kotara s.n. from the Bonin Islands and Koch s.n. from Dutch New Guinea. Hatusima (1966) cites his no. 28565 and gives the general distribution of the variety as "Japan to Malaysia, Australia and Polynesia". Li (1963) cites Faurie 452 & 1169, Gressitt 523, A. Henry s.n., Oldham 382, Owatari s.n., Price 494 & 650, Takenouchi s.n., E. H. Wilson 10978, and Yamamoto s.n. from Formosa. Miquel (1870) cites Oldham 1 [specimen?], Bürger 7 [specimens?], Keiske 1, Maximowicz 1, and Siebold 3.

The A. Henry 12302 and Saint John & Fosberg 16976, distributed as this variety, are actually var. subtrisecta (Kuntze) Moldenke. On the other hand, many collections of var. simplicifolia have been distributed in herbaria as typical V. trifolia L.

Additional citations: CHINA: Chekiang: Chiao 1445 [Herb. Univ. Nanking 14644] (Bi, W—1427017); R. C. Ching 1967 (W—1246828). Shantung: Chiao 2774 (W—1596234). CHINESE COASTAL ISLANDS: Hainan: Fung 20500 (Mi); Liang 62926 (W—1670956). Lantau: McClure s.n. [Herb. Lingnan Univ. 13095] (W—129810); Taam 1702 (W—2244609); Tsang s.n. [Herb. Lingnan Univ. 16649] (W—1249810). HONGKONG: Bodinier 679 (W—2497124); C. Wright s.n. [Hong Kong] (W—44911). THAILAND: Larsen, Smitinand, & Warncke 1246 (Ac, Rf). INDOCHINA: Tonkin: Pételot 317 (W—1716990). KOREA: R. K. Smith s.n. [Aug. 23, 1932] (Bi); Mrs. R. K. Smith s.n. [8-10-31] (W—1757013). KOREAN COASTAL ISLANDS: Quelpart: In-cho 1124 (Mi, S); E. H. Wilson 9392 (W—1054188). WESTERN PACIFIC ISLANDS: JAPAN: Anashima: Koidzumi s.n. [5.8.1922] (Mi). Honshiu: Collector undetermined 364 (W—73901), s.n. [Sagami, 17 Juli 1910] (W—1133035); Ichikawa 200661 [122] (W—1347414); Kirono 762 (S, W—2336304); Maruyama & Okamoto 1600 (W—2315764); Maximowicz 90 (W—73900); Sasaki & Tagasi 606 (Mi, W—2156562); Savatier s.n. [Yokaska] (W—2497127). Kiushiu: Hurusawa 202 (W—2038128); Takenouchi 1728 (W—1271675). Shikoku: Collector undetermined s.n. [Susaki, Tosa, Aug. 16, 1892] (W—206183). FORMOSA: Gressitt 523 (N); A. Henry s.n. [Takow] (W—455205); Takenouchi s.n. [Aug. 5,

1940] (W--2063401); E. H. Wilson 10978 (W--1052371). PHILIPPINE ISLANDS: Luzon: Haenke s.n. [Luzon, 1792] (Bi). Mindoro: H. H. Bartlett 13708, in part (Mi). Sibuyan: Elmer 12135 (Bi). BONIN ISLANDS: Anijima: Kondo 115 (Bi). Chichijima: Kondo 33 (Bi). Imajima: H. L. Porter 3 (Mi). Island undetermined: C. Wright s. n. [Bonin Islands] (W--73896). VOLCANO ISLANDS: Iwojima: H. L. Porter 3 (W--1944269). MELANESIA: NEW HEBRIDES: Aneityum: Kajewski 690 (Bi). AUSTRALIAN REGION: AUSTRALIA: Queensland: Brass 1919 (Bi). POLYNESIA: HAWAIIAN ISLANDS: Hawaii: A. F. Judd s.n. (Bi). Kauai: F. R. Fosberg 12734 (Bi, Bi); A. A. Heller 2731 (Bi, Ms--30950); Saint John, Hosaka, Hume, Inafuku, Lindsay, Masuhara, Mitchell, & Wong 10841 (Bi); C. Skottsberg 1059 (Bi). Lanai: G. C. Munro 90 (Bi), 122 (Bi), s.n. [Kaena Point, 12/2/ 15] (Bi). Maui: Topping s.n. [O. Degener 9504] (Bi, Lb--15779, Mi). Molokai: O. Degener 9506 (Bi, Mi), 9507 (Bi). Niihau: Handy s.n. [Aug. 14, 1931] (Bi); J. F. G. Stokes s.n. [Kiekie] (Bi). Oahu: O. Degener 10018 (Bi, Mi), 11245 (Bi), 11247 (Bi); F. R. Fosberg 8881 (Bi), 10360 (Bi), 13148 (Bi, Bi), 14184 (Bi); J. A. Harris C.242140 (Bi), C.242201 (Bi); Hathaway & Caindec 139 (Bi); Meebold s.n. [Paumalu, May 1932] (Bi); H. N. Moldenke 21808 (Bi, Ca, Fg, Mi); J. W. Moore s.n. [July 14, 1929] (Bi, Bi); J. F. Rock 43 (Bi, Bi); J. F. G. Stokes s.n. [Alaopapa, June 1-2, 1920] (Bi); Topping 3012 (Bi); M. M. Townsend s.n. [Oct. 20, 1940] (Mi); D. P. Wilder s.n. [Leilehua Plain, 1912] (Bi). Island undetermined: O. Degener 11246 (Bi); C. N. Forbes s.n. (Bi); Hillebrand & Lydgate s.n. (Bi); G. P. Wilder s.n. [1913] (Bi). CULTIVATED: Johnston Island: E. H. Bryan s.n. [August 30, 1944] (Bi).

VITEX TRIFOLIA var. SIMPLICIFOLIA f. ALBIFLORA (Y. Matsumura) Moldenke

Additional bibliography: Moldenke, Phytologia 6: 197. 1958; Moldenke, Résumé 173, 388, & 479. 1959.

VITEX TRIFOLIA var. SUBTRISECTA (Kuntze) Moldenke

Additional bibliography: Warb. in Engl., Bot. Jahrb. 13: 429. 1891; Kuntze, Rev. Gen. Pl. 2: 510 & 511. 1891; Mak., Ill. Fl. Nipp. 186. 1940; Moldenke, Phytologia 3: 178. 1949; Moldenke in Humbert, Fl. Madag. 174: 72, 82, & 273. 1956; Moldenke, Phytologia 8: 88--90. 1961; Moldenke, Biol. Abstr. 37: 1062. 1962; Hocking, Excerpt. Bot. A.6: 534. 1963; Neal, In Gard. Hawaii, ed. 2, 727 & 728. 1965.

It is worth recording here that Makino's original Japanese description of his var. heterophylla has been rendered in Latin by Hara (1948) as "Folia aut simplicia aut tripartita". The corolla is described as "purple" on M. S. Clemens 11067bis and on Native collector DI.149 [Herb. Roy. Forest Dept. 3567], "reddish-

purple" on S. K. Lau 270, and "blue" on Rock 7838. Rock refers to the plant as a "common shrub along banks" in the Southeastern Shan States of Burma; it is also said to be common on the plains in Thailand, where the bark and roots are employed as a febrifuge and where the plant is known as "phi-suae". The plant has also been collected in sandy areas behind the beach on outer sandhills in Thailand, at 3000 feet altitude in New Guinea, and between 3000 and 4000 feet altitude in Yünnan! It has been collected in anthesis in February and June.

R. K. Godfrey 59186 bears a notation "locally naturalized in sandy lots" in Pinellas County, Florida. P. O. Schallert 23077 is var. variegata Moldenke in most herbaria, but the specimen of this number preserved in the Berlin herbarium shows no variegation, although the leaf-edges are irregularly turned over, which may be an indication of variegation.

Additional citations: FLORIDA: Pinellas Co.: R. K. Godfrey 59186 (Hi—154718). BURMA: Shan States: J. F. C. Rock 2325 (W—1214807). CHINA: Yünnan: A. Henry 12302 (W—459013); J. F. C. Rock 2669a (W—1214891), 2969 (W—1213252), 7838 (W—1332140). CHINESE COASTAL ISLANDS: Hainan: S. K. Lau 270 (W—1629142). THAILAND: Larsen, Smitinand, & Warncke 1321 (Ac, Rf); Native collector DI.149 [Herb. Roy. Forest Dept. 3567] (W—2064795). WESTERN PACIFIC ISLANDS: RYUKYU ARCHIPELAGO: OKINAWAN ISLANDS: Okinawa: Field & Loew 21v (Mi). PHILIPPINE ISLANDS: Mindoro: H. H. Bartlett 13708, in part (Mi). INDONESIA: GREATER SUNDA ISLANDS: Sumatra: Hamel & Toroes 551 (Mi); Schiffner 2454 (Bi); Toroes 910 (Mi); Yates 524 (Mi). MELANESIA: NEW GUINEA: Northeastern New Guinea: M. K. Clemens 11067 bis (Mi), 41503 (Mi). SOLOMON ISLANDS: Bougainville: Waterhouse 60 [Herb. Mus. Yale Sch. Forest. 22664] (Bi, Bi). YASAWA FIJI ISLANDS: Viti Levu: J. W. Gillespie 4380 (Bi); A. C. Smith 4559 (Bi), 6078 (Bi). POLYNESIA: LINE ISLANDS: Palmyra: E. Y. Dawson 19825 (Bi). MARQUESAS ISLANDS: Island undetermined: Quayle 1281 [2181] (Bi). TUAMOTU ISLANDS: Anaa: H. Saint John 14252 (Bi). Raroia: Doty & Newhouse 11724 (Bi). SOCIETY ISLANDS: Raiatea: J. W. Moore 696 (Bi). AUSTRAL ISLANDS: Rimatara: Saint John & Fosberg 16976 (Bi). Rurutu: Chapin 853 (Bi); F. R. Fosberg 11981 (Bi); H. Saint John 16573 (Bi); A. M. Stokes 1 (Bi). CULTIVATED: Baker Island: E. H. Bryan 1315 (Bi). Florida: P. O. Schallert 23077, in part (B). Hawaiian Islands: J. F. Rock s.n. [S. Kona, April 28, 1957] (Bi). Johnston Island: K. P. Fosberg 15 (Bi). Marshall Islands: F. R. Fosberg 36709 (Bi).

VITEX TRIFOLIA var. SUBTRISECTA f. ALBIFLORA Moldenke

Bibliography: Moldenke, Phytologia 8: 90—91. 1961; Moldenke, Biol. Abstr. 37: 1062. 1962; Hocking, Excerpt. Bot. A.6: 534. 1963.

Additional citations: POLYNESIA: AUSTRAL ISLANDS: Rurutu: H. Saint John 16705 (Bi--isotype).

VITEX TRIFOLIA var. VARIEGATA Moldenke

Synonymy: Vitex trifolia variegata [Moldenke] ex Lord, Shrubs & Trees Austral. Gard., rev. ed., 232. 1964.

Additional & emended bibliography: Neal, In Gard. Hawaii, ed. 1, 641. 1948; L. H. Bailey, Man. Cult. Pl., ed. 2, 844 & 1114. 1949; Kuck & Tongg, Mod. Trop. Gard. 77 & 236. 1955; Moldenke, Phytologia 8: 91. 1961; Menninger, Seaside Pl. 154 & 155. 1964; E. E. Lord, Shrubs & Trees Austral. Gard., rev. ed., 232. 1964; Neal, In Gard. Hawaii, ed. 2, 728. 1965; Moldenke, Résumé Suppl. 15: 15. 1967; Moldenke, Phytologia 17: 52. 1968.

Illustrations: Menninger, Seaside Pl. pl. 223. 1964.

Lord (1964) describes this variety as "Vitex trifolia variegata with the leaves broadly cream-margined, a very showy shrub", and recommends it for coastal areas in Australia. Kuck & Tongg (1955) state that the plant is very wind-resistant.

The Berlin specimen of P. O. Schallert 23007 does not show any variegation, although its leaf-margins are turned over, and is cited by me herein under V. trifolia var. subtrisecta (Kuntze) Moldenke. It is very possible that the turning over of the leaf-margins is an indication that they were variegated there and that the specimen should, therefore, be cited here under var. variegata.

Additional citations: CULTIVATED: Florida: H. N. Moldenke 24094 (Ac, Rf). Hawaiian Islands: Ito s.n. [Schofield, May 1936] (Bi); C. S. Judd s.n. [Puunene, Feb. 8, 1940] (Bi); Neal s.n. [Nov. 19, 1944] (Bi), s.n. [July 9, 1945] (Bi); J. A. Price s.n. [May 10, 1943] (Bi).

VITEX TRIPINNATA (Lour.) Merr.

Additional & emended bibliography: Jacks. in Hook. f. & Jacks., Ind. Kew., pr. 1, 1: 582 (1893) and 2: 1036 & 1121. 1895; A. W. Hill, Ind. Kew. Suppl. 6: 219 (1926) and 9: 297 & 298. 1938; Merr. & Chun, Sunyatsenia 5: 178. 1940; Jacks. in Hook. f. & Jacks., Ind. Kew., pr. 2, 1: 582 (1946) and 2: 1036 & 1121 (1946) and pr. 3, 1: 582 (1960) and 2: 1036 & 1121. 1960; Moldenke, Phytologia 8: 91--92. 1961; Moldenke, Biol. Abstr. 37: 1062. 1962; Hocking, Excerpt. Bot. A.6: 534. 1963.

Recent collectors have found this plant growing in evergreen forests, at 150 meters altitude, fruiting in August. The corollas are described as having been "yellow" on Clemens & Clemens 3394.

The Bejaud 223, in part, in the Berlin herbarium, cited by me previously as V. tripinnata, proves actually to be var. clemensorum Moldenke.

Additional citations: CHINESE COASTAL ISLANDS: Hainan: How 72997 (Bi). THAILAND: Larsen, Smitinand, & Warncke 1385 (Ac, Rf). INDOCHINA: Annam: Clemens & Clemens 3394 (W--1427499). Tonkin: Pételot 6398 (W--1759457), 6419 (W--1759467). State undetermined: Eberhardt 4132 [Hoa-Binh] (W--2497092).

VITEX TRIPINNATA var. CLEMENSORUM Moldenke

Bibliography: Moldenke, Phytologia 8: 92. 1961; Moldenke, Biol. Abstr. 37: 1062. 1962; Hocking, Excerpt. Bot. A.6: 534. 1963.

The Berlin specimen of Bejaud 223, previously cited by me as typical V. tripinnata, has been re-examined and proves to be var. clemensorum. It is, however, mixed with something not verbenaceous.

Additional citations: INDOCHINA: Cambodia: Bejaud 223, in part (B).

VITEX TRISTIS S. Elliot

Additional bibliography: Durand & Jacks., Ind. Kew. Suppl. 1, pr. 1, 457 (1906) and pr. 2, 457. 1941; Moldenke in Humbert, Fl. Madag. 174: 74, 113—115, & 273, fig. 17 (1). 1956; Moldenke, Phytologia 6: 200—201. 1958; Moldenke, Résumé 157 & 479. 1959; Durand & Jacks., Ind. Kew. Suppl. 1, pr. 3, 457. 1959.

Illustrations: Moldenke in Humbert, Fl. Madag. 174: 115, fig. 17 (1). 1956.

VITEX UBANGHENSIS A. Chev.

Additional bibliography: Prain, Ind. Kew. Suppl. 5, pr. 1, 273. 1921; Moldenke, Phytologia 6: 201. 1958; Moldenke, Résumé 140 & 479. 1959; Prain, Ind. Kew. Suppl. 5, pr. 2, 273. 1960.

VITEX UMBROSA Sw.

Additional synonymy: Nephrandra dubia Willd. in Cothen., Disp. Veg. 8. 1790.

Additional bibliography: J. F. Gmel. in L., Syst. Nat. Veg., ed. 13, pr. 1, 2: 963 (1789) and pr. 2, 2: 946 & 963. 1796; Pers., Sp. Pl. 3: 361. 1819; Steud., Nom. Bot. Phan., ed. 1, 888. 1821; Griseb., Cat. Pl. Cub. 216. 1866; Jacks. in Hook. f. & Jacks., Ind. Kew., pr. 1, 2: 308 (1894) & 1214 (1895) and pr. 2, 2: 308 & 1214. 1946; Asprey & Robbins, Ecol. Monog. 23: 385 & 411, fig. 20. 1953; Hocking, Dict. Terms Pharmacog. 32. 1955; Jacks. in Hook. f. & Jacks., Ind. Kew., pr. 3, 2: 308 & 1214. 1960; Moldenke, Phytologia 8: 92. 1961; Moldenke, Résumé Suppl. 15: 21. 1967.

Additional illustrations: Asprey & Robbins, Ecol. Monog. 23: 385, fig. 20. 1953.

Recent collectors describe this species as a tree, 12 m. tall, the stem diameter 50 cm. at breast height, the flowers scented, and the fruit orange, growing on steep wooded hillsides, at 1000 feet altitude. The corolla is described as "purple with yellow blotch at top of lower lip" on Stearn 976. Hocking (1955) reports the common names "boxwood" and "South American boxwood" for this species.

Additional citations: JAMAICA: Proctor 19783 (N); Stearn 976 (S).

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A TAXONOMIC REVISION OF THE GENUS BONAMIA (CONVOLVULACEAE)

Tin Myint and Daniel B. Ward [1]

Table of Contents

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[1] Art and Science University, Mandalay, Burma; and the University of Florida, Gainesville, Florida.

This study is derived from a doctoral dissertation written by the senior author, University of Florida, 1964, under the direction of the junior author. The authors' gratitude is hereby expressed to the Government of the Union of Burma, who met important expenses by a State Scholarship grant, to the curators of those herbaria who generously sent their specimens, including types, for examination, to the Center for Tropical Agriculture, University of Florida, for preparation of the typescript, and to the Department of Botany, University of Florida, for meeting the direct cost of publication.

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Introduction

The genus Bonamia belongs to the Convolvulaceae, a family of flowering plants. According to the concept presented in this study, it is a genus of forty-five species and eleven varieties. Bonamia is a fairly large genus compared with some of its close relatives, Stylisma (represented by six species), Calycobolus (represented by eleven or twelve species) and Seddera (represented by about fifteen or twenty species). In contrast to the narrow distribution of these genera, Bonamia occurs throughout the tropical and warm temperate regions of both hemispheres, with a concentration of species in South America, Australia and Madagascar. Several species are known only by type collections or only from type localities and are poorly represented in the herbaria of the world. Several others are known only by a modest number of specimens. Only fourteen species are known from ten or more collections, and only five species are not restricted to a narrow geographical region.

The only synopsis of the genus Bonamia, that of H. Hallier (1897), contained twenty-eight species, one of which definitely belongs to the genus Seddera and another to the genus Metaporana; no key was given. Recent studies of the genus (van Ooststroom, 1954, O'Donell, 1959, Verdcourt, 1963 and Myint, 1968) deal only with a few species of particular areas or countries. Other recent students (Meeuse, 1957, Wilson, 1960, and Shinners, 1962), have applied the name Bonamia in a somewhat broader sense by inclusion of some species here considered as belonging to related genera. In contrast to these authors, Roberty (1952) breaks Bonamia into more than one genus. These conflicting treatments create doubt as to generic limits and invite a thorough investigation of the entire genus. That some clarification of the species and varieties comprising the genus Bonamia is needed is evident from the large number of misidentified or misplaced specimens extant in most herbaria. With the addition of many species to the original genus, and due to the inclusion of several species of related genera, it becomes desirable to redefine the generic limits of Bonamia, to form three sections within the genus, to evaluate some characters that have not been used in its classification, and to determine boundaries of several species which were inadequately described and are poorly known.

Bonamia is characterized technically by the possession of free or partially free styles, nonaccrescent sepals, and ovate, obovate or ovate-cordate cotyledons. It is not surprising that Asa Gray, recognizing the overall similarity of Bonamia and Stylisma, put the members of the latter in Bonamia. However, a recent monographic study of Stylisma by the senior author (Myint, 1966) together with additional information gathered during the present investigation, strongly indicates the feasibility and desirability of treating them as separate genera, while admitting the existence of connection between them.

In the present study, one new species, two new varieties and one new form are described; three new combinations are made; and three sections are proposed. A key to sections, a general key to all species, and three regional keys to species are presented. All specimens (assigned to the genus Bonamia and its related genera) available from the following herbaria were examined. The abbreviations are listed here according to Lanjouw and Stafleu (1964).

A- Arnold Arboretum, Cambridge, Massachusetts.
B - Botanisches Museum, Berlin-Dahlem, Germany.
BM - British Museum of Natural History, London, Great Britian.
BRI - Botanic Museum and Herbarium, Brisbane, Queensland, Australia.
EA - The East African Herbarium, Nairobi, Kenya.
F - Chicago Natural History Museum, Chicago, Illinois.
G - Conservatoire et Jardin Botaniques, Geneve, Switzerland.
GH - The Gray Herbarium of Harvard University, Cambridge, Massachusetts.
HBG - Stattsinstitut fur allgemeine Botanik, Hamburg, Germany.
K - The Herbarium, Royal Botanic Gardens, Kew, Great Britian.
L - Rijksherbarium, Leiden, Netherlands.
MEXU - Herbario Nacional del Instituto de Biologia, Mexico, D.F. Mexico
NY - New York Botanical Garden, New York, New York.
R - Divisao de Botanica do Museu Nacional, Rio de Janeiro, Brazil.
RB - Jardim Botanico, Rio de Janeiro, Brazil.
UC - Herbarium of the University of California, Berkeley, California.
US - National Museum, Smithsonian Institution, Washington, D.C.
W - Naturhistorisches Museum, Wien, Austria.

In addition to the species from the above-mentioned herbaria, specimens of B. grandiflora, B. multicaulis and B. ovalifolia from the following herbaria were examined.

DUKE - Duke University, Durham, North Carolina.
FLAS - Herbarium of the University of Florida, Gainesville, Florida.
FSU - Florida State University Herbarium, Tallahassee, Florida.
GA - Herbarium of the University of Georgia, Athen, Georgia.
MICH - University Herbarium, University of Michigan, Ann Arbor, Michigan.
NCU - Herbarium of University of North Carolina, Chapel Hill, North Carolina.
NSC - Department of Botany, North Carolina State College, Raleigh, North Carolina.
PH - Academy of Natural Sciences, Philadelphia, Pennsylvania.
SMU - Herbarium of Southern Methodist University, Dallas, Texas.

History

The generic name Bonamia was established by DuPetit-Thouars (1804) in honor of Francois Bonami (1710-1786), a French physician and botanist who wrote the Flora of the Environ of Nantes in 1782.

It was based on a woody vine of Madagascar, later described as B. alternifolia by Jaume Saint-Hilaire (1805) and as B. madagascariensis by Poiret (1810).

The generic name Breweria was proposed by Robert Brown (1810) in honor of Samuel Brewer (1670-1743), an English amateur botanist. The generic description was based on three Australian species, Breweria linearis, Br. media and Br. pannosa (i.e. Bonamia linearis, B. media and B. pannosa of the present treatment). Before the comparative study of the Convolvulaceae by Hallier (1893), Breweria was most commonly treated as a genus distinct from Bonamia.

The generic name Trichantha was described by Karsten and Triana (1856), based on a woody vine of Columbia, described by them as Trichantha ferruginea (=Bonamia trichantha of the present treatment). However, this generic name is invalid, since it is preoccupied by Trichantha Hooker (1844) of the Gesneriaceae.

The name Perispermum was established by Otto Degener (1932), based on a woody vine, Perispermum albiflorum (=Bonamia menziesii of the present treatment), which is endemic to the Hawaiian Islands.

A fifth generic name, Breweriopsis, was proposed by G. Roberty in his new and strange system of classification of the Convolvulaceae (1952). It was based on Breweriopsis elegans (=Bonamia elegans of the present treatment), an endemic of lower Burma.

Although these five generic names were described from different plants from various parts of the world (Madagascar, Australia, Columbia, Hawaii and tropical Asia), they all are characterized by essentially similar floral features. Other generic names of close nomenclatural association, especially to the names Breweria and Bonamia, are Stylisma Rafinesque (1818), Seddera Hochst. (1844), Calycobolus Willd. ex Roem. and Schult. (1819), Prevostea Choisy (1825), Dufourea H.B.K. (1818), Reinwardtia Spreng. (1825), Dethardigia Nees et Mart. (1823), Codonanthus G. Don (1856), and Metaporana N.E. Brown (1914).

The treatment of these genera in the past has varied widely. Choisy (1845) treated Bonamia, Breweria, Stylisma, Seddera and Prevostea (=Calycobolus) as distinct genera. Gray, in his earlier manual (1856), treated Stylisma as a distinct genus; but later (1862) he questioned the validity of Breweria and Stylisma, and suggested their reduction to Bonamia. Bentham and Hooker (1876) did not accept Gray's suggestion and treated Bonamia as a monotypic genus of Madagascar and Breweria in a very broad sense by including species previously assigned to Seddera, Stylisma and Calycobolus, in addition to species described under Breweria and Trichantha. Peter (1897) slightly modified Bentham and Hooker's classification by treating Bonamia as containing two species (B. alternifolia and B. menziesii), members of Calcycobolus and one species of Bonamia (B. ferruginea) under the generic name Prevostea, and the rest in three subgenera (namely Seddera,

Stylisma and Eubreweria) under the generic name Breweria.

Hallier (1893) was the first to call attention to the weakness of the differences observed between Bonamia and Breweria sen. str. He combined the two groups into a single genus, and the older name Bonamia was substituted for the later Breweria. He retained Stylisma, Seddera and Prevostea as distinct genera from Bonamia (although his choice of the name Prevostea rather than Calycobolus was incorrect). The generic delimitation thus adopted and revised by Hallier was accepted by House (1907), but he treated three species of Bonamia under Calycobolus, since he missed the fact that members of Calycobolus are characterized by accrescent sepals rather than by unequal sepals. Amongst the authors of some local floras, Baker and Rendle (1906), Hutchinson and Dalziel (1931), Small (1933), van Ooststroom (1932; 1954), O'Donell (1959) and Vercourt (1963) followed Hallier, whereas Clarke (1883), Bailey (1901), Baker and Wright (1904) and Fernald (1950) apparently followed Bentham and Hooker. In the more recent studies Meeuse (1957), working on south African species, referred a species of Seddera to Bonamia, and Wilson (1960) and Shinners (1962), independently working on the North American species, referred all species of Stylisma to Bonamia.

Roberty's treatment of Bonamia and its related genera in his new system of classification (1952) is so different from all other authors mentioned above and so artificial in selection of the distinguishing characters that it is not at all acceptable and deserves no special attention except a short comment. His proposal of the new genus Breweriopsis and treatment of Bonamia and Breweria as distinct genera are based on insufficient knowledge of the plants, as is evident from the fact that he included B. spectabilis in Breweriopsis (under B. elegans) and B. minor in Bonamia (under B. cymosa), whereas these two are definitely conspecific (the difference being only in the pubescence of stems, which is variable). Further, he included three species of Bonamia in Stylisma humistrata in addition to all known species of that genus; he also associated Bonamia ferruginea with Dipteropeltis ferruginea, an entirely different plant of tropical Africa. Several other serious errors have been pointed out by Verdcourt (1957; 1963).

Morphology

The morphological characteristics of species of Bonamia are poorly known because of the infrequent or rare occurrence and sporadic or limited distribution of many species. Most previous studies, except Hallier's comparative study of the family and synopsis of Bonamia, have been directed mainly to the descriptions of essential features for delimiting different species.

HABIT: Plants of Bonamia are perennial, woody, suffrutescent or rarely herbaceous vines, occasionally small shrubs or

subshrubs, growing from deep-seated roots. The roots are mostly woody and never tuberous as they are in some species of Ipomoea, the largest genus of the Convolvulaceae. The tap roots are thick, at least near the bases of the shoots, and gradually taper downward. Adventitious roots at the nodes are not common, even in the prostrate or trailing species.

The stem is generally weak and slender or occasionally woody, mostly prostrate, twining or scandent, infrequently procumbent, suberect or erect. Members of section Trichantha are consistently woody and high-climbing vines or small erect shrubs, as in B. corumbaensis. The habit of members belonging to section Bonamia is quite variable from species to species, from suberect or procumbent as in B. sericea and B. ovalifolia, prostrate, twining or scandent as in most other species, to very high climbing as in B. brevipedicellata, B. maripoides, B. ferruginea, and B. semidigyna. B. brevipedicellata has been recorded as "50 ft. high, 1 inch in diameter." Members belonging to the section Breweria are generally smaller, somewhat herbaceous, suffrutescent or becoming woody. They are mostly prostrate, procumbent or erect, rarely twining. The stem is usually slender, as in B. linearis, B. media and B. brevifolia, or thick and erect as in B. rosea and B. velutina. In general, section Trichantha and section Breweria show the extreme types of habit, whereas section Bonamia is somewhat intermediate.

STEM: The stems are mostly terete or slightly angular, smooth, minutely striated, punctate or provided with lenticels, glabrous, sparsely pubescent, glabrescent, moderately to densely sericeous, villous, tomentose, velutinous or ferrugineous. Internodes, highly variable in length from species to species, are one or two centimeters long, as in most species of section Breweria and some species of section Bonamia, to several centimeters long, as in most species of section Trichantha and a few species of section Bonamia. The colors are light green, greyish green, silvery grey or brownish grey depending on the absence or presence of a dense coating of hairs. Underground stems have not been seen, although they might be present in several species. Branching is alternate, and frequent or occasional. Extent of branching is not a constant feature and is variable even in a single species. In some species there is a little or no secondary branching.

LEAVES: In general, the leaves show a homoblastic series, with all leaves similar in shape, although with the upper smaller than the lower. B. elegans shows a heteroblastic series, with the juvenile leaves ovate, elliptic or ovate-elliptic, and the upper leaves (on flowering branches) oblong.

Leaf shape in members of the genus Bonamia varies from elliptic, ovate, cordate, or orbicular (with length-width ratios of one or very close to one) to oblong, lanceolate or linear (with length-width ratios of two or higher). Leaf size also varies from one

centimeter of slightly longer as in B. brevifolia, B. media and B. rosea, to several centimeters long as in B. agrostopolis, B. ferruginea, B. mattogrossensis, B. kuhlmannii, B. subsessilis and B. trichantha. In general, the leaves are smaller in members of section Breweria and larger in those belonging to section Trichantha, while most species of section Bonamia possess leaves of somewhat intermediate sizes.

Leaves are sessile, subsessile or shortly petiolate in the members of section Breweria, whereas they are distinctly petiolate or long-petiolate in those of section Trichantha. Leaves in members of section Bonamia may be sessile, subsessile, shortly petiolate or long-petiolate. Leaves are thin, herbaceous or slightly subcoriaceous as in section Breweria, thin or thick, soft or subcoriaceous, as in most species of section Bonamia, or thick, subcoriaceous, coriaceous or leathery as in section Trichantha. Leaf base and apex vary inconsistently from acute and attenuate to obtuse, rounded, truncate and cordate or emarginate; leaves are frequently mucronate or mucronulate. Such wide variations of leaf base and apex are shown in all three sections.

Leaves are entire in most species, slightly undulate in B. alternifolia and slightly crenate or somewhat wavy in B. burchellii. They are mostly green, dark green or greyish green on the upper surface, pale or light green on the lower surface. Leaf surfaces are glabrous, sparsely pubescent, puberulous, sericeous, velutinous, tomentose, strigose, or ferrugineous, frequently more densely so on the lower surface or on the veins. Veins are thin and obscure as in some species of section Breweria or very prominent as in most species of section Trichantha, in which even the intercostal veins are prominent. In the species of section Bonamia, veins are not distinct as in B. densiflora, B. multicaulis, and B. sericea, or are very prominent as in B. alternifolia and B. ferruginea. Lateral veins are few (2-5), as in some Australian species, or several (6-11), as in most South American species.

INDUMENTUM: Hairs, except glandular ones, in all species of Bonamia are two-celled, and are usually appressed. The stalk-cell is extremely small, and the terminal cell bears two elongated arms. Both stalk and two-armed cells are mostly thick-walled or rarely thin-walled. The two arms of hairs on the vegetative parts and on the sepals are equal or slightly unequal and usually point in opposite directions. However, hairs on the margin of the sepals, when present, possess erect arms, thus pointing approximately in a single direction (i.e. away from surface); hairs on interplicae of the corolla and upper part of the tube possess unequal arms, with one extremely long arm pointing toward the apex of the petals and another very short or almost indistinguishable arm pointing toward the base of the corolla; hairs on the filaments of the stamens are curly and soft and occasionally glandular; hairs on the ovary, mostly at the apex, have two straight arms pointing toward the mouth of the corolla.

The type of hairs is generally uniform in the whole genus, although their density, length or arms and occurrence on different parts vary from species to species and are taxonomically important. They are distinctly appressed when their occurrence on certain parts is sparse or scattered; but when the hairs are dense, they are less appressed and sometimes crisped.

INFLORESCENCE: The flowers are axillary and mostly solitary or in simple dichasial cymes in the members of section Breweria. In the members of section Trichantha, the flowers are mostly in axillary compound or simple cymes, or in terminal panicles, rarely solitary or in simple cymes. The flowers in the members of section Bonamia are variable from axillary and solitary to dense clusters in an axillary or terminal position. Solitary flowers seem to be a result of reduction of compound inflorescences, since the less advanced species possess inflorescences of large number of flowers, whereas the more advanced species generally possess solitary flowers or simple cymes. This is evident in some species in which the aborted floral buds occur in the axils of bracts or bracteoles.

FLOWER: The flowers are sessile, shortly pedunculate or shortly pedicellate, distinctly pedunculate and pedicellate or long-peduculate. Such a wide variation is most evident in the section Bonamia. In B. ovalifolia, B. grandiflora, B. multicaulis, and B. sericea, the flowers are sessile, subsessile, shortly pedunculate or shortly pedicellate, whereas in B. semidigyna and B. cordata the peducles are comparatively very long. In B. peruviana and B. kuhlmannii the pedicels and secondary peduncles are nearly as long as the primary peduncles, whereas in B. maripoides and B. sulphurea the pedicels are fairly long, sometimes longer than the short peduncles. This feature is rather uniform in the members of section Breweria and section Trichantha.

Bracts and bracteoles are usually small, reduced and scale-like, with a few exceptions. In most species they are linear, linear-lanceolate or subulate and mostly shorter than pedicels. However, bracts in B. pannosa are long-linear, distinctly longer than pedicels; bracts in B. brevifolia are as long as the pedicels; bracts in B. cordata and B. mossambicensis are foliaceous, mostly ovate-lanceolate or elliptic-lanceolate in shape and as long as or longer than the sepals. Bracteoles also show the same range of shapes, although their size is smaller. Both bracts and bracteoles in most species are alternate. The alternate position is not conspicuous in B. mossambicensis and B. sphaerocephala, whose inflorescences are multiflorus and dense because of absence of pedicels. The bracts and bracteoles are persistent in most species but deciduous in some species of section Trichantha.

CALYX: All species have calyces composed of five quincuncially imbricated sepals, which are free or slightly fused at their extreme base. In all species of the genus the sepals are

not accrescent. This is the most important characteristic distinguishing the genus Bonamia from the genus Calycobolus. The sepals in Bonamia are coriaceous, subcoriaceous or rarely soft and somewhat herbaceous, but never membranous. The shape and size are highly variable from species to species. In general, they are lanceolate, ovate, ovate-lanceolate, oblong-ovate, elliptic, orbicular or rarely ovate-subcordate, obovate or oblique-ovate. They are acute, obtuse, acuminate, obtuse-mucronate, rounded, truncate or slightly emarginate at the apex. They are equal or subequal in most species and distinctly unequal in some species, such as B. cordata, B. ferruginea, B. mossambicensis, B. pannosa, B. peruviana and B. kuhlmannii. In all these species, the outer two sepals are large, ovate, ovate-orbicular, ovate-cordate, or rarely ovate-lanceolate, densely tomentose, ferrugineous, or pilose outside, densely sericeous or velutinous inside except at the center, or glabrous. The in-out sepal (third sepal) is smaller like the inner two, or large and oblique-ovate in shape and similar to the outer sepals in its pubescence (except at the inner margin). In the members of section Breweria, sepals are mostly ovate-lanceolate, small and equal or subequal except in B. pannosa. They are sericeous, tomentose, pilose or velutinous outside in all members of this section. In the members of section Trichantha, sepals are ovate, ovate-orbicular, oblong-ovate or orbicular, equal or slightly unequal, and tomentose, sericeous, sparsely pubescent, puberulous or rarely glabrous outside. The sepals are glabrous inside except in B. mattogrossensis. In the members of section Bonamia the sepals are highly variable from species to species in their shape, from lanceolate to ovate or orbicular, from equal to unequal, in their size from small to large, in their apices from acute and acuminate to obtuse and rounded, and in their surface from glabrous or sparsely puberulous to densely tomentose, villous or ferrugineous. Sepals are generally thin, herbaceous or rarely subcoriaceous in section Breweria, thick and coriaceous in Trichantha and variable in section Bonamia.

COROLLA: The corolla is sympetalous, funnel-shaped, shortly tubular campanulate, narrow-campanulate or campanulate-funnelform, and plicate in the bud stage. It is shallowly lobed as in B. alternifolia, somewhat lobulate, entire or subentire as in most species of the genus. During the bud-stage the lateral edges of each petal are hidden by being folded inwardly along the line of fusion between the petals. The infolded areas, termed plicae, are roughly triangular with their apices extending toward the tubular portion of the corolla, with the lateral angles of adjacent plicae nearly meeting at the apex of each petal. Between the plicae, the central portions of the petals or mesopetaline bands, termed interplicae, form the exposed surface of the bud. Each interplica is narrowly triangular tapering toward the apex of the petal, with the base merging with adjacent interplicae to form the tubular portion of the corolla. The size of the corolla varies from small to large. In the section Breweria, the corolla is usually small, 8-15 mm. long, rarely longer. In the section Trichantha, the corolla is somewhat larger, mostly 18-25 mm. long. In the section

Bonamia, the corolla is large or small.

The pigmentation of the corolla varies from species to species, but it is constant within a single species--blue, deep blue, purplish blue, or purple in B. grandiflora, B. elliptica, B. ovalifolia, B. multicaulis, B. elegans, B. spectabilis, B. mossambicensis, B. mattogrossensis, B. pannosa, and B. media; red, rose, or pink in B. abscissa and B. rosea; yellow or yellowish in B. balansae and perhaps in B. corumbaensis and B. menziesii. In the remaining species, the corolla is white, or, in a few of them, unknown. The color of the corolla is variable from blue to white in B. media and B. pannosa, and from red to pink or white in B. rosea.

ANDROECIUM: The stamens are five, alternate to the petals. They are mostly inserted, or rarely exserted as in B. alternifolia. The filaments are epipetalous, being adnate to the corolla at the basal portion. They are usually slightly longer than the styles, but may be appreciably longer or shorter. They are equal, subequal or unequal in length, and generally filiform above and flattened or widened near the base. The filaments are glabrous, sparsely or densely villous, at least the lower part. The anthers are bilocular, introrse or partially introrse, dehiscing by longitudinal slits. Their attachment to the filaments is mostly dorsal or basidorsal, and sagittate, cordate or subcordate at the base. They are oblong, oblong-ovate or lanceolate and usually 1.5-5 mm. long.

GYNOECIUM: The gynoecium is composed of two carpels, fused except for the stigmas and a portion of the styles. The degree of fusion of the stylar branches, termed stylodia, is variable from species to species; but in general the stylar branches are free at least for the upper one-fourth and in many species they are free to the middle, nearly to the base or readily separable to the base. The stylar branches are filiform, glabrous or rarely with scattered hairs, and equal or unequal in length. Each stylar branch is provided with a single vascular strand, which branches near the stigmas in the members of section Trichantha; in the members of two other sections it is unbranched. The stigmas are globose, subglobose, globose-capitate, capitate, conical, reniform, or bilobed, rarely peltate. They are usually wider than the tips of stylar branches, and rarely small and not distinctly distinguishable. The surfaces of stigmas are smooth, warted or occasionally rugose or rugulose. In the section Breweria stigmas are usually large, globose, subglobose or globose-capitate, rarely peltate and mostly smooth. In the section Trichantha stigmas are large, reniform, bilobed or capitate and smooth. In the section Bonamia stigmas are variable from small to large, globose to capitate or peltate, and from smooth to rugose or rugulose.

The ovary contains two chambers, each of which encloses two erect ovules in axile placentation. It is ovoid, ovoid-conical, oblong or conical. It is sparsely long-pilose, densely long-pilose, tomentose or glabrous, often pilose only at the apex. The ovary

at its base is usually surrounded by a thin or thick annular disc, very prominent in several species and frequently enlarged in the fruit.

FRUIT: The fruits in all species are valvular capsules with persistent sepals. They are most frequently two- to four-seeded, but occasionally one-seeded. Although the number of seeds per capsule is variable and is not a good characteristic for distinguishing Bonamia from Stylisma (as was done by Hallier), the mean number differs between the two genera (higher in Bonamia and lower in Stylisma) and in several species two- or one-seeded capsules are rare. The capsules are thin-walled or thick-walled and four- or eight-valvular, rarely two-valvular. In some species the individual valves may break again into smaller pieces, and thus the capsules may superficially appear to be multivalvular. In the members of section Trichantha, the capsule walls are thick and hard, frequently breaking into two pieces, although they are four-valvular in reality. Occasionally the capsules may remain indehiscent for a long time as in B. menziesii. The septum in the capsule is thin in most species of section Breweria and section Bonamia, whereas it is thick and hard in the members of section Trichantha. The capsules are small in section Breweria and are large in section Trichantha, whereas they are variable in size in section Bonamia.

SEED: Seeds are somewhat similar in shape from species to species, but are variable in size, color, surface and indumentum. In section Bonamia seeds are small or large, varying from 3-6 (7) mm. in length, brown, dark brown, or black in color and smooth or punctate and glabrous on the surface. In section Breweria, seeds are small, 2-4 mm. long, brown or dark brown, smooth or punctate and glabrous. In section Trichantha, seeds are small or large, 4-7 mm. long, brown or dark brown, and long-haired along the edge and villous or long-haired on the ventral and dorsal surface. The seedcoat is hard in all species and is frequently covered with a thin perisperm.

The embryo is embedded in cartilaginous endosperm, which on wetting swells into a gelatinous mass. The embryonic axis is short with an indistinguishable hypocotyl or elongate with a short hypocotyl. The plumule is located between the two cotyledonary petioles or on the side of the stalk formed by the fusion of the two cotyledonary petioles. The cotyledons are petiolate, foliaceous, thin and herbaceous. They are generally ovate, obovate, ovate-cordate, orbicular, obscurely bilobed or rarely linear-bifid, rounded, truncate or emarginate at the apex, cordate or truncate at the base, and mostly symmetrical or rarely somewhat oblique. The two cotyledons are closely appressed to each other and the two fold together repeatedly (thus appearing to be multiplicate and corrugate) and also fold against the radicle. In some species the closely appressed cotyledons are flat and folded once or twice and then against the radicle.

Systematic Treatment

Bonamia DuPetit-Thouars, Hist. Veg. Isl. France Reunion, Madagascar 1:33, pl. 8. 1804, nom. cons.

Breweria R. Br. Prodr. Fl. Nov. Holl. 487. 1810. Type: Bonamia linearis (R. Br.) Hall. f. (as Breweria linearis R. Br. 1810--BM! W!).

Trichantha Karst. et Triana, Linnaea 28:437. 1856. Type: Bonamia trichantha Hall. f. (as Trichantha ferruginea K. et T. 1856--G! BM! W!); not Trichantha Hooker, Icon. Pl. tt. 666,667. 1844.

Perispermum O. Degener, Flora Hawaiiensis, Fam. 307. 1932. Type: Bonamia menziesii Gray (as Perispermum albiflorum Degener, 1932--MO!).

Breweriopsis G. Roberty, Candollea 14:31. 1952. Type: Bonamia elegans (Wall.) Hall. f. (as Breweriopsis elegans (Wall.) Roberty, 1952--BM! G!).

Perennial, herbaceous, suffrutescent or woody, twining, prostrate or trailing, occasionally procumbent or suberect, shubby vines or erect subshrubs; shoots a few to several, simple or branched, growing all year around or arising annually from old shoots, bases of previous shoots, crowns, horzontally spreading subterranean stems, or from roots. Roots deep-penetrating, often becoming thick in some, frequently with pulpy bark, never bulbous nor fleshy. Stems mostly thin, elongate, occasionally becoming as thick as 2.5 cm. at the base, as long as a few decimeters to several meters in height, smooth or lenticellate, glabrous to densely pubescent, villous, sericeous or ferrugineous. Leaves petiolate, subsessile or sessile, estipulate, herbaceous or subcoriaceous, occasionally leathery; blades simple, entire, occasionally undulate or slightly wavy, ovate, ovate-cordate, elliptic, ovate-elliptic, oblong-ovate, lanceolate, oblong, linear or linear-lanceolate, often large, acute, obtuse, acuminate, acute-mucronate, obtuse-mucronate or slightly emarginate at the apex, acute, attenuate, cordate, rounded or truncate at the base; veins prominent to inconspicuous except the midribs, mostly impressed above, often with distinct intercostal veins; hairs appressed, two-armed, straight or crisped, very fine to distinctly long, scattered or dense, silvery grey, greyish white, pale brown or grey, often becoming rusty brown when dry. Inflorescences axillary or terminal, pedunculate or subsessile, simple or compound dichasial cymes of few to several flowers, often solitary or terminal panicles composed of several dichasial cymes; peduncles short or elongate, usually shorter than leaves, or absent; pedicels usually short, occasionally elongate (becoming as long as 2 cm.); bracts small and linear or distinctly foliaceous, mostly two for each individual flower, opposite or slightly alternate, sometimes crowded in congested clusters. Sepals five, quincuncially imbricate, free or rarely united at the extreme base,

mostly ovate, ovate-lanceolate, broadly lanceolate, orbicular, or oblong-orbicular, equal or unequal, acute, acuminate, obtuse, rounded or slightly emarginate at the apex, sericeous, tomentose, pilose, velutinous, ferrugineous or glabrous on the inner surface, persistent in capsules. Corolla white, blue, bluish purple, pink or red, yellow, yellowish white or greenish white, funnel-shaped, campanulate or shortly tubular campanulate, plicate in bud, sympetalous with entire, subentire, lobed or lobulate limb, outside sparsely or densely pilose on interplicae (midpetaline bands), glabrous on plicae (infolded areas); individual hairs on interplicae with two unequal arms (long arms directed toward apices of petals). Stamens five, alternate with petals, inserted or rarely exserted, all fertile; filaments epipetalous (being adnate to the lower, narrow part of the corolla), straight, filiform or somewhat dilated below, dorsiventrally flattened, unequal, subequal or equal in length, glabrous or thinly to densely villous or glandular-villous (with crisped or curly hairs), frequently villous only on the basal dilated portions; anthers two-celled, oblong or oblong-lanceolate, dorsifixed or apparently basifixed, frequently sagittate or cordate at the base, introrse or partially extrorse by vertically dehiscing slits; pollen colpate and punctitegillate, not spiniferous. Ovary superior, bicarpellate, bilocular, long-pilose or hirsute with two-armed hairs (both arms of each hair directing toward the mouth of the corolla) or glabrous, surrounded by annular disc at the base; ovules two in each loculus, erect, anatropous, in axile placentation, appearing to be basal; styles terminal, two, almost free to partially united, included in the corolla to partially exserted; stylar branches (or stylodia) equal to unequal, filiform, mostly glabrous, occasionally with scattered hairs; stigmas large or small, globose, subglobose, capitate, reniform, bilobed conical or rarely peltate, smooth or rugose, occasionally lobulate. Fruits 1- to 4-seeded, 4- to 8-valvular, rarely 2-valvular capsules with thin and chartaceous or thick and ligneous walls, ovoid, globose or conical-ovoid, apiculate at the apex, glabrous or with scattered hairs, two-celled with thin or thick septum, with persistent sepals, dehiscing by valves, occasionally dehiscing by basal circumcision, rarely remaining indehiscent for a long time after ripeness. Seeds brown, dark brown or black, smooth or punctate,glabrous or lanate, oval and plano-convex or roughly three-angled, with hard or rarely soft seedcoat, covered with thin transparent perisperm; endosperm scanty or copious, cartilagenous, swelling on wetting. Cotyledons thin, foliaceous, ovate, obovate, ovate-cordate or orbicular, rarely linear-bifid, mostly symmetrical, rarely slightly oblique, corrugate-plicate and folded against radicle or simply flat or slightly folded along central line and folded against radicle; cotyledonary petioles free or fused. Flowering from summer to winter.

Type: B. madagascariensis Poiret, in Lamarck, Encycl. Meth. Bot. suppl. 1:677. 1810, nom. illeg. (B. alternifolia J. St. Hilaire, Expos. Fam. 2:349. 1805.)

Dry sandy soils of various types, rarely moist or wet ground, frequently coastal plains and dunes, occasionally inland high ground, open forests, grassy plains, scrubby lands, edges of dense forests, frequently along streams and riverbanks; of tropics, subtropics and warm temperate regions of both hemispheres, with a concentration of more species in South America, Australia and Madagascar, and fewer species in Asia, North America and mainland Africa.

The genus is heterogeneous and is roughly separable into three sections.

Key to Sections of Bonamia

1. Seeds glabrous; fruits with thin walls, dehiscing into four or eight valves, rarely indehiscent, with thin or membranous septa; flowers solitary, in simple or compound cymes, umbellate or capitate heads (axillary or terminal). 2

1. Seeds fulvous-villous on the ventral and dorsal sides, long-haired along the edge; fruits with ligneous and thick walls, dehiscing into two or four valves, with ligneous or thick septa; flowers mostly in panicles or pseudopanicles, rarely solitary or simple cymes. Sect. Trichantha

2. Corolla 1.8 cm. or longer, if shorter, flowers in dense capitate clusters; peduncles or pedicels or the two together consistently as long as 1 cm. or longer, rarely shorter; leaves 3 cm. or longer; flowers mostly in cymes, dense clusters, or occasionally solitary. Sect. Bonamia

2. Corolla shorter than 1.8 cm.; peduncles or pedicels or the two together mostly 5 mm. or shorter, rarely longer; leaves shorter than 3 cm., narrower than 2 cm., if longer or wider, corolla shorter than 1.8 cm.; flowers mostly solitary, occasionally in simple cymes, rarely 5 to 7-flowered cymes. Sect. Breweria

General Key to Species of Bonamia

1. Outer sepals larger than inner sepals, as wide as or wider than twice the width of inner sepals and more densely tomentose. 2

1. Outer and inner sepals equal, subequal or slightly unequal (outer sepals 1.5 X inner sepals or narrower). 7

2. Leaves shorter than 4 cm.; flowers solitary or rarely in simple cymes, sessile or subsessile, rarely short-pedunculate or short-pedicellate. 31. B. pannosa

2. Leaves longer than 4.5 cm.; flowers mostly in compound cymes, usually numerous or in capitate cymes, or long-pedunculate and/or long-pedicellate. 3

3. Pedicels longer than 1 cm. or peduncles 3 cm. or longer; inflorescences loose cymes or few-flowered cymes; leaves ovate or ovate-cordate. 4

3. Pedicels very short, rarely as long as 7 mm.; inflorescences dense capitate, sessile or shortly pedunculate; leaves ovate-lanceolate, ovate-elliptic or oblong-ovate. 6

4. Bracts foliaceous, ovate or ovate-lanceolate, 5 mm. or longer; pedicels short; peduncles 3 cm. or longer. 6. B. cordata

4. Bracts minute, scale-like, linear or subulate, 2-4 mm. long; pedicels longer than 1 cm.; peduncles 2.5 cm. or shorter. 5

5. Leaves 5-12 cm. by 3-8 cm., cordate or subcordate at the base; outer sepals 2 cm. by 1.7 cm.; styles free almost to the ovary. 24. B. kuhlmannii

5. Leaves 5.5-7 cm. by 3-4 cm., obtuse or truncate at the base; outer sepals 8-12 mm. by 7-10 mm.; styles fused at least lower one-third. 25. B. peruviana

6. Sepals ferrugineous or tomentose (with short hairs); outer sepals thick, ovate or ovate-subcordate, obtuse at the apex; leaves obtuse or acute at the apex; bracts inconspicuous. 21. B. ferruginea

6. Sepals long-sericeous or hirsute (with long hairs); outer sepals thin and somewhat foliaceous (with distinct venation), ovate-lanceolate, acute or acuminate at the apex; leaves acute or acuminate at the apex; bracts 1 cm. long. 5. B. mossambicensis

7. Sepals consistently (both outer and inner) acute or acuminate at the apex; if obtuse then 10 mm. or longer. 8

7. Sepals (at least the inner or the outer) obtuse, rounded, obtuse-mucronate or emarginate. 29

8. Flowers in dense clusters, capitate or dense umbellate cymes, mostly sessile, subsessile or rarely shortly pedicellate. 9

8. Flowers solitary or in axillary loose cymes of 3-7; if more, pedicels or peduncles 2 cm. or longer. 11

9. Leaves elliptic, oblong or oblong-elliptic, 4 cm. or shorter, 2 cm. or narrower, long-mucronate at the apex, dense lanate on the surface; corolla 1 cm. or shorter. 23. B. sphaerocephala

9. Leaves elliptic-lanceolate or ovate-lanceolate, longer than 4 cm. or wider than 2 cm., attenuate at the apex, sericeous, hirsute or glabrate on the surface; corolla longer than 1.5 cm. 10

10. Sepals hirsute with long hairs, unequal; corolla blue; bracts pilose or hirsute with long hairs. 5. B. mossambicensis

10. Sepals pubescent with short hairs, equal or subequal; corolla white; bracts puberulous, finely sericeous or nearly glabrous. 18. B. holtii

11. Pedicels or peduncles or the two together as long as 1 cm. or longer consistently. 12

11. Pedicels or peduncles or the two together shorter than 1 cm. (at least a few of them). 23

12. Sepals ovate or ovate-lanceolate, usually shorter than 1.5 X width, tomentose, villous, densely sericeous or ferrugineous, mostly 12 mm. or shorter, rarely longer. 13

12. Sepals lanceolate or oblong-lanceolate, usually as long as 1.5 X width or longer, glabrous or puberulous, mostly 12 mm. or longer, rarely slightly shorter. 19

13. Sepals 7-12 mm. wide, densely villous or ferrugineous. 14

13. Sepals 4-6 mm. wide, softly pubescent, tomentose, sericeous or nearly glabrous. 18

14. Leaves linear-lanceolate, 10 mm. or narrower, with length-width ratio of 2.5 or higher; corolla blue. 15. B. multicaulis

14. Leaves ovate, cordate, elliptic, oblong-elliptic or rotund, wider than 10 mm. and/or with length-width ratio of 2 or lower; if higher, corolla white. 15

15. Leaves cordate at the base, 4 cm. or wider; peduncles 3 cm. or longer. 16

15. Leaves rounded, obtuse or rarely subcordate at the base, 3 cm. or narrower; peduncles shorter than 3 cm. 17

16. Corolla white or yellowish white, with slightly lobulate limb; flowers mostly in simple or compound cymes. 7. B. semidigyna

16. Corolla red or pink, with entire or subentire limb; flowers mostly solitary, rarely in simple cymes. 41. B. abscissa

17. Leaves ovate or orbicular, 2.5 cm. or shorter; corolla blue, 3 cm. or longer; stem 1 m. or shorter, procumbent or suberect. 14. B. ovalifolia

17. Leaves oblong-elliptic, elliptic, oblong-lanceolate or rarely rotund, mostly longer than 2.5 cm.; corolla white or yellowish, 2.5 cm. or shorter; stem longer than 1 m., scandent or twining, rarely prostrate. 10. B. menziesii

18. Leaves 4 cm. or shorter, 1.8 cm. or narrower, acute or attenuate at the base; flowers solitary or in simple cymes, never in dense clusters; stem 1 m. or shorter. 16. B. sericea

18. Leaves longer than 4 cm., 2 cm. or wider, obtuse or truncate at the base; flowers in dense clusters (composed of numerous simple or compound cymes); stem longer than 1 cm. 4. B. thunbergiana

19. Styles free for no more than one-third of length; stigma capitate or peltate; leaves, subtending flowers, narrowly oblong or oblong-lanceolate, with length-width ratio of 2 or higher. 8. B. elegans

19. Styles free to the middle or lower; stigma globose or subglobose; leaves, subtending flowers, ovate or elliptic, with length-width ratio of 1.8 or less. 20

20. Corolla shorter than 2.5 cm., 2.3 cm. or narrower at the limb. 13. B. sulphurea

20. Corolla 3 cm. or longer, wider than 2.5 cm. at the limb. 21

21. Flowers in simple or compound cymes; pedicels as long as 1 cm. or longer; leaves elliptic or ovate-elliptic, 3.5-6 cm. by 2.5-4 cm. 12. B. elliptica

21. Flowers solitary or in simple cymes of 2 or 3; pedicels shorter than 1 cm.; leaves ovate, rotund or ovate-subcordate, 2-3 cm. by 1.7-2.5 cm; if larger, long-mucronate at the apex. 22

22. Leaves ovate or ovate-subcordate, widest near the base, with long mucros; petioles 5 mm. or longer; stem slender, shorter than 2 m. 9. B. dietrichiana

22. Leaves orbicular or ovate-orbicular, widest at the middle; mucros, if present, very minute; petioles 1-4 mm.; stem mostly 2 m. or longer. 11. B. grandiflora

23. Corolla 3 cm. or longer; sepals wider than 5 mm. 15. B. multicaulis

23. Corolla shorter than 2 cm.; sepals narrower than 5 mm. 24

24. Leaves orbicular; corolla red, pink or white; stem erect or suberect. 30. B. rosea

24. Leaves linear, oblong, linear-oblong, ovate, elliptic or rarely somewhat orbicular; corolla white or blue; stem prostrate or twining; if erect, leaves elliptic. 25

25. Leaves cordate at the base, acute at the apex, with length-width ratio 1 or close to 1. 28. B. brevifolia

25. Leaves obtuse, acute, truncate or subcordate at the base, obtuse, acute or emarginate at the apex, with length-width ratio more than 1; if 1 or close to 1, emarginate or obtuse at the apex. 26

26. Leaves linear, linear-lanceolate or narrow-oblong, usually 5 mm. or narrower. 27

26. Leaves ovate, ovate-oblong, obovate, elliptic, usually wider than 5 mm. 28

27. Leaves narrow-oblong, rounded at both ends, sessile or subsessile, densely sericeous or villous. 27. B. oblongifolia

27. Leaves linear or linear-lanceolate, acute, obtuse or attenuate at the base, obtuse or acute at the apex; petiolate, sparsely or rarely densely sericeous. 26. B. linearis

28. Leaves elliptic, 2.5-4.5 (5.5) cm. long, 1-2.5 cm. broad; stem erect or suberect; sepals spathulate. 32. B. velutina

28. Leaves ovate, ovate-oblong, rarely elliptic, 1-2.3 cm. long, rarely longer, 8-15 mm. wide; stem prostrate or climbing; sepals ovate or ovate-acuminate. 29. B. media

29. Sepals glabrous or merely ciliate at the margin, rarely sparsely pubescent; leaves glabrous or sparsely pubescent. 30

29. Sepals, at least inner sepals, pubescent, tomentose or sericeous; leaves tomentose, sericeous or villous at least on the lower surface, rarely glabrate. 32

30. Leaves oblong or oblong-elliptic; inflorescences umbellate cymes of 5 or more flowers. 22. B. umbellata

30. Leaves ovate or ovate-cordate; flowers solitary or in simple cymes of 2 or 3. 31

31. Stem longer than 1 m., twining or scandent; styles fused to the middle or higher; leaves glabrous, attenuate or acute at the apex. 34. B. balansae

31. Stem 70 cm. or shorter, erect or suberect; styles free nearly to the base; leaves with scattered hairs, obtuse or truncate and mucronate at the apex. 35. B. corumbaensis

32. Corolla distinctly lobed; stamens exserted; leaves with very distinct minor venations, undulate at the margin. 1. B. alternifolia

32. Corolla entire, subentire or merely lobulate or angular; stamens inserted; minor veins, except intercostal veins, scarcely distinct. 33

33. Leaves narrowly elliptic, narrowly oblong or oblong-elliptic, narrower than 2 cm.; if wider, length-width ratio 1.5 or more and acute or attenuate at the base. 34

33. Leaves ovate, ovate-cordate, broadly elliptic, oblong-ovate or oblong-cordate, 2 cm. or wider; if narrower, length-width ratio less than 1.5 and obtuse, truncate or subcordate at the base. 35

34. Sepals 2-3 mm. long; corolla white, 1.8 cm. long or shorter; leaves with scattered hairs or nearly glabrous, obtuse or truncate at the base. 3. B. densiflora

34. Sepals 4-6 (8) mm. long; corolla blue, 2 cm. or longer, rarely shorter; leaves distinctly pubescent at least on the lower surface, acute or cuneate at the base. 2. B. spectabilis

35. Individual flowers sessile or subsessile, occasionally with pedicels up to 1-2 (3) mm. long; peduncles of individual cymes absent. 36

35. Individual flowers pedicellate or solitary and peduncular, with pedicels 3 mm. or longer; if shorter, peduncles present. 38

36. Corolla 1.2 cm. or shorter; leaves glabrous above. 20. B. brevipedicellata

36. Corolla 1.5 cm. or longer; leaves sericeous or tomentose above. 37

37. Corolla white. 39. B. subsessilis

37. Corolla purple, violet or with purple eye. 40. B. mattogrossensis

38. Stem 1 m. or shorter; if longer, leaves 3.5 cm. or shorter and rounded or obtuse at the apex. 39

38. Stem mostly longer than 1.5 m. 40

39. Stem erect or suberect, 30-60 cm. long; leaves sparsely pubescent or becoming glabrous. 35. B. corumbaensis

39. Stem slender, prostrate, procumbent or climbing, longer than 70 cm.; leaves densely sericeous or villous. 17. B. boliviana

40. Flowers solitary, rarely in simple cymes. 43. B. langsdorffii

40. Flowers in simple or compound cymes, pseudopanicles or racemose panicles. 41

41. Leaves glabrous on the upper surface, rarely with scattered hairs. 42

41. Leaves sericeous or tomentose on the upper surface. 45

42. Corolla 1.2 cm. or shorter; flowers in dense capitate clusters; styles shorter than 1 cm. 20. B. brevipedicellata

42. Corolla 1.5 cm. or longer; flowers in loose cymes, panicles or pseudopanicles. 43

43. Pedicels 1 cm. or longer; inner sepals rounded at the apex; outer sepals uniformly appressed sericeous. 19. B. maripoides

43. Pedicels shorter than 1 cm.; inner sepals truncate or slightly emarginate at the apex; outer sepals tomentose or glabrate. 44

44. Leaves with veins distinctly impressed above; intercostal veins prominent at least on the lower surface; leaves mostly elliptic, 9 cm. or longer. 33. B. agrostopolis

44. Veins not impressed on the upper surface; intercostal veins obscure, if distinct not impressed; leaves mostly ovate, if oblong or elliptic, blades 8 cm. or shorter. 33. B. trichantha

45. Leaves obtuse, rounded or truncate at the base; acuminate or acute, rarely obtuse at the apex. 46

45. Leaves subcordate or rarely truncate at the base; obtuse, rounded or slightly emarginate at the apex. 38. B. tomentosa

46. Leaves elliptic or oblong-elliptic, 9 cm. or longer, sparsely pubescent or glabrescent above; ovary glabrous. 36. B. agrostopolis

46. Leaves ovate or ovate-elliptic, shorter than 8 cm., densely tomentose or sericeous, rarely sparsely so on the upper surface; ovary pilose at least at the apex. 37. B. burchellii

Regional Keys

The following regional keys are given as supplementary to the general key because the identification of a specimen belonging to Bonamia is much simplified if the geographical source is known.

Key to the African and Asian Species

1. Outer sepals distinctly larger than inner sepals or with indumentum of dense, long, spreading hairs (drying golden brown); bracts mostly foliaceous. 2

1. Outer and inner sepals equal, subequal or slightly unequal; bracts mostly small, occasionally foliaceous (as in B. semidigyna) 3

2. Sepals, at least outer ones, obtuse, with short appressed hairs; leaves cordate or ovate-cordate; peduncles long, mostly 1 to 7-flowered; corolla white. 6. B. cordata

2. Sepals acuminate or acute, with long spreading hairs; leaves elliptic-lanceolate to oblong-ovate; peduncles short, multi-florous; corolla blue. 5. B. mossambicensis

3. Sepals, both outer and inner, consistently acute or acuminate at the apex. 4

3. Sepals obtuse or rounded, rarely broadly acute, at the apex. 8

4. Peduncles 3 cm. or longer, rarely slightly shorter; leaves cordate or ovate-cordate, usually long-attenuate at the apex, 4 cm. or wider. 5

4. Peduncles shorter than 2 cm.; leaves elliptic, ovate-elliptic, oblong-elliptic or oblong, rarely slightly cordate at the base, obtuse, acute or acuminate at the apex, narrower than 3.5 cm. 6

5. Corolla white or yellowish white, with slightly lobulate limb; flowers mostly in simple or compound cymes. 7. B. semidigyna

5. Corolla red or pink, with entire or subentire limb; flowers mostly solitary, rarely in simple cymes. 41. B. abscissa

6. Flowers in cymes of few to several, usually forming secund dense clusters; leaves glabrous or sparsely pubescent on the upper surface. 4. B. thunbergiana

6. Flowers solitary or in cymes of two or three; leaves densely velutinous or pilose on both surfaces. 7

7. Corolla blue, longer than 2.5 cm.; sepals longer than 10 mm.; stems long, climbing or prostrate, weak. 8. B. elegans

7. Corolla white, shorter than 2 cm.; sepals shorter than 10 mm.; stems short, erect. 32. B. velutina

8. Stamens exserted; corolla distinctly lobed; leaves undulate at the margin, strongly nerved, shortly petiolate or subsessile, with length-width ratio less than 2. 1. B. alternifolia

8. Stamens inserted; corolla subentire or merely sub-lobulate; leaves entire at the margin, with indistinct minor venation, distinctly petiolate, with length-width ratio 2 or more. 9

9. Sepals orbicular or ovate-orbicular, 3.5 mm. or shorter, sparsely pubescent or glabrescent; leaves sparsely pubescent or becoming glabrous, obtuse, rounded or truncate at the base; corolla white. 3. B. densiflora

9. Sepals ovate or oblong-ovate, 4.5 mm. or longer, densely sericeous; leaves mostly sericeous, rarely becoming glabrous, cuneate, subcuneate or acute at the base; corolla blue or bluish white. 2. B. spectabilis

Key to the Australian Species

1. Outer sepals obtuse, large, as wide as or wider than twice the width of inner sepals; third (or in-out) sepal oblique. 31. B. pannosa

1. Outer and inner sepals equal, subequal or slightly unequal; third (or in-out) sepal symmetrical. 2

2. Corolla large, longer than 2.5 cm.; leaves mostly 3 cm. or longer, rarely shorter, 2 cm. or wider, mucronate at the apex. 9. B. dietrichiana

2. Corolla small, 2 cm. or shorter; leaves 2.5 cm. or shorter, if longer, blades linear or oblong and narrower than 1.5 cm., acute, obtuse or emarginate at the apex, if mucronate, mucro minute, shorter than 1 mm. 3

3. Leaves linear, linear-lanceolate or narrow-oblong, usually 5 mm. or narrower; length-width ratio mostly 3 or more. 4

3. Leaves orbicular, ovate, ovate-elliptic, oblong-ovate or ovate-cordate, with length-width ratio less than 2.5. 5

4. Leaves linear, acute or acuminate at both ends, rarely rounded at the base, with length-width ratio of 4 or more; petioles 1-4 mm. long. 26. B. linearis

4. Leaves oblong or linear-oblong, obtuse or rounded at both ends, with length-width ratio less than 4; petioles 0-1 mm. long. 27. B. oblongifolia

5. Plant erect or suberect; leaves orbicular, rarely broadly ovate, emarginate, rounded or obtuse at the apex; sepals densely long-haired; corolla rose, pink or rarely white. 30. B. rosea

5. Plant prostrate or procumbent; leaves ovate, ovate-elliptic or ovate-subcordate, acute or obtuse, rarely emarginate at the apex; sepals finely pubescent or villous; corolla white or blue. 6

6. Leaves cordate at the base and acute at the apex. 28. B. brevifolia

6. Leaves rounded, obtuse or subcordate at the base, obtuse or emarginate at the apex; if acute then base not cordate. 29. B. media

Key to the American and Hawaiian Species

1. Outer sepals twice the width of inner sepals or wider, obtuse or rounded in contrast to inner acute or acuminate sepals. 2

1. Outer and inner sepals equal, subequal or slightly unequal, acute, obtuse or acuminate at the apex, rarely slightly different. 4

2. Pedicels longer than 1 cm.; inflorescences loose cymes of 3-7 flowers, rarely more than 7 flowers; peduncles long; secondary peduncles longer than 1 cm. 3

2. Pedicels very short, rarely as long as 7 mm.; inflorescences dense capitate clusters of more than 10 flowers; peduncles short; secondary peduncles absent. 21. B. ferruginea

3. Leaves 5-12 cm. by 3-8 cm., cordate or subcordate at the base; outer sepals 2 cm. by 1.7 cm.; styles free almost to the ovary. 24. B. kuhlmannii

3. Leaves 5.5-7 cm. by 3-4 cm., obtuse or truncate at the base; outer sepals 8-12 mm. by 7-10 mm.; styles fused at least lower one-third or half. 25. B. peruviana

4. Sepals consistently, both outer and inner, acute or acuminate at the apex. 5

4. Sepals obtuse, rounded or slightly emarginate at the apex. 13

5. Flowers in dense capitate or umbellate cymes; individual flowers sessile, rarely shortly pedicellate. 6

5. Flowers solitary or loose cymes of 3-7; individual flowers pedicellate. 7

6. Leaves elliptic, oblong-elliptic, 4 cm. or shorter, 2 cm. or narrower, obtuse-mucronate or acute-mucronate at the apex, lanate at least on the lower surface; corolla shorter than 1.5 cm.; inflorescence a dense terminal head. 23. B. sphaerocephala

6. Leaves ovate or ovate-lanceolate, longer than 4 cm. or wider than 2.5 cm.; acuminate or acute at the apex, glabrous or puberulous; corolla 1.8 cm. or longer; inflorescence axillary. 18. B. holtii

7. Leaves linear, linear-lanceolate, narrowly elliptic or narrowly oval-elliptic, with length-width ratio of 2 or more, usually narrower than 1.5 cm., rarely slightly wider. 8

7. Leaves ovate, broadly elliptic or ovate-elliptic, with length-width ratio of less than 2; if 2 or more, stem longer than 1 m., usually wider than 1.5 cm.; if narrower then ovate or orbicular. 9

8. Corolla blue or purplish blue, 3 cm. or longer; sepals 7 mm. or wider, densely villous, velutinous or tomentose; leaves densely velutinous. 15. B. multicaulis

8. Corolla white, shorter than 3 cm.; sepals 6 mm. or narrower, finely or densely sericeous; leaves sericeous. 16. B. sericea

9. Sepals ovate or ovate-lanceolate, with length-width ratio of 1.5 or less, usually 11 mm. or shorter, densely tomentose, velutinous or villous. 10

9. Sepals lanceolate or oblong-lanceolate, with length-width ratio of more than 1.5, glabrous, puberulous or finely sericeous. 11

10. Corolla blue, 3 cm. or longer; leaves ovate or orbicular, 2.5 cm. or shorter; stem 1 m. or shorter, procumbent or suberect. 14. B. ovalifolia

10. Corolla white or yellowish, 2.5 cm. or shorter; leaves elliptic, oblong-elliptic, oblong-lanceolate or rarely ovate or orbicular; stem longer than 1 m., scandent or twining. 10. B. menziesii

11. Corolla shorter than 2.5 cm., 2.3 cm. or narrower at the limb. 13. B. sulphurea

11. Corolla 3 cm. or longer, wider than 2.5 cm at the limb. 12

12. Flowers in simple or compound cymes; pedicels 1 cm. or longer; leaves elliptic or ovate-elliptic, 3.5 cm. or longer. 12. B. elliptica

12. Flowers solitary or rarely in simple cymes; pedicels shorter than 1 cm.; leaves ovate or ovate-orbicular, 3 cm. or shorter. 11. B. grandiflora

13. Sepals glabrous or merely ciliate at the margin, rarely sparsely pubescent; leaves glabrous or sparsely pubescent. 14

13. Sepals, at least inner sepals, tomentose, sericeous or ferrugineous, rarely glabrescent; leaves tomentose, sericeous or villous at least on the lower surface, rarely glabrate. 16

14. Leaves oblong or oblong-elliptic; inflorescences umbellate cymes of 5 or more flowers, rarely 3 flowers. 22. B. umbellata

14. Leaves ovate or ovate-subcordate; flowers solitary or in simple cymes of 2 or 3. 15

15. Stem longer than 1 m., twining or scandent; styles fused to the middle or higher; leaves glabrous, attenuate or acute at the apex. 34. B. balansae

15. Stem 70 cm. or shorter, erect or suberect; styles free nearly to the base; leaves with scattered hairs, obtuse or truncate and mucronate at the apex. 35. B. corumbaensis

16. Individual flowers sessile or subsessile, occasionally with pedicels up to 1-2 (3) mm. long; peduncles of individual cymes absent. 17

16. Individual flowers pedicellate or solitary and pedunculate, with pedicels 3 mm. or longer; if shorter, individual cymes or flowers pedunculate. 19

17. Corolla 1.2 cm. or shorter; leaves glabrous above. 20. B. brevipedicellata

17. Corolla 1.5 cm. or longer; leaves sericeous or tomentose above. 18

18. Corolla white. 39. B. subsessilis

18. Corolla purple, violet or with purple eye. 40. B. mattogrossensis

19. Stem 1 m. or shorter; if longer, leaves 3.5 cm. or shorter, rounded or obtuse at the apex. 20

19. Stem mostly longer than 1.5 m.; if shorter, leaves acute or acuminate at the apex. 21

20. Stem erect or suberect, 30-60 cm. long; leaves sparsely pubescent or becoming glabrous. 35. B. corumbaensis

20. Stem slender, prostrate or climbing, usually longer than 70 cm.; leaves densely sericeous or villous. 17. B. boliviana

21. Flowers solitary, rarely in simple cymes. 43. B. langsdorffii

21. Flowers in simple or compound cymes, pseudopanicles or racemose panicles. 22

22. Leaves glabrous on the upper surface, rarely with scattered hairs. 23

22. Leaves sericeous or tomentose on the upper surface. 26

23. Corolla 1.2 cm. or longer; flowers in dense capitate clusters; styles shorter than 1 cm. 20. B. brevipedicellata

23. Corolla 1.5 cm. or longer; flowers in loose cymes, panicles or pseudopanicles. 24

24. Pedicels 1 cm. or longer; inner sepals rounded at the apex; outer sepals uniformly appressed sericeous. 19. B. maripoides

24. Pedicels shorter than 1 cm.; inner sepals truncate or slightly emarginate, rarely rounded at the apex; outer sepals tomentose or glabrate. 25

25. Veins distinctly impressed on the upper surface; intercostal veins prominent at least on the lower surface; leaves mostly elliptic, 9 cm. or longer, acute or obtuse at the base. 36. B. agrostopolis

25. Veins not impressed on the upper surface; intercostal veins obscure; leaves mostly ovate; if oblong or elliptic, blades 8 cm. or shorter, rounded, obtuse or subcordate at the base. 33. B. trichantha

26. Leaves subcordate or rarely truncate at the base; obtuse, rounded or slightly emarginate at the apex. 38. B. tomentosa

26. Leaves obtuse, rounded or truncate at the base; acuminate or acute, rarely obtuse at the apex. 27

27. Leaves elliptic or oblong-elliptic, 9 cm. or longer, sparsely pubescent or glabrescent above; ovary glabrous. 36. B. agrostopolis

27. Leaves ovate or ovate-elliptic, shorter than 8 cm., densely tomentose or sericeous, rarely sparsely so on the upper surface; ovary pilose at least at the apex. 37. B. burchellii

I. Section: Bonamia

Stems woody or becoming woody, occasionally slender, twining, scandent, prostrate, procumbent or suberect, commonly long, rarely slightly shorter than 1 m., occasionally attaining several meters long. Leaves petiolate or shortly petiolate, soft, herbaceous, subcoriaceous or somewhat leathery, rarely thin; blades mostly elliptic, elliptic-oblong, ovate, cordate or rarely lanceolate or oblong, usually large, 2.5 cm. or longer, 1 cm. or wider, rarely slightly short or slightly narrower, rounded, truncate, subcordate or cordate, rarely slightly attenuate at the base, acuminate, obtuse or acute at the apex. Flowers solitary or in cymes of few to several flowers, in cymose panicles or in capitate or dense clusters, usually pedunculate; individual flowers distinctly pedicellate; pedicels short or up to 2 cm. long; bracts small or foliaceous. Sepals subcoriaceous or coriaceous, equal or unequal, often large, ovate, lanceolate, oblong-ovate or ovate-acuminate,

acute or obtuse, occasionally short-acuminate at the apex. Corolla blue, purplish blue, white or red, usually large, 2 cm. or longer, sometimes slightly shorter, subentire, lobulate or lobed at the margin. Stamens included or partially exserted; filaments sparsely or densely long-villous or pilose, often glabrous or nearly glabrous; anthers 2 mm. or longer, sagittate or cordate at the base. Ovary ovoid or ovoid-conical, long pilose or glabrous; styles free nearly to the base or fused to the middle or higher with a single vascular bundle (up to stigma) in each stylar branch; stigmas small or large, globose, subglobose, conical or capitate. Fruits 4- to 8-valvular capsules, thin-walled, rarely 0.5 mm. thick; seeds glabrous, smooth or punctate, brown or black, 3-6 mm. long, rarely smaller. Cotyledons ovate, ovate-cordate, obovate or linear-bifid, corrugate, multiplicate or slightly folded.

Type: B. alternifolia J. St. Hilaire.

Tropics, subtropics and warm temperate of both hemispheres, covering the whole range of the genus, occurring on all continents.

This section is less homogeneous than the other two sections because of inclusion of several species whose morphology is incompletely known. Future studies may lead to separating it into more than one section or subsection.

1. Bonamia alternifolia J. St. Hilaire, Expos. Fam. 2:349. 1805.
   Bonamia madagascariensis Poir. Encycl. Meth. Bot. Suppl. 1:677. 1810.
   Bonamia thouarsii Elliot, Journ. Linn. Soc. Bot. 29:35. 1891.

Perennial shrubs or woody vines. Stems erect or suberect, with weak branches, terete, finely pubescent or villous while young, becoming sparsely pubescent or glabrescent in age, 1.5-1.8 m. high. Leaves shortly petiolate, coriaceous or subcoriaceous, sparsely appressed-pubescent, more densely so while young; petioles 2-7 mm. long, brown-villous; blades elliptic, ovate-acuminate or obovate, 3-7 cm. long, 2-4 cm. wide, undulate at the margin, acute or obtuse at the base, obtuse-acuminate, obtuse or acute-mucronate at the apex; midrib prominent, with 3-5 pairs of prominent lateral veins; finer veins distinct, clearly visible with naked eye, especially on the lower surface. Inflorescence commonly congested terminal panicles of numerous flowers or few-flowered cymes in axils of upper leaves, shortly pedunculate; peduncles short, 5-10 mm. long. villous or finely pubescent; pedicels as long as peduncles or slightly longer, brown-villous; bracts subulate, 2-4 mm. long or sometimes smaller, deciduous or persistent. Sepals orbicular or ovate, coriaceous, villous, unequal or subequal; the two exterior smaller, mostly 4.5-5.5 mm. long, orbicular, slightly emarginate or rounded at the apex; the interior longer, 6-7 mm. long, rounded or rarely obtuse at the apex. Corolla white, tubular campanulate or funnel-shaped, with cylindrical narrow tube and distinctly lobed limb, indup-

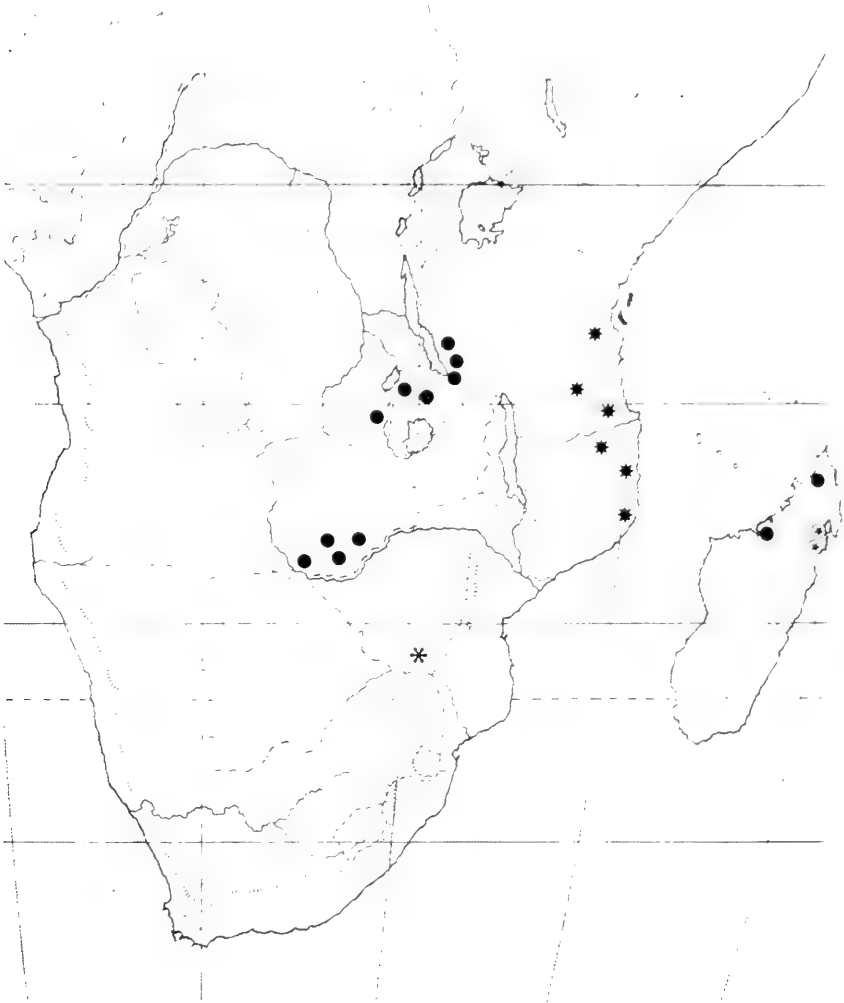
licate in the bud, 1.4-2 cm. long, pilose on interplicae and upper part of tube; corolla lobes 2-3 mm. long, mostly 3 mm. wide, rounded or obtuse at the apex. Stamens exserted; filaments adnate to the corolla tube, glabrous above, with scattered long hairs below, distinctly longer than styles; anthers dorsifixed, versatile, introrse, oblong, 2.5-3 mm. long. Ovary conical, glabrous; styles free to the base, glabrous; stigmas capitate, warted or rugose. Capsules with tightly appressed sepals, glabrous, slightly woody, ovoid, cuspidate or apiculate, 2- to 4-seeded, apparently two-valved (really four-valved), somewhat woody; seeds glabrous. Cotyledons ovate, folded.

Type: Madagascar. Type specimen not seen, presemably at Paris.

This species is endemic to Madagascar, where it grows at low altitude (Map 1). One collector (Mocquerys 176) noted forest as the habitat of this species. It has been collected in flower in November. The flowering period otherwise is not definitely known.

Bonamia alternifolia is somewhat related to B. spectabilis but differs from it in many features. It is a very recognizable species of the genus with the following distinctive characteristics: (1) strongly nerved leaves with undulate margin, (2) terminal congested panicles, (3) closely appressed sepals, (4) distinctly lobed corolla with narrow limb and long tube, (5) exserted stamens with versatile anthers, (6) styles free to the base, (7) warted or rugose stigmas, (8) somewhat woody capsules with slightly appressed sepals, and (9) glabrous seeds. Of these several differences from other species in the genus, lobed corolla and exserted stamens are most outstanding and were paid serious attention by earlier botanists in maintaining it as a monotypic genus. Its slightly woody capsules (which dehisce into two valves) indicate a slight affinity to the members of section Trichantha, but it differs from the latter by its glabrous seeds.

This species is the type species of the genus, first described by Thouars (1805) without a binomial name. In the following year J. St. Hilaire published Bonamia alternifolia for the plant Thouars had described. Although this binomial was published earlier for the species later described as B. madagascariensis Poiret (1810), the latter name has replaced it in most recent literature. This adoption of the later name is probably owing to the fact that St. Hilaire's publication was rare, and since the name was included only in the appendix of Index Kewensis, it was overlooked. House (1907) first found this overlooked name and designated it as the type species of the genus. But the compiler of conserved generic names did not note House's designation of the type, thus resulting in the citation of B. madagascariensis as the type species of Bonamia in the International Code.



Distribution of

⊕ B. alternifolia ✸ B. mossambicensis

● B. spectabilis ✻ B. velutina

Map 1

B. alternifolia must be reinstated as the correct name for the species, and the improper choice of name in the Code should be corrected in the future.

Specimens examined:
MADAGASCAR: Soanierana, Rivieroever, liana, bl. wit, welriekend, Lam en Meeuse 5548, 30.11.1938 (L); Maroa, Forets a l'interieur de la baie d'Antongil, Arbre mince, elance, fleurs blanches, A. Mocquerys 176, 1897 (G); M. Richard de Bourbon 1966 (G). Unknown collector: N. de Madagascar, #367 (L).

2. Bonamia spectabilis (Choisy) Hall. f. Bot. Jahrb. 16:529. 1893.
Breweria spectabilis Choisy. Mem. Soc. Phys. Geneve 8:68 1839.
Breweria hildebrandtii Vatke, Linnaea 43:523. 1882.
Type: Hildebrandt 2903
Bonamia hildebrandtii (Vatke) Hall. f. Bot. Jahrb. 18:91 1893.
Bonamia minor Hall. f. Bot. Jahrb. 18:91. 1893.
Type: Pogge 1214
Bonamia minor var. argentea Fries, Wiss. Ergebn. Schwed. Rhod.--Kongo--Exped. 1:268. 1916. Type: Fries 827

Perennial, woody, climbing or twining, rarely trailing vines, growing all year around. Root thick, woody; stems terete, frequently ridged, sparsely appressed-pubescent, becoming glabrous in age, about 1.5-2.5 mm. in diameter. Leaves petiolate, membranous to subcoriaceous, glabrescent and green or silvery pubescent above; moderately or densely silky pubescent below; petioles mostly 5-12 mm. long, slightly winged and canaliculate above, minutely appressed-pubescent or becoming glabrous in age; blades elliptic, 1.8-5.5 cm. long, occasionally shorter, 6-20 mm. wide, sometimes slightly wider, entire at the margin, attenuate or cuneate at the base, acute or obtuse and apiculate at the apex, with about 5-8 pairs of lateral veins. Inflorescences shortly pedunculate cymes of 2-3 or few flowers, aggregated towards the end of branchlets; peduncles and pedicels mostly 5-10 mm. long, pubescent or glabrescent; bracts small. Sepals oblong-elliptic, 7-8 mm. long, abruptly acute, rarely obtuse, silky pubescent outside. Corolla blue, funnel-shaped, (1.5) 2-2.5 cm. long, silky pilose on interplicae, entire or subentire. Stamens included; filaments dilated and hairy below; anthers oblong with cordate base. Ovary glabrous; style bifid from about the middle or lower; stigmas ellipsoidal, rugulose. Capsule globose, about 7 mm. in diameter, shortly apiculate, glabrous. Seeds ovate-oblong, compressed on the inner side, 3-4 mm. long, brownish or blackish, with hyaline golden wings on edges. Cotyledons oblong, deeply bifid; cotyledonary petioles fused.

Type: Madagascar, Bombatok, Bojer (K - lectotype, not available; W - isotype!)

Republic of Congo, Northern Rhodesia, Tanganyika and Madagascar (Map 1).

Collectors recorded edge of dense forest, savannah forest on steep rockhills, mixed woodlands on sandy slopes, and degraded thickets on Kalahari sands at edge of river flats as habitats of this species. It has been collected in flower from March through December and in fruit from July through December.

Hallier (1897), after careful study of the Madagascarian species, treated B. hildebrandtii as conspecific with B. spectabilis, although he had accepted them previously (1893) as distinct species. He retained B. minor which he described in his earlier work. The type specimen of B. minor has not been seen in the present study, but a number of sheets which Hallier annotated have been examined. Hallier used the glabrous stem as a principal feature to distinguish it from B. spectabilis. Examination of sheets annotated by him shows pubescence to be consistent only if they are compared with specimens annotated by him as B. spectabilis. If one considers the additional collections now available it seems apparent that the characteristic which Hallier mentioned falls well within the total range of variation of a single species. Verdcourt (1963), realizing this fact, remarked, "Hallier unites B. hildebrandtii and B. spectabilis but retains B. minor as distinct. B. hildebrandtii is, however, undoubtedly identical with B. minor....."

This species is highly polymorphic in several features, particularly leaf shape and size (Figure 1), and villosity on stem and leaves. Future collections might reveal consistent features to account for the infraspecific groups in it.

Specimens examined:

REPUBLIC OF CONGO: KATANGA: Kasenga, W. Robyns 1845, 3. IV. 1926 (K).

MADAGASCAR: Env. de Majunga, C.D. Alleizette, 30. XI. 1906 (L); Central Madagascar, R. Baron 4906 (BM); Seandit in sylvis juxta Mazangay in Bombatok ora occidentalis ins. Madagas: Flor. Aug. 5. Flores in spicam longam congregati Cyanei, Bojer, II. q. 1830 (W); Nosse-be, J.M. Hildebrandt 2903, April 1879 (BM, L, W); Beravi interior: Gebrige, fl. albi, Hildebrandt 3093, July 1879 (BM, W); Nosifaly 8 (L); Iles Maurice, de Madagascar et Comorres, Mac William, Aout-Octobre 1838 (G).

NORTHERN RHODESIA: Barotse: Sesheke, climbing over small shrubs on edge of dense Baikiaea "mutemwa", Longe Forest, N. of Machile, climber with bright blue flowers, A. Angus 956, 19. 12. 1952 (EA); on Kalahari sand in open degraded Baikiaea "mutemwa" on edge of Kazu Forest near Machile, suffrutex with woody rootstock and numerous small shoots together, flower blue, Angus 983, 20. 12. 1952 (EA); Abercorn Dist. 2700 ft. B.D. Burtt 6325, 20. 5. 1936 (BM, EA); Barotseland, Nangweshi, 3400 ft., semiwoody climber in mixed woodlands on sandy slopes, blue flowers, L.E. Codd 7156, 23. 7. 1952 (L); between Pemba and Mazabuka, I.B. Pole Evans 2807, 11. 7. 30 (K); L. Mweru Dist. common vine scrambling over evergreen thicket, blue, showy with paler or white guide lines, D.B. Fanshawe F-4653, 6. 8. 1958 (EA); Abercorn Dist., A.H. Gamwell 68 (BM); Abercorn Dist. Alt. 4800 ft., A.H. Gamwell 94, August 1935

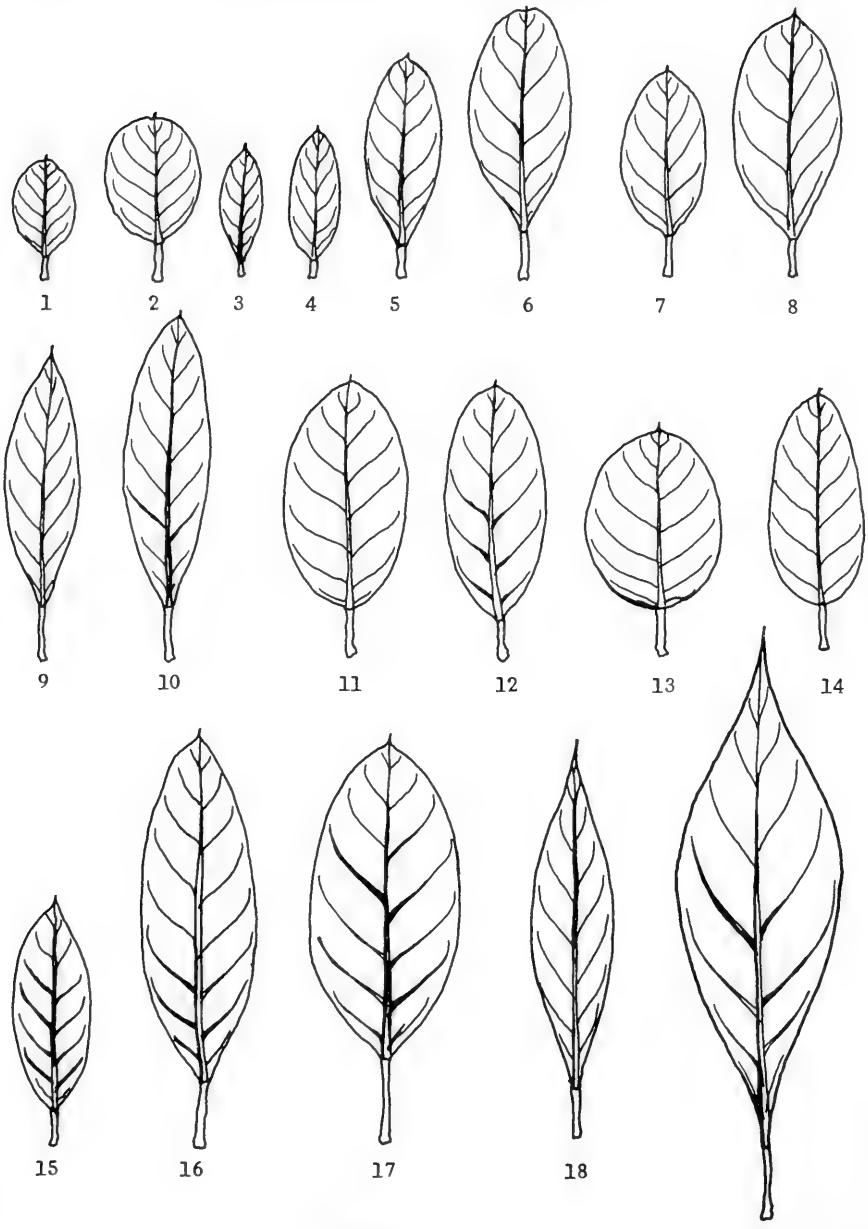


Figure 1

Variations in sizes and shapes of leaves in Bonamia spectabilis

(BM); Kafue 35 mi. s. of Lusaka, near Kafue Methodist Mission, roadside, climbing over shrubs and on red soils, A.E. King 55, 11 July 1955 (K); Mpulunga Road 10 mi. from Abercorn, 4000-5000 ft., herbaceous climber, flowers delicate sky blue, leaves dull green, pubescent, R.M. Lawton 208, June 1955 (EA); roadside, Kafue River, flower blue, plant mat forming, Leach and Brunton 9997, 12. 6. 60 (EA); J.D. Martin 196 (K); Abercorn Mpulunga Road, not far from Mukoma turning, alt. 4000 ft. on bank and trailing over low bushes, in a tangled mass, Mrs. H.M. Richards 5307, 5. 4. 1955 (EA); Mporokoso Dist., Sumba Malango Road, 900 m. in sandy soil on side of road, trailing plant, Mrs. Richards 6264, 24. 9. 1956 (EA); 26 mi. north of Choma, dry bush by roadside, climber rising on shrubs to height of 12 ft., E.A. Robinson 767, 17. V. 1954 (K); southern prov., Mazabuka Dist., Choma to Lusaka, Gt. North Road, mile 34, growing in Pterocarpus angolensis--Combretum mechowianum woodland, F. White 2285, 19. III. 1952 (EA); Namwala Dist., 20 mi. west of Mamwala Boma, growing in degraded thicket on Kalahari sands at edge of Kafue Flats, White 2962, 22. VI. 1952 (EA).

TANGANYIKA: Mpanda Dist., Masigo, Mulele Hills Forest Reserve, alt. 4500 ft., blue flowered creepers in thicket, J. Proctor 2086, July 1962 (EA); Ufipa Dist., Kasanga, alt. 840 m., side of road in very gritty soils, climbing over low bushes, Mrs. Richards 10093, 13. 6. 1957 (EA, K); Escarpment above Kasanga, alt. 900 m., climbing over dense vegetation by twining stems, Mrs. Richards 11001, 30. 3. 1959 (EA).

3. Bonamia densiflora (Baker) Hall. f. Bull. Herb. Boiss. 5:999. 1879.
Breweria densiflora Baker, Journ. Linn. Soc. Bot. 25:336. 1890.

Perennial twining vines. Stems slender, woody or becoming woody, terete, finely striated or smooth, finely pubescent and glabrescent; internodes mostly 2-5 cm. Leaves shortly petiolate, soft-subcoriaceous or herbaceous, sericeous with very fine, soft, appressed hairs when young, becoming sparsely sericeous or nearly glabrous (except on veins) in age; petioles 2-4 mm. long, 0.5 mm. thick, sparsely sericeous with soft hairs; blades oblong-elliptic or lanceolate-elliptic, 3-4.8 cm. long, 1-1.4 cm. broad, rounded or subtruncate at the base, obtuse-mucronate or acute-mucronate at the apex; midrib slightly impressed above, distinct beneath, with 6-8 pairs of thin lateral veins. Inflorescences axillary, pedunculate, umbellate cymes of three to seven flowers or terminal panicles; peduncles slender, short, 1-2 cm. long, finely pubescent or becoming sparsely so; pedicels slender, 3-6 mm. long, becoming slightly longer in fruit-bearing stage, sparsely soft-sericeous; bracts minute, linear, 0.5-1.5 mm. long. Sepals ovate or ovate-orbicular, rounded or slightly emarginate at the apex, coriaceous or subcoriaceous, soft-sericeous outside, slightly unequal; outer two ovate, mostly 3 mm. long, 2 mm. broad, and rounded at the apex; inner three orbicular or ovate-orbicular, 3-4 mm. long, mostly 3 mm. broad and slightly emarginate at the apex, scarious at the margin. Corolla white,

shortly tubular-campanulate or funnel-shaped, 1.2-1.8 cm. long, densely soft-pilose on interplicae. Stamens inserted; filaments filiform and glabrous above, dilated and villous below; anthers oblong, 1.5-2 mm. long, sagittate at the base. Ovary ovoid-conical, with distinct circular disc at the base, glabrous; styles filiform, glabrous, bifid for upper one-third or one-fourth; stigmas small, capitate. Capsules globose-subacute, 4-6 mm. long, apiculate, glabrous, 2- to 4-seeded, 4 valvular; seeds ovate-oblong, 3 mm. long, black or dark brown. Cotyledons deeply bifid; cotyledonary petioles short.

Type: Madagascar, R. Baron 5868 (K-not seen).

Known only from Madagascar.

Collectors give no definite location nor habitat. It was collected only a few times during the last century, and no recent collection is available for the present study. The species is poorly known, and the above description is mainly based on a single specimen and the original description by Baker.

The outstanding features of this species are (1) slender and sparsely sericeous stem, (2) softly sericeous and glabrescent leaves, thin in texture, (3) ovate-orbicular or orbicular and small sepals and (4) smaller corolla. It is a close relative of B. spectabilis from which it can be distinguished by its finely sericeous and glabrescent leaves, smaller sepals and shorter corolla. When a larger number of specimens of this species, showing more completely the variations to be found in it, is available in the future, its separation from B. spectabilis might be reconsidered.

Specimen examined:
MADAGASCAR: "N. de Madagascar, No. 213" unknown collector (L).

4. Bonamia thunbergiana (Roem. et Schult.) Williams, Bull. Herb. Boiss. (ser. II) 7:371. 1907.
Convolvulus Thunbergianus Roem. et Schult., Syst. Veg. IV: 884. 1819.
Convolvulus cymosus Thunberg ex Roem. et Schult., Syst. Veg. IV:303. 1819; not C. cymosus Desr. in Lamarck Encycl. Meth. III: 556. 1792.
Bonamia cymosa (Roem. et Schult.) Hall. f. Bot. Jahrb. 18: 91. 1893.
Convolvulus senegambiae Spreng., Syst. Veg. 1:610. 1825.
Ipomoea senegambiae Choisy, in DC Prodr. 9:351. 1845.
Ipomoea secunda Don, Gen. Syst. IV:282. 1838.
Breweria secunda Benth. in Hook. Niger Fl. 470. 1849.

Perennial, woody climber reaching 4 m. long. Stems twining, terete, 1.5-4 mm. thick, pubescent with brown hairs, densely so while young, becoming glabrous in age. Leaves petiolate, subcoriaceous or membranous, green and glabrous or rarely thinly

puberulous above, densely pubescent with golden brown hairs beneath; petioles mostly 5-13 mm. long, 1 (-1.5) mm. thick, pubescent; blades oblong to oblong-lanceolate, about 2.5-8.5 cm. long, 1.5-3.5 cm. broad, entire at the margin, rounded at the base, obtuse-mucronulate, rarely acute or acuminate at the apex; nerves sunken above, prominent beneath; lateral nerves about 6-10 pairs. Inflorescences dense cymes of many flowers, usually secund on short peduncles or congested into a terminal panicle; peduncles 5-15 mm., tomentose; pedicels 5-10 mm, tomentose; bracts minute, lanceolate. Sepals oblong-lanceolate to ovate, acuminate or acute at the apex, about 6-8 mm. long, the inner slightly shorter, coriaceous to glumaceous, densely silky tomentose on the back. Corolla white, 1.6-2 cm. long, obscurely lobed or subentire; outside pilose or hirsute on the interplicae, glabrous on the plicae. Stamens included; filaments unequal, filiform, widening toward the base, glabrous above, pilose along the edge near the base; anthers oblong, cordate at the base. Ovary ovoid, with a disc at the base, pilose near the apex; style bifid above the middle, with scattered long hairs; stigmas conical, rugose. Capsule ovoid, 8-valved, 4-seeded, rarely less, apiculate, glabrous, about 5-8 mm. long; seeds black, ovate-oblong, glabrous.

Type: Sierra Leone.

Coastal districts of tropical west Africa, from Gambia, French Guinea, Sierra Leone, Liberia, Ivory Coast, Gold Coast, Nigeria, Cameroun and the western part of Congo Republic (?) (Map 2).

It has been collected in flower from November to May and in fruit from December to April.

Hallier in his Convolvulaceae of Africa and monograph of the genus, used the specific epithet cymosa, since he had overlooked Roemer and Schultes' correction of cymosus to thunbergianus in the errata at the end of the volume. As pointed out by Williams (1907), the epithet cymosus is illegitimate since it is preoccupied by C. cymosus of Desrousseaux. The species was first collected by Thunberg in Sierra Leone and was named in his honor.

Specimens examined:

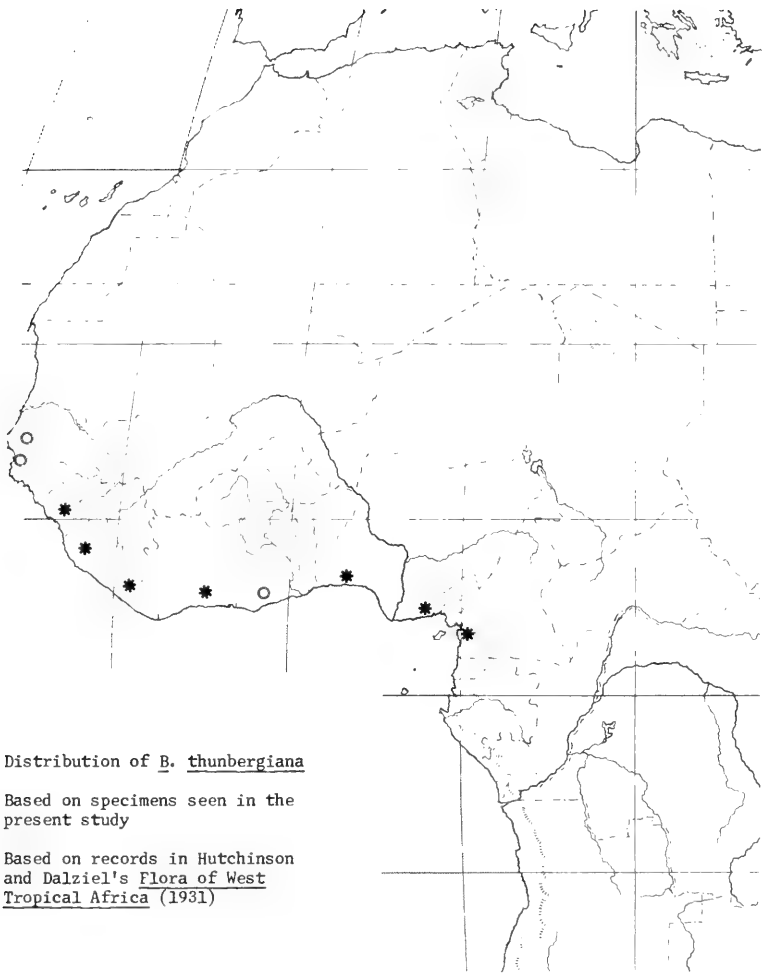
CAMEROUN: Gross-Batanga, M. Dinklage 684, Ende Juni 1890 (HBG); Dinklage 684, 16. XI. 1890 (HBG); Bipende, Urwaldgebiet, G. Zenker 4112, 1911 (BM).

FRENCH GUINEA: Kouakry, Boue 38, II. 1910 (G); Mamou, G. Roberty 10600, 9. 2. 1948 (G).

FRENCH WEST AFRICA: Adiopodoume N (B. 30. 8. Df.), Roberty 15655, 24. 11. 1954 (G); U Zo, NW. (B. 29. 22. Bd.), Roberty 16076, 17. 12. 1954 (G).

IVORY COAST: Mau, Roberty 6737, 26. 12. 1946 (G); Basse cote d'Ivoire, secteur cotier, boisements perilagunaires, Dabou, Roberty 13626, 1950-51 (G).

LIBERIA: Along Dukwia R., vine with white flowers, common name Doo, G.P. Cooper 220, 1929 (F, NY, US); Monrovia, Max Dinklage 2148,



Distribution of B. thunbergiana

✱ Based on specimens seen in the present study

○ Based on records in Hutchinson and Dalziel's Flora of West Tropical Africa (1931)

1903-04 and 2399, 9 Jaunar. 1909 (B); 3 mi. north-east of Guacoco, Gbarnga, central prov., thicket, gravelly soil, vine 9 ft. tall, V.P. Konneh 125, Feb. 17, 1951 (MO); within a radius of 20 mi. from Kakatown, A. Whyte, April 1904 (BM, W).

NIGERIA: Baikie's Nigeria Expedition (Lagos), C. Barter 2227, 1857-59 (GH); main road from Oron to Eket--28 mi., mostly farm clearing, Eket Dist., southern Nigeria, P.A. Talbot, 1912-13 (BM); white, tinted palest mauve at edge of corolla, Oban, P.A. Talbot 88A (=1535), 1909 (BM).

SIERRA LEONE: Afzelius (BM); R.H. Bunting, 1913-14 (BM); Njala, Allison v. Armour Expedition 1926-27, J.M. Dalziel 8048, 20. 1. 27 (US); Makump, roadside and old farms, creeper with white flowers, Temne--"Rakil," R.R. Glanville 108, 9. 12. 1928 (K); Mamansu, V. Marmo 145, 30. 11. 1958 (K); bush near Regent, Mahera, Kitchom, G.F. Scott-Elliot 3930, Dec. 6. (BM, GH); Scott-Elliot 5835, March 4, 1892 (BM); climbing over bushes near Madina, Scott-Elliot 5865 (BM); Smeatman (BM); Rornks, alt. 200 ft , N.W. Thomas 5780, 24. 11. 1914 (EA); Magvile, alt. 100 ft., Thomas 6385, Dec. 8, 1915 (BM); Thomas 6604, 1915 (B), 6818, Dec. 23 - Jan. 2, 1914-15 (B), 6860, 1915 (B), 7051, Dec. 31, 1914 (B), 8513, 1915 (W).

(?) CONGO REPUBLIC: oubangui, Reg. de Tanga, Herb. de C. d'Alleizette, May 1920 (L).

5. Bonamia mossambicensis (Klotzsch) Hall. f. Bot. Jahrb. 18:91. 1893.

Prevostea mossambicensis Klotzsch in Peters, Reise Mossamb. Bot. 1:244, t. 39. 1861.

Breweria buddleoides Baker, Kew Bull. 1894:69. 1894.

Perennial, shrubby climbers to 4-5 m. Stems terete, velvety with patent and tangled hairs, white or grey in life, golden-brown when dry. Leaves shortly petiolate, coriaceous or subcoriaceous, velvety pubescent, more densely so beneath; petioles 4-10 mm. long, velvety pubescent with hairs similar to those on the stems, blades elliptic lanceolate to oblong-ovate, 2.5-8.5 cm. long, 1-4.8 cm. wide, rounded or slightly cordate at the base; acute, acute-mucronulate, acuminate or apiculate at the apex; veins distinctly depressed above, prominent below; about 6-10 pairs of lateral veins. Inflorescences capitate, bracteate, densely hirsute, shortly pedunculate or nearly sessile; peduncles up to 3.2 cm. long; pedicels almost absent; bracts elliptic or oblong-elliptic, 1-1.2 cm. long, 5-8 mm. wide, hirsute outside, almost glabrous inside. Sepals unequal, coriaceous except near the apices of outer ones; the two exterior larger and hirsute near the apices. Corolla blue, funnel-shaped, 2 cm. long, subentire or almost entire; outside pilose on interplicae, glabrous on plicae. Stamens included; filaments short, unequal, adnate to corolla tube, glabrous or with scattered hairs; anthers oblong, about 2 mm. long and 1 mm. broad. Ovary hairy at the apex; style bifid above the middle; stylar branches unequal; stigmas ovoid or globose, rugose. Capsule 4-valved, 2 (-4)-seeded, thin-walled, hairy outside, at least at the apex; seeds ovate-oblong, 2-3 mm. long, dark brown with narrow hyaline wings on edge. Cotyledons ovate-cordate.

Type: Mozambique, Sena, Peters (B-holotype-not available).

Restricted to thickets and secondary evergreen forests on loam and sand in coastal districts at the altitude of 120-450 m. in Mozambique and Tanganyika (Map 1).

The outstanding characteristics of this species are: (1) densely velvety pubescent leaves and stems, (2) foliaceous bracts, (3) capitate, densely hirsute inflorescences, (4) absence of pedicels and (5) short peduncles.

Specimens examined:

MOZAMBIQUE: Port Amelia, white, R. Dummer 64, July 1913 (BM); Niasa Dist., Port Amelia, 150 ft. "fl. sky blue," J. Gerster 7172, 24. 6. 1949 (L, K); 4 mi. west of Lumbo; pale mauve blue, L.C. Leach and Rutherford-Smith 10944, 21. 5. 1961 (EA); 11 km. on the road to Monapo on light sandy soil, Pedro-Pedrogar 3139, May 5, 1948 (EA); between Femad Veloso and Nacala on red sandy soil in dense secondary bush-thicket, Pedro-Pedrogar 4813, Aug. 15, 1948 (EA); Trepadeira de flores azul-purpures, Mocimboa da Praia, entre Diaca e Meuda, Pedro-Pedrogar 5216, Sept. 15, 1948 (EA).

TANGANYIKA: Orero-Kilwa Kivindje, Braun 1304, 4. 11. 1906 (EA); Daressalaam Dist., Puguhills; exposed banks and railway cuttings; trailing or rambling habit to 4 ft.; fl. pretty sky blue, leaves silver green, B.D. Burtt 4470, 25. 4. 1933 (K); W. Busse 2565 (1903) (EA) and 2467a (EA); Kisarawe, Karonzurir (Kizaramo), a scandent shrub with clusters of pale blue flowers, very common with Dichapetalum spp. and Acacia pennata in Antidesma, Xylopia, Trema, Diospyros, Enclea; secondary evergreen forest on red sandy soils, 1000 ft. alt., P.J. Greenway 4993, 1. 8. 1937 (EA); Lindi, Mkae Plantation; blue creeper which affects badly most of the land on the estate, Manager 14, 5. 1932 (EA); Tandagura to Lindi, foot of Notoplateau, alt. 900 ft., old farm land, climber furry stalk and leaves, fl. terminal buff bracts, blue, monopetal, F.W.H. Migeod 812 and 813, 22. 8. 30 (BM); Usaramo, Puguberge, bem. 21. 5-24, 5, entland der Bahnstrecke, blace, A. Peter 31316, 24. X. 1926 (B); Daressalam--Mbagara--see, P. Schlingt, blau, Peter 44927, 5. IX. 1926 (B); Bagamoyo--Mapinga, Meist Verblicht, tila, Peter 51646, 5. XII. 1915 (B); Usaramo bei Toga, Peter 51649, 13. XII. 1915 (B); Usambara, Bwiti Urwald bei Maramba, Blau, ca. 280 m., Peter 51705, 6. VI. 1917 (B); Mahenge, Sali, ca. 35 km. sudlich Station Mahenge Savanne and Bushland, 900-1000 m. scclinger, vereinzelt, Blute blau, H.J. Schlieben 2242, 24. 5. 1932 (B, BM, G, HBG); 40 km. west of Lindi, 240 m. u. M. Lutamba-see, schlinger in gr. Gruppen uber Stranchern sehr haufig, Schlieben 5193, 29. 8. 1934 (B, BM, G, HBG); Usaramo, Stuhlmann 105, 18. VIII. (18)88 (HBG); Pugu Hills, powder blue flowers, very common all up the road, J.H. Vangham 2340, April 13, 1936 (EA); 41 mi. from Daressalaam on main road to Morogoro, climbing over trees and shrubs in hillside thicket margins; also trailing plant on roadsides; climber, 10-12 ft.; stem covered with greyish white hairs, sage green, paler on backs; corolla tube cream. lobes pale blue, very common, J.R. Welch 303, July 4, 1955 (K).

6. Bonamia cordata (Hall. f.) Hall. f. Bull. Herb. Boiss. 7:43 1899.
Prevostea cordata Hall. f. Bot. Jahrb. 18:93. 1894.
Not Breweria cordata Blume. Bydr. Fl. Nederl. Ind. 722. 1825.

Perennial twining vines. Stems woody, terete, twining, long, finely villous, more densely villous when young; internodes 6-10 cm. long. Leaves petiolate, soft, herbaceous, thin or sometimes submembranous, moderately or densely villous or scabrous on the upper surface, densely villous of ferrugineous on the lower surface; petioles 1.5-3 cm. long, villous; blades ovate-cordate to ovate-acuminate, 4.5-7.5 cm. long, 3-5 cm. wide, cordate at the base, acuminate or acute at the apex; midrib impressed above, prominent beneath, with 6-10 pairs of lateral veins. Inflorescences axillary, pedunculate cymes of few to several flowers; peduncles long, usually 3-8 cm., 1.5-2 mm. thick, rigid, densely villous or tomentose; secondary peduncles 4-6 mm. or rarely longer; pedicels short or nearly absent; bracts foliaceous, petiolate, ovate-lanceolate, 1-2 cm. long, 6-10 mm. wide, indumentum as on leaves; bracteoles lanceolate or ovate-lanceolate, 5-8 mm. long, sepals coriaceous or soft-coriaceous, unequal; outer sepals orbicular-mucronate or ovate-orbicular, 11-14 mm. in diameter, villous or ferrugineous outside, moderately or densely ferrugineous inside, abruptly acuminate or obtuse-acuminate at the apex; inner sepals small, ovate or ovate-lanceolate, 7-9 mm. long, 4-6 mm. wide, densely ferrugineous or villous outside, glabrous inside, acute at the apex. Corolla and stamens not known. Ovary globose or subglobose, sparsely short-pilose or glabrous; styles bifid to the middle or higher, glabrous; stigmas small, globose. Fruits and seeds not known.

Type: Madagascar (Cote orientale), Boivin 2184, 1846-1852 (G-lectotype).

Endemic to east coast of Madagascar, and known only by type collection, which is incomplete, lacking corolla, stamens, fruits and seeds.

Although the only available material is the type which is fragmentary, this is a very distinct species and can easily be recognized by its unequal sepals, outer enlarged sepals being pubescent on both surfaces, foliaceous bracts and large cordate leaves. It superficially resembles B. semidigyna, to which it seems to be more closely related than to any other species, because of similarity in their indumentum, large cordate leaves, long pedunculate cymes and long internodes. It differs from B. semidigyna in its unequal sepals and foliaceous bracts.

Hallier (1894) hesitantly described this species under the genus Prevostea, presumably because of its unequal sepals. He later transferred it to Bonamia because the sepals are merely unequal and not accrescent as in the genus Calycobolus (=Prevostea).

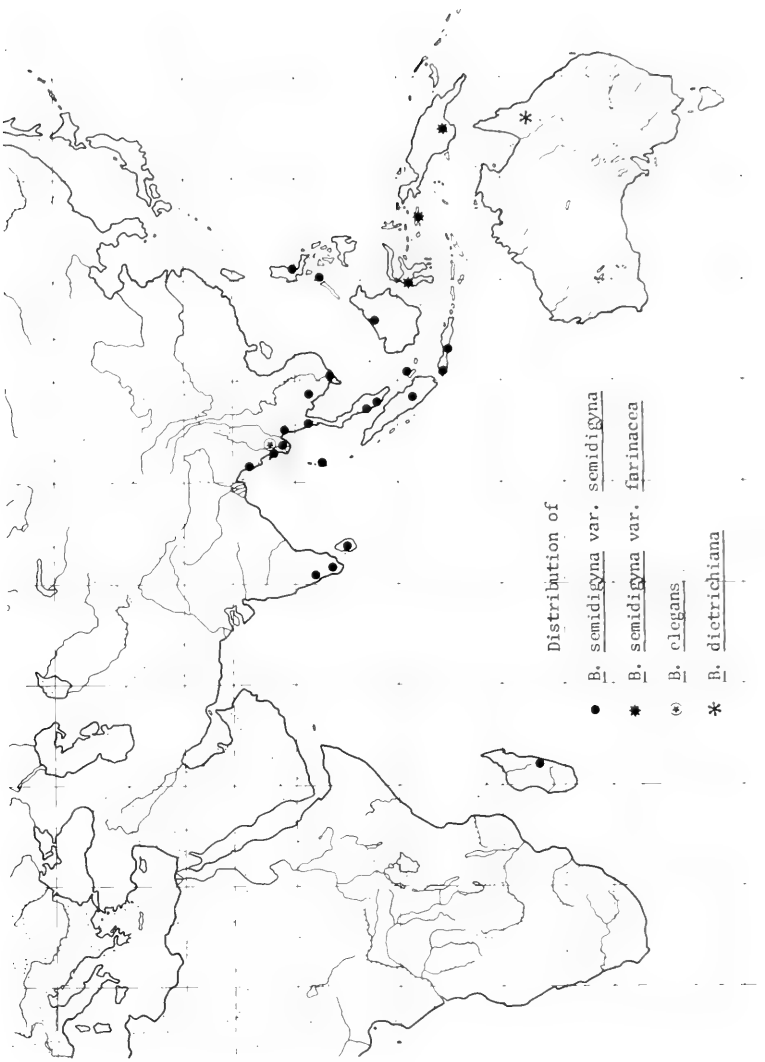
7. Bonamia semidigyna (Roxb.) Hall. f. Bot. Jahrb. 16:528. 1893.
Convolvulous semidigynus Roxb. Fl. Ind. (ed. Carey et Wall.) 2:47. 1824.
Breweria cordata Blume, Byrd. Fl. Nederl. Ind. 722. 1825; not Bonamia cordata (Hall. f.) Hall. f. Bull. Herb. Boiss. 7:43. 1899.
Breweria roxburghii Choisy, Mem. Soc. Phys. Geneve 6:493. 1833.
Breweria madagascariensis Choisy, l. c. 1933; not Bonamia madagascariensis Poir, Encycl. Meth. Bot. Suppl. 1:677. 1810.

Perennial, woody vines. Stems twining to a height of 15 m., terete, densely brown or reddish brown tomentose. Leaves petiolate, subcoriaceous, soft, leathery or membranous, densely or sparsely tomentose underneath; petioles 18-35 (-60) mm. long, tomentose like stems, canaliculate above; blades broadly to narrowly ovate, 6.5-15 cm. long, 4-10 cm. wide, broadly cordate or occasionally truncate at the base, shortly acuminate or cuspidate at the apex; veins impressed above, prominent underneath; lateral veins 5-7 pairs. Inflorescences axillary, pedunculate, umbelliform cymes of 2-5 (-7) flowers, rarely solitary by abortion of lateral flowers; peduncles long, variable in length, mostly 2-12 cm. long, 1.5-2.5 mm. thick, tomentose as the stems; pedicels variable in length, 4-15 mm. long, 1.5-2 mm. thick, densely tomentose; bracts linear or lanceolate, mostly small, rarely foliaceous, 5-10 mm. long, rarely 20 mm. long. Sepals ovate, or ovate-oblong, or ovate-acuminate, equal, subequal or the inner slightly shorter, 7-14 mm. long, densely tomentose, acuminate or acute at the apex. Corolla white, campanulate to funnel-shaped, 3-5 cm. long, lobulate or subentire at the margin, long-pilose on interplicae, glabrous on plicae. Stamens included; filaments glabrous above, sparsely pilose near the base; anthers oblong, 3-4 mm. long, cordate at the base. Ovary ovoid, with dense long hairs; styles bifid to the middle or lower, glabrous above with scattered hairs near the base; stigmas globose-peltate. Capsules broad-ovoid to subglobose, apiculate, hairy at the apex, about 10-14 mm. in diameter, 2 celled, 4- to 8-valved, 4-seeded, rarely less seeded by abortion; seeds glabrous, black, oval in outline, convex on one side, and plane on two other sides, 5-6 mm. long. Cotyledons ovate, broadly cordate at the base, folded; cotyledonary petioles fused.

Type: India; type specimen not available.

From Madagascar through Ceylon, India, Pakistan, Burma, Thailand, South Vietnam, Malaya, Borneo, Sumatra, Java, Celebes, Culion and Luzon to Moluccas and New Guinea (Map 3).

This is the only species of the genus so widely distributed, commonly collected and represented in most large herbaria of the world. Hallier recognized three varieties under this species mainly on account of differences in indumentum. However, Van Ooststroom (1954) skeptically treated var. ambigua, stating,


Distribution of
B. semidigyna var. semidigyna
B. semidigyna var. farinacea
B. clegans
B. dietrichiana

Map 3

"It is...more difficult to draw a satisfactory line between var. semidigyna and this variety, than with var. farinacea. It is not impossible that Hallier is right that we have here a hybrid before us." Specimens (bearing the varietal epithet ambigua and annotated by Hallier) are somewhat variable in several features, but presumably all were collected by Hallier from a single plant in the Botanical Garden of Bogor. It had best be retained as an aberrant form of var. semidigyna from which it differs mainly by its very large leaves.

Key to Varieties

1. Stems and lower leaves with a dense brown or reddish brown tomentum; finer nervations of leaves indistinct or rarely transverse veins between adjacent lateral veins (or intercostal veins) barely visible; outer sepals acute to acuminate..... ..... var. semidigyna.

1. Stems and lower leaves sparsely tomentose or covered with short, closely appressed paler hairs; finer nervations of the leaves often more visible by the absence of a dense hair coating; outer sepals acute..... var. farinacea.

7a. B. semidigyna (Roxb.) Hall. f. var. semidigyna.
B. semidigyna (Roxb.) Hall. f. var. ambigua Hall. f. Bull. Herb. Boiss. 5:817. 1897.

Stems tomentose with brown or reddish brown hairs. Leaves densely tomentose underneath, with barely visible finer nerves (because of dense coating of hairs). Sepals 10-14 mm. long, rarely slightly shorter, densely brown tomentose, acute or acuminate at the apex, thick, rarely with slightly visible nerves.

Edges of secondary forests, thickets, hedges, waysides and river banks, from sea-level to about 250 m., rarely to higher altitudes.

B. semidigyna var. ambigua of Hallier is treated here as a form of the typical variety.

Specimens examined:

ANDAMAN ISLANDS: S. Andaman, Port Monat-hill jungle, King's Collector, 19. 12. 1891 (US); Prain's collector 21, 8. 3. 1901 (BM, G); Prain's collector 95, March 1901 (G); (doubtful) "Tenasserim and Andamans," Helfer 5874 (W).

BURMA: Maulmein, Sammlugen O. Kuntze's Weltreise 6289, X. 75 (NY); Sandoway, Arracan, Capt. Margrave (L); Tenasserim, J.D.V. Packman (BM); Pegu, Scott (L); without loc. J.H.B.C. 1405 (L).

CEYLON: James Macrae 533 (BM); H.K. Thwaites 2853, 1855 (BM, G, GH, W); Col. Walker (G).

COCHINCHINA (SOUTH VIETNAM): M. Germain 78, 1879 (G), Recule, 1 Avril 1880 (F, L, UC); fl. albi. Hab. ad Um dzan mot in Oust. Coch. L. Pierre, 1. 1864 (BM); ad Um dzan mot. in Ouest. Coch. fl.

albi., L. Pierre 22, 1. 1867 (A,F,G,GH,NY); ad Bien hoa in Ouest. Coch. fl. albi., Pierre, 12. 1869 (F. L. UC) [many of Pierre's label notes not deciphered]; M. le Dr. Thorel 612, 1862-1866 (A).

INDIA: Travancore, Madaras, J.S. Gamble 14778, Sept. 1884 (HBG, K); Prope Mercara, Terr. Canara, R.F. Hohenacker 563, Jan., Febr., M. 1847 (BM, G); Tidal Creek, Naiti, N. Kanara Dist., W.A. Talbot 2868, 10. 1. 93 (G); "India," Wallich 1405. 1, 1405. 2, 1405. 3 (BM).

INDONESIA: JAVA: Batavia, Heurdterrein z. van Djassinga, 250 m., Backer 26030 (L); Blume 1851 (L); Buitenzorg, Boerlage (L); Java Res. Batavia Barengkok. W. v. Leuviliang, alt. 250 m., Bakhuizen von den Brink Jr. 770, 16. 6. 1921 (L, W); corolla lactea, cult. in Hort. Bog., Hallier C. 18. a., 24. V. 1893 (G, L), C. 18. b., 5. V. 1893 (L), C. 18. c., 13 V. 1895 (L); Hallier 104d, 14. 8. 1896 (L); Cult. in Hort. Bog., Hallier (L); Korthals 226 (L); Kandang Japi, Korthals (L); Zollingero 1339, 1844 (G). Location indefinite. Blume (L); Reinwardt 362 (L). Unknown collector: "Java" (1). SUMATRA: Korthals 48 (L), 1711 (L); Pasier Cantang, lat. 2°S, sea level, fl. white, H.C. Robinson and C.B. Kloss 2, 18. VI. 1914 (BM). SUNDA: Straights of Sunda, Macartney and Staunton (BM).

MADAGASCAR: Envir. Tamatave, C.D'Alleizette, Nov. 1906 (L); central Madagascar, Rev. R. Baron 2773, Dec. 1883 (BM); M. Goudot 222 (?), 1833 (G); Hab. ad Tamatave, flores albi, Helsemberg (BM); Hunblet 211 (W); Tamatave, D. Paulay, June 1887 (W).

MALAYA: Kuband Ulu, Province Wellesley, C. Curtis, July 1890 (BM); Pulo-Pinang, A. Delessert 632, 1835 (G); Selangor, C.W. Franck 1013, 16. 9. 1937 (A); Perlis, Kangas, alt. low, M.R. Henderson 22858, Nov. 16, 1829 (BM, BRI); "2" specim. lect. in Ins. Penang, G. Porter, in 1822 (NY); Penang, unknown collector, with Wallich Herbarium No. 1405.2, 1832 (G).

PAKISTAN: Chittagong, Regio tropl. alt. 1000 ped. J.D. Hooker and T. Thomson, 1861 (BM, G, GH, L, W); The Chittagong Hill Tracts, Dr. King's collector 206, 1885 (K), 615, 1887 (L).

PHILLIPPINES: Central Luzon, A. Loher 4155(US); Culion Island, E.D. Merrill 538, Dec. 18, 1902 (NY, US), 618, Jan. 1, 1903 (NY, US).

SARAWAK: Baram Mouth, Baram Dist., C. Hose 27, Dec. 1894 (BM).

THAILAND: Kao Saming (Krat), under 50 m., A.F.G. Kerr 9399, 25. 11. 1924 (A, L); Hat Yai (near Songkhla), under 50 m., Kerr 13535, 22. 12. 1927 (A, L).

Locations not determined: Anamallays, R.H. Beddome 5627 (BM); Sillet (Indes Or.), Wallich 1405. 1, 1832 (G); Peninsula Indiae Orientalis, Wight 1999 (GH, L, NY). Locations unknown: Wallich 1405, 1832 (G); Wallich 1405.2 (L). Collector unknown: (G).

7aα. B. semidigyna var. semidigyna forma ambigua (Hall. f.) Myint and Ward, comb. nov.

B. semidigyna (Roxb.) Hall. f. var. ambigua Hall. f. Bull. Herb. Boiss. 5:817. 1897.

Differs from the typical form by its greyish and thinner indumentum, larger and wider leaves with broadly rotund-cordate bases, longer petioles, larger bracts and bracteoles, and larger corolla.

Type: Bangka (culta in horto Bogor.), Hallier C. 17. a., 23. V. 1893 (L-lectotype!).

Known only from type location.

All specimens deposited at the Rijksherbarium were collected from a single plant grown in the Botanical Garden at Bogor, according to Van Ooststroom (1954). Since no further collection has been made, Van Ooststroom questioned it as a distinct variety. When it was described, Hallier suggested it as a hybrid between var. semidigyna and var. farinacea, and Van Ooststroom remarked that Hallier may well be right. Future collections are much desired.

Specimens examined:
INDONESIA: Bangka, culta in horto Bogor., H. Hallier C. 17. a., 23. V. 1893 (L); C. 17. b., 7. IV. 1893 (L); C. 17. c., 29. III. 1893 (L); C. 17. d., 5. V. 1893 (L); Hallier X. F. 75 (L).

7b. B. semidigyna (Roxb.) Hall. f. var. farinacea Hall. f. Versl.'s Lands Pl.-tuin Btzg. 125. 1895 (1896).
Lettsomia bancana Miq. Fl. Ind. Bat. Suppl. 561. 1861.

Differs from var. semidigyna in stems and lower leaves covered with short, closely appressed hairs of a paler color, grey or light brown; finer nerves of leaves distinctly visible (because of thin coating of soft hairs); sepals 7-12 mm. long, sparsely or moderately tomentose (not densely tomentose except in young buds), mostly acute or shortly acuminate, frequently with distinct nerves.

Type: Celebes, cult. in horto Bogor., H. Hallier C. 16. a., 23. V. 1893 (L-lectotype!).

Thickets on beaches and rocks, both in marshy and dry localities, from sea-level to 75 m., in Malaysia from Banka and Celebes to Moluccas (Ceram) and New Guinea. Van Ooststroom notes that Ceram and Celebes specimens possess aberrant characters (longer pedicels and elliptic-obtuse sepals) which with future collections might prove to be taxonomically important.

Specimens examined:
CELEBES: Sudwest Celebes, Bau-Bau, Gestrupp, 0-75 m., sehr trocken, korallenkalk, J. Elbert 2641, Sept. 5, 1909 (L); Padangoma, 0-10 m., Mangrovenwald, Strandbusch, Sumpf, lehmig, Elbert 3250, Oktober, 1909 (L); Cult. in horto Bogor., H. Hallier C. 16. a, 23. V. 1893 (L), C. 16. b, 17. II. 1893 (L), C. 16. c, 13. V. 1895 (L), C. 18. c, 13. V. 1895 (G); Provincia Minahassa, S.H. Koorders 16559B (L); Bonto Parang, Rachmat 4 (exp. van Vuuren), 24. 6. 1913 (L).

SERAM (CERAM): Poeloe Tikoes, ± 0 m., Kornassi 1274 (exp. Rutten), 10. 5. 1918 (L).

NEW GUINEA: Papua: Lower Fly River, east bank, opposite Sturt Island, robust climber in second growth, rain forest, flower white, L.J. Brass 8180, Oct. 1936 (A).

8. Bonamia elegans (Wall.) Hall. f. Bot. Jahrb. 16:529. 1893.
Convolvulus elegans Wall. Cata. p. 38, no. 1392. 1828.
Breweria elegans (Wall.) Choisy, Mem. Soc. Geneve 6:193. 1833.
Breweriopsis elegans (Wall.) Roberty, Candollea 14:31. 1952.

Perennial, woody vines. Stems terete, twining, pilose or becoming glabrous in age, thin and wiry or becoming 2-3 mm. thick. Leaves shortly petiolate, subcoriaceous or soft-coriaceous, thinly pilose above, densely strigose beneath; petioles 2-8 mm. long, densely sericeous or pilose; blades variable in shape and size, older being ovate-elliptic; younger leaves lanceolate or sublinear, 2-4 cm. long, rounded or slightly cordate at the base, obtuse or obtuse-mucronate at the apex; veins impressed above, prominent beneath; lateral veins about 3-4 pairs. Flowers axillary, solitary or rarely in shortly pedunculate cymes of 2-3 flowers; peduncles 5-18 mm. long, mostly 1 mm. thick, finely pubescent; pedicels 2-5 mm. long, frequently slightly thicker than peduncles, brown-pubescent; bracts two, opposite, linear or linear-lanceolate, 3-6 mm. long. Sepals coriaceous or subcoriaceous, ovate-lanceolate, 12-15 mm. long, 4-5 mm. wide, acuminate or acute at the apex, equal or slightly unequal, finely pubescent, more densely so near the base. Corolla blue, campanulate-infundibuliform, 4-5 cm. long, slightly lobulate or subentire, pilose on interplicae, glabrous on plicae; tube cylindrical, wide, not distinct from the limb. Stamens included; filaments glabrous above, with scattered hairs below, at least along the edges; anthers oblong or oblong-lanceolate, 3-4 mm. long, cordate at the base. Ovary conical, with long hairs at the apex, glabrous near the base; styles fused near to the stigma, with scattered hairs on the lower part; short stylar branches unequal; stigmas depressed-capitate. Fruits not known. Cotyledons oval, not folded in young stage, unknown in mature stage; cotyledonary petioles fused.

Type: Burma: Prome, Wallich (G-lectotype!, BM-isotype!)

Known only from the type locality (Map 3).

This species is poorly known and rarely collected. It is repsented in a few large herbaria of Europe only by an old collection made by the author of the species more than a century ago. Apparently no further collections have been made since that time. The type collection is fragmentary, since it is only of a flowering branch and is without leaves of the vegetative parts. According to Clarke (1885), the juvenile leaves are much larger, attaining 7.5 by 3.1 cm, whereas the leaves on flowering branches are 3.8 by 0.8 cm. Since the vegetative branches and fruiting

material are not available in the present study, a more complete description of the species has to await future collections.

Roberty (1952), in erecting his new genus Breweriopsis typified by this species, lumped B. elegans, B. grandiflora and B. minor as constituting a single species. These three species of different continents differ in several important features. The most obvious common feature is their blue flowers, by which Roberty characterized his new genus. His treatment is quite artificial in many respects. He excluded several species possessing blue flowers, two of which were treated under an entirely distinct genus, Stylisma. But perhaps the most unacceptable part of his classification was his treating B. spectabilis and B. minor under two different genera, whereas these two, as pointed out by Verdcourt, are so similar in all features that they are conspecific.

9. Bonamia dietrichiana Hall. f. Bull. Herb. Boiss. 5:1012. 1897.
Bonamia pannosa sensu Hall. f. l. c. 5:810, as to the description and quoted specimen, not Breweria pannosa R. Br. Prodr. 488. 1810.

Perennial twining vines. Stems slender, terete, becoming woody, mostly 1-2 m. long, 1-2 mm. thick, fulvous-tomentose or subsericeous; internodes variable in length, 1.5-5 cm. long. Leaves shortly petiolate, soft and thick or slightly leathery, sericeous and apparently dark green above, densely sericeous and pale green beneath; petioles 4-8 mm. long, sometimes slightly shorter, sericeous; blades ovate or ovate-subcordate, 2.5-4 cm. long, 1.7-2.7 cm. broad (smaller on upper leaves), subcordate or truncate at the base, obtuse-mucronate or emarginate-mucronate at the apex; mucro 1 mm. long; nerves indistinct above, prominent beneath; lateral nerves 5-7 pairs. Flowers axillary, solitary or in simple cymes of 2-3, shortly pedunculate; peduncles 3-7 mm. long, terete, slender, sericeous; pedicels 2-4 mm. long; bracts opposite, ovate, shortly petiolate, 7-10 mm. long, 4-6 mm. broad, finely tomentose or sericeous. Sepals lanceolate or ovate-lanceolate, 12-13 mm. long, subcoriaceous or coriaceous; outer sepals densely villous or sericeous outside, acuminate at the apex, slightly longer than inner ones; inner sepals sparsely pubescent or nearly glabrous outside, acute or shortly acuminate at the apex. Corolla white (?), funnel-shaped, 3.5-4.5 cm. long, 3-3.5 m. broad, subentire or slightly lobulate at the limb, long-pilose on interplicae. Stamens inserted; filaform, glabrous above, pilose near the base; anthers linear-oblong, 2-3.5 mm. long, cordate at the base. Ovary ovoid, long-pilose at the apex, glabrous below; styles bifid to the middle or nearly to the base, filiform, glabrous or with scattered hairs near the base; stigmas large, globose-capitate. Fruits and seeds not known.

Type: Queensland, Australia, A. Dietrich 19 (HBG).

This species, endemic to Queensland, Australia (Map 3), is distinct from all other Australian species in its longer and lanceo-

late sepals, larger corolla and foliaceous bracts. It is somewhat related to B. pannosa because of similarity in its indumentum, slightly unequal sepals and larger subcordate leaves. It is probably more closely related to B. elegans of the Orient because of similarity in their sepals and corolla.

Hallier, in his earlier treatment, included this species under B. pannosa and later realized its distinction from the latter. It differs from B. pannosa in its larger and white corolla, nearly equal, closely appressed and lanceolate sepals, outer sepals being glabrous inside, and leaves being obtuse-mucronate or emarginate-mucronate at the apex (Figure 5).

Specimens examined:
AUSTRALIA: Queensland: A. Dietrich 19 (HBG-lectotype and isotype); Stony Creek, Stuart, Townsville, "K. K." 8, April 4, 1954 (BRI).

10. Bonamia menziesii Gray, Proc. Am. Acad. 5:336. 1862.
Breweria menziesii (Gray) Bentham and Hooker, Gen. Pl. 2:877. 1876.
Bonamia Herminieri Hall. f. Bot. Jahrb. 16:529. 1893.
Perispermum albiflorum O. Degener, Fl. Hawaiiensis, Fam. 307. 1932. Type: Degener, Park and Nitta 4111!
Perispermum menziesii (Gray) O. Degener, Fl. Hawaiiensis, K6. 1934.

Perennial, woody, slow-growing, coarse vines, up to 10 m. Stems twining, terete, long, without milky juice, glabrescent and with pale yellowish bark, fulvous-tomentose when young, distantly leafy, soon becoming woody, later bearing short leafy spurs. Leaves petiolate, soft-coriaceous, tomentulose and hoary to glabrous above, densely fulvous-tomentose below; petioles 8-25 mm. long, sulcate, fulvous-tomentose or becoming less tomentose in age; blades oblong-elliptic, ovate or rarely orbicular, 3.2-9 cm. long, 1.5-3.5 cm. broad, rounded at the base; truncate, emarginate, obtuse or acute at the apex. Flowers axillary, solitary, rarely in cymes of two to few flowers; peduncles short, 2-5 mm. long, demarcated from pedicels by two inconspicuous bracts, fulvous-tomentose, mostly thicker than pedicels; pedicels longer than peduncles, commonly 1.2-2 cm. long; floral buds mostly erect. Sepals ovate, densely fulvous-tomentose outside, glabrous inside, soft-coriaceous, persistent and brittle in the fruit, subequal; the two exterior about 10 mm. long, 8 mm. wide; the three interior mostly 7 mm. long. 7 mm. wide, thinner, less densely fulvous-tomentose and less acute at the apex. Corolla white, yellowish brown or greenish, funnel-shaped with narrow spreading limb of 5 subtruncate lobes (or lobules), 22 mm. long, 16 mm. wide; outside glabrous on plicae, hirsute with pale tawny silky hairs on interplicae. Stamens inserted; filaments slightly lower than the corolla, filiform, stiff, adnate to corolla for about 6 mm.; anthers white, oblong, about 3-3.5 mm. long. Ovary with narrow dixc, ovoid-conical; styles connate for about 2 mm. near the base, about 15 mm. long; stigmas rugose-capitate, 1 mm. wide. Capsules pendent on stiff pedicels, hardly dehiscent,

Distribution of Bonamia menziesii
var. menziesii
var. rockii

Map 4

glabrous with chartaceous wall, about 10-15 mm. long and 8-10 mm. wide, ovoid-conical, straw colored, 4- to 2- (-1) seeded, with very thin and soft septum; persistent sepals spreading and brittle. Seeds covered with black perisperm, glabrous, about 6-8 mm. long, and almost 5 mm. wide, ovoid-angular-convex, with yellowish brown or crimson testa. Cotyledons corrugate and folded, bilobed, cordate at the base, with fused cotyledonary petiole.

Type: Iles Sandwich--Maui, M.J.Remy 420, 1851-1855 (GH).

On rocky slopes and valleys on Hawaii, Lanai, Maui, Molokai and Oahu Islands (Map 4).

Hallier (1893) gave the name B. herminieri, in honor of the collector, Herminier, to a specimen presumably from Guadeloupe, West Indies. Since this range disjuction has not been supported by further collections, it seems reasonable to suppose the original label in error. The type specimen has not been examined, and, in fact, cannot now be located at the herbarium of Boissier, Geneva, where it was presumably deposited, but the name is placed in synonymy under B. menziesii on the authority of Hallier (1897) who, on further study, considered B. herminieri to be no more than a somewhat aberrant form of B. menziesii.

O. Degener (1932) erected a new genus for this species because of its hardly dehiscent capsules, perispermous seeds and supposed lack of septa. Since the fruits (capsules) remain closed for a long period after ripeness, he assumed them as completely indehiscent, which does not seem to be true. Further, he missed the fact that the presence of perisperm on the seeds is common throughout the genus Bonamia. Degener definitely overlooked the presence of thin septa, thus characterizing his new genus with nonseptate capsules. He also proposed a new species, which he treated under this genus. The specimens collected on the island of Hawaii differ appreciably from the specimens collected on Lanai, Maui, Molokai and Oahu, and thus are treated here as belonging to a distinct variety (Figure 2).

Specimens examined:

LANAI: Dry forests, west end, C.N. Forbes 152.L, June 1913 (A, F, MO, NY, UC, US); W. Hillebrand, 1874 (GH); Hillebrand, 1890 (BM); A.S. Hitchcock 14712, Sept. 22, 1916 (US); Paomaio, G.C. Munro, 3. 19. 1914 (BM), 4. 18. 1914 (NY, UC, US).

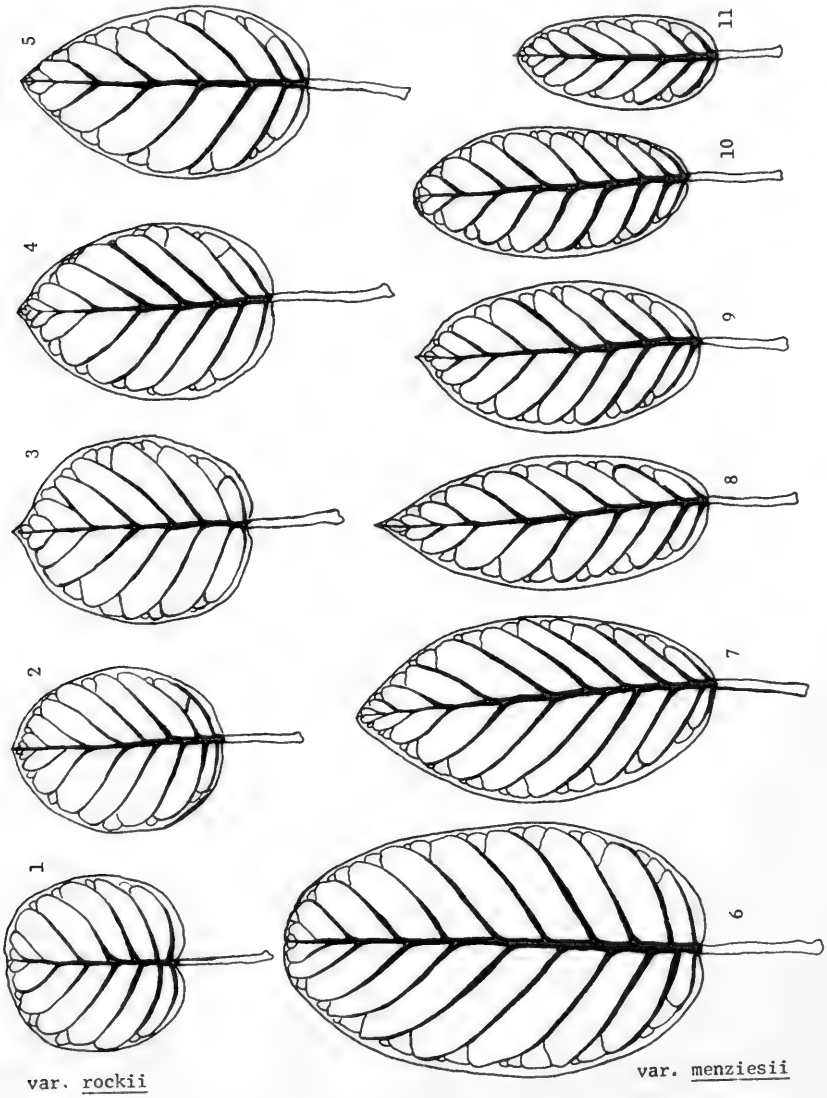
MAUI: Pakiloi, Forbes 2067 M, Mar. 23, 1920 (NY, UC, US); Komauu, Forbes 2067 MO, Mar. 23, 1920 (UC); M.T. Remy 420, 1851-1855 (GH, lectotype), 421 (L).

MOLOKAI: Kalapamoa, Forbes 430 MO, Aug. 1912 (MO, UC, US); west end, Kokio Gulch, J.F. Rock 14015, May 21, 1918 (NY, UC, US); west end, Rock, Feb. 1920.

OAHU: Small, arid, rocky gully two-thirds of a mile from the sea on the south slope of Keaau Valley, O. Degener, K.K. Park and Y. Nitta 4111, Feb. 7, 1932 (MO); middle ridge of Niu Valley, on

Figure 2

Leaf shapes and sizes in the varieties of Bonamia menziesii



partly wooded, sunny slope, 50 ft. above stream, Degener, Park and Nitta 5975, June 4, 1932 (MO); small east-central ridge near head of Wailupe Valley, over bushes and low trees at 1500 ft., Degener 21186 and W. Hatheway, Dec. 19, 1950 (BM, MO, UC); south-west side of Poamoho Gulch; south-west side of Brodie Camp, on rocky, grassy, sparingly shrubby, precipitous slope at 1500 ft. elevation, Degener 21257 and Hatheway, Jan. 25, 1951 (UC, US); Kaala Mountains, H. Mann and W.T. Brigham 618 (BM, F, G, GH, MO, NY, US); U.S. Exploring Expedition under the command of Captain Wilkes (US). Unknown location: Hillebrand 1889 (US).

Bonamia menziesii var. rockii Myint and Ward, var. nov.

Differt a varietate typica foliis orbicularibus, orbiculari-ovatis, vel ovatis, 2.5-4. cm. longis, 1-1.2plo longioribus quam latioribus, raro 1.5plo, apice emarginato, truncato, obtuso vel raro abrupte acuto.

Differs from the typical variety in possessing orbicular, orbicular-ovate or ovate leaves, 2.5-4 cm. long, with a length-width ratio of 1-1.2, rarely 1.5, emarginate, truncate, obtuse or rarely abruptly acute at the apex.

Type: Kona: Puu Waawaa, J.F. Rock, March, 1912 (GH).

All three specimens cited here were collected by J.F. Rock between Kona and Puu Waawaa at varying dates; this variety is named in his honor.

Specimens examined:
HAWAII: Kona: Lava beds between Huehue and Puu Waawaa, J.F. Rock 3541, June 4, 1909 (GH); Puu Waawaa, Rock, March, 1912 (GH); Puu Waawaa, Kamanomano, Rock (NY).

11. Bonamia grandiflora (Gray) Hall. f. Bull. Herb. Boiss. 5:810. 1897.
Breweria grandiflora A. Gray, Proc. Am. Acad. 15:49. 1880.

Perennial, trailing, herbaceous or suffrutescent pseudoliana, growing annually from lower nodes of previous shoots or from slightly enlarged roots. Stems terete, rarely ridged or subterete, glabrous to finely puberulous, 2-4 mm. thick, becoming 3-5 m. long, with frequent branching. Leaves sessile or subsessile, subcoriaceous to membranous, glabrous or finely puberulous and glabrescent; petioles almost absent or 1-3 mm. long, and curved; blades ovate, 2.2-3 cm. long, 2-2.5 cm. broad, rounded or slightly cordate at the base; obtuse, acute or rarely retuse at the apex; lateral veins mostly 4-7 pairs. Flowers axillary, solitary; two lateral abortive buds sometimes present in the axils of the bracts; peduncles 1-4 cm. long, sometimes becoming longer in age, grey pubescent or puberulous; pedicels short, slightly thicker than peduncles, densely pubescent while young; bracts small, linear or scale-like, 1-2

mm. long. Sepals broadly lanceolate or oblong-ovate-lanceolate, acute or acuminate at the apex, equal, or unequal, outer being slightly shorter, 1.5-2.6 (2.8) cm. long, 4-10 mm. wide, membranous or subcoriaceous, outside finely puberulous with grey or silvery hairs. Corolla deep blue or purplish blue, lighter towards tubular base, tubular-campanulate or funnel-form, 7-8.5 cm. long, 5-7 cm. wide, shallowly lobulate, silky pilose with long hairs on interplicae, glabrous on plicae. Stamens included; filaments epipetalous, shorter than styles, as high as half the length of the corolla, slightly unequal, glabrous above, villous below; anthers 4-5 mm. long, oblong-lanceolate, cordate at the base, introrse by longitudinal slits. Ovary conical, glabrous with four vertical ridges, with a circular disc near the base; styles inserted, terminal, mostly 5 cm. long or sometimes longer, bifid above the middle (rarely trifid, then ovary trilocular and six-ovulate); stigmas globose-peltate. Capsules conical, apiculate, 4- or 8-valved, rarely 6-valved, 4-seeded, rarely 6-seeded. Seeds oval, brownish, glabrous, rarely with scattered hairs on dorsal sides. Cotyledons oval or oboval with emarginate apices, folded against the radicle, with free cotyledonary petioles.

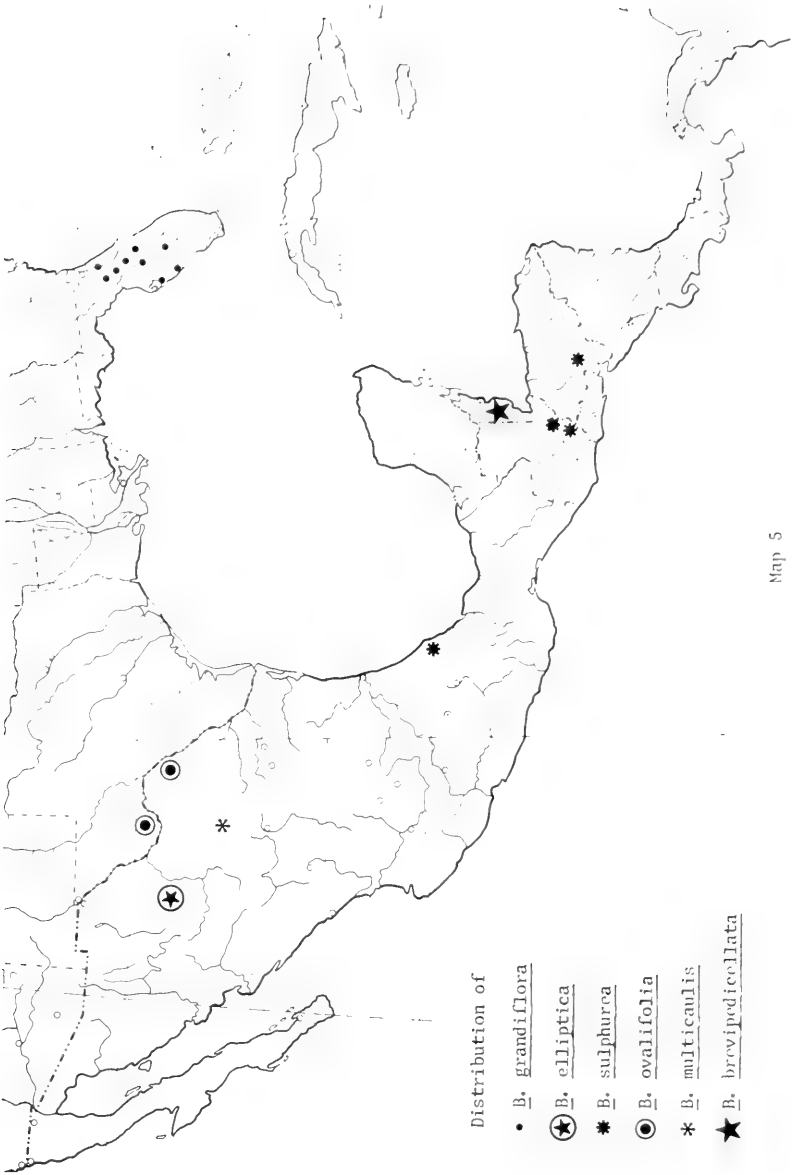
Type: Manatee and Sarasota, Florida, A.P. Garber, June, 1878 (GH-Lectotype! F, FLAS, MO, PH, US - Isotypes!).

Dry, deep sandy areas in scrubs or edge of scrubs, more commonly in open ground and disturbed areas, occasionally on ancient sand dunes, ranging from south to central Florida (Map 5).

Bonamia grandiflora is geographically completely isolated from related species of Mexico and Central America, and it is the only species entirely restricted to the continental United States. It has been included in B. elegans of the Orient by Roberty (1952) who treated it under his new genus Breweriopsis, which he characterized by the large corolla. However, B. grandiflora shows several distinct features from B. elegans, particularly leaf shape and size, fusion of the stylar branches and stigmas. In B. grandiflora the leaves are orbicular or ovate, 2.2-3 cm. long and 2.2-5 cm. wide, stylar branches are connate only for the lower half, and the stigmas are small and globose, whereas in B. elegans, the leaves are oblong or oblong-ovate, 3-4.5 cm. long and 8-15 mm. wide (except the lower ones which are slightly wider), the stylar branches are connate for three-fourths of the total length or higher, and the stigmas are larger and depressed-capitate.

The derivation of the specific name is quite appropriate for its large, conspicuous and beautiful flowers, purplish blue in color.

Specimens examined:
FLORIDA: Highland County: Open, dry, sandy slope among the "inland sand dunes" near Sebring, D.S. Correll and J.B. McFarlin 6227, August 3, 1936 (DUKE); Scrub, south end of Lake Jackson,


Distribution of
• B. grandiflora
B. elliptica
B. sulphurea
B. ovalifolia
B. multicaulis
B. brevipedicellata

Map 5

Sebring, Ray Garrett, April 21, 1948 (GA); sand dunes, Sebring, F.W. Hunnewell 1049, May 15, 1927 (GH); sand hills, Sebring, J.B. McFarlin 9414, September 6, 1934 (FLAS), 5701, 6. 9. 1931 (MICH); sandy scrub, Lake Placid, F.H. Sargent 7180, May 23, 1955 (SMU); scrub, Sebring, J.K. Small and E. West, September 5, 1934 (FLAS). Lake County: In scrub near Mt. Dora, J.J. Fennel 463, July 18, 1937 (UC); in vicinity of Eustis, A.S. Hitchcock, June-July, 1894 (F, FLAS, MO); in vicinity of Eustis, G.V. Nash 1326, July 16-31, 1894 (F, G, GH, MICH, MO, PH, UC, US); near Lake Dora, Tavares, P.H. Rolfs 511, June 29, 1893 (F, FLAS, MO). Manatee County: Sand ridge, Manatee River, Bradenton, A. Cuthbert 1358, June 23, 1916 (FLAS); A.P. Garber, June, 1878 (F, FLAS, GH, MO, PH, US); J.H. Simpson, 1889 (US); Palma Sola, S.M. Tracy 6431, September 10, 1889 (NCU). Marion County: Sandy roadsides, Nat. Forest, A.V. Cleet, August 2, 1937 (NSU); near observation tower on highway, Ocala National Forest, Bailey and Hume, August 19, 1935 (FLAS); in a scrub, Ocala National Forest, Hugh O'Neill, September 12, 1929 (FLAS, US); frequent; 1 mi. east and 4.8 mi. south of Central Tower, Ocala National Forest, D.B. Ward and T. Myint 2126, July 28, 1960, (FLAS, FSU). Orange County: In sand scrub, Orlando, Hugh O'Neill 88, August, 1924 (US); sandy scrub near Windemere, P.O. Scallert 20849, October 4, 1947 (SMU); sand hill among scrub oak, Orlando, E. West, May 24, 1929 (FLAS); Clarocona, C.S. Williamson, July, 1895 (PH). Osceola County: Sandy soil, near swamp, Tampa highway, Mary L. Singletary 370, May 24, 1938 (DUKE, NSC). Polk County: Vicinity of Crooked Lake, J.B. McFarlin 3365, October 28, 1930 (FLAS, MICH). Sarasota County: Sarasota, A.P. Garber 46, June, 1878 (F, FLAS, PH, US). Volusia County: Dry scrub near Seville, A.H. Curtiss 6687, July 16, 1900 (G, GA, GH, L, MO, UC, US). County unknown: F. Rugel, 1842-1849 (MO, US).

12. Bonamia elliptica (Smith & Schubert) Myint & Ward, comb. nov.
Breweria elliptica Smith & Schubert, Contr. Gray Herb. n. s. No. CXXVII: 31, tab. II, fig. 31 & 32. 1939.

Perennial, shrubby, twining vines. Stems woody, terete, white, densely pilose, mostly 2-4 mm. thick. Leaves petiolate, soft, leathery or subcoriaceous, long-strigose above, densely strigose beneath; petioles 7-10 mm. long, densely strigose; blades elliptic, 3-5.5 cm. long, mostly 2.5-4 cm. wide, rounded and slightly oblique at the base, obtuse-mucronate at the apex; veins distinct, with about 6-8 pairs of lateral veins. Inflorescences axillary, cymose, of 5-12 (-15) flowers, pedunculate; peduncles 2.5-5.5 cm. long, 1-1.5 mm. thick, densely strigose; secondary peduncles as long as pedicels; pedicels 7-10 mm. long, densely strigose as peduncles, mostly 1 mm. thick; bracts linear or lanceolate, pilose, 3-10 mm. long, acuminate. Sepals ovate-acuminate, equal or slightly unequal, densely strigose or becoming less so, with ciliate, thin margins, 12-15 mm. long, 4-7 mm. wide. Corolla blue or pale blue, infundibuliform, mostly 4-5 cm. long, slightly lobulate or subentire, long-strigose on interplicae, glabrous on plicae. Stamens

inserted; filaments glabrous or only with scattered short hairs, unequal (two short, two long and one medium, which are as high as styles); anthers oblong, 3-4 mm. long, cordate at the base. Ovary conical, glabrous; styles bifid three-fourths the length, glabrous, as long as the medium stamen; stigma capitate. Fruit unknown.

Type: Chorrera, Temascaltepec Dist. Mexico, G.B. Hinton 2176, 10. 14. 1932 (GH-holotype).

Known only from Temascaltepec Dist., Chihuahua, Mexico (Map 5).

Further collections of this species are to be desired, since it is known only from two collections from the same district, and fruit and seed are not yet known. The second collection has been associated with the vernacular name "manto."

This species is related to B. sulphurea of southern Mexico and Central America, from which it is different by its long pedunculate, much branched cymes of large numerous flowers, borne in the axils of the leaves of the primary branches.

Specimens examined:
MEXICO: Chihuahua: Chorrera, 1230 m., Temascaltepec Dist., vine, flower blue, G.B. Hinton 2176, 10. 14. 1932 (F, GH, MO, US); Volcan, Temascaltepec Dist., flower blue, Hinton et al. 8487, 9. 24. 1935 (MO, US).

13. Bonamia sulphurea (Brandg.) Myint & Ward, comb. nov.
Breweria sulphurea Brandegee, Univ. Calif. Publ. Bot. 4:384. 1913.

Perennial, shrubby climber. Stems terete, mostly twining, pubescent and becoming glabrous in age, about 2-5 mm. in diameter. Leaves petiolate, coriaceous or subcoriaceous, greenish pubescent and glabrescent above, densely brown tomentose below; petioles 3-20 mm. long, 1-1.5 mm. thick, sulcate above, finely pubescent or becoming glabrous; blades broadly ovate or elliptic, 3.5-7.5 cm. long, 2-4.5 cm. broad, entire at the margin, rounded or slightly cordate at the base, and acuminate, obtuse-mucronate or rarely acute-mucronate at the apex; veins inconspicuous above, prominent beneath; about 4-7 pairs of lateral veins. Inflorescences loose cymes of few flowers, rarely solitary in the axils of small leaves, frequently pseudopanicles composed of numerous cymes on short leafy twigs; peduncles variable in length, sometimes hardly present; pedicels distinctly elongate, 1-2 (2.5) cm. long, 1-1.5 mm. wide, pubescent; bracts small, lanceolate, mostly inconspicuous. Sepals ovate-lanceolate, acute or obtuse at the apex, equal or subequal, densely brown-tomentose outside, inner two less densely so, 8-13 mm. long, 3-7 mm. wide, coriaceous or membranous. Corolla white, mostly 1.5-2 cm. long, tubular-campanulate with narrow limb, lobulate at the margin; outside surface pilose on the interplicae,

glabrous on the plicae. Stamens included; filaments adnate to the corolla tube, glabrous above, pilose near the base, shorter than styles; anthers oblong, about 2 mm. long, 1 mm. broad. Ovary hirsute; styles bifid above the middle; stylar branches unequal; stigmas globose-capitate. Fruit subconical capsule, valvular, shorter than persistent sepals, brown hirsute at the apex. Seeds ovate, glabrous, black. Cotyledons ovate-orbicular.

Type: Mexico: Vera Cruz, Banos de Carizal, C.A. Purpus 5995 (UC, 155241).

Southern Mexico, Gautemala and Honduras at the altitude of 200-1000 m. (Map 5).

Most collectors reported damp bushy slopes, damp thickets, and rocky slopes as the habitat of this species. More collections will be needed to determine its general distributions, type of habitat and flowering periods. Specimens, mostly in flower, have been collected in August, September and October.

This species is undoubtedly related to B. elliptica of northern Mexico. From the latter it is different in possessing flowers with longer pedicels and smaller corolla and less branched cymose inflorescences which are borne in the axils of leaves of the secondary leafy branches, rather than in the axils of leaves of the primary branches.

Both this genus and this species are reported here from Guatemala and Honduras for the first time. Previously this species has been known only from southern Mexico. In this general area B. brevipedicellata is also reported from British Honduras for the first time.

Specimens examined:

GUATEMALA: Chiquimula: Divide on the railway above El Ricon, alt. 870 m., damp bushy slope, woody vine, Paul C. Standley 74730, October 17, 1940 (F); damp bushy slope, vine over trees, corolla white, Standley 74755, October 17, 1940 (F). Zacapa: Vicinity of Zacapa, alt. ca. 200 m., damp thicket, large woody vine, buds only, Standley 74201, October 7-16, 1940 (F, US); rocky slopes between San Pablo and Pepezca, alt. 200-250 m., climbing in thickets, corolla white, leaves olive-dull green, yellow-green beneath, Julian A. Steyermark 29337, October 8, 1939 (A, F).

HONDURAS: Morazan: La Granja, along Rio Choluteca near Tequcigalpa, alt. 936 m., fls. white, vine, Antonio Molina R. 10493, September 8, 1946 (BM, MO, US).

MEXICO: Vera Cruz: Banos del Carizal, C.A. Purpus 5998, August, 1912 (UC-holotype! BM, F, MO, NY, US-isotype).

14. Bonamia ovalifolia (Torr.) Hall. f. Bot. Jahrb. 16:528. 1893.
Evolvulus ovalifolius Torr. Bot. Mex. Bound. 150. 1859.
Breweria ovalifolia (Torr.) A. Gray, Syn. Fl. N. Am. 2(1): 217. 1878.

Perennial, procumbent or suberect, occasionally prostrate, shrubby vines, growing from lower nodes of old shoot or root. Root thick, mostly 5-12 mm. near the base, with pulpy bark. Old stems 3-10 mm. or thicker, woody; new branches 3-6 dm. tall, wiry or slightly woody, light green, densely sericeous or velutinous. Leaves sessile or subsessile, rarely with short petioles of 1-3 mm. long, soft and leathery or subcoriaceous, densely velutinous on both upper and lower surfaces; blades ovate, oblong-ovate or rounded, 1.4-2.6 (3.0) cm. long, mostly 1-2 cm. wide, occasionally smaller, rounded or obtuse or slightly cordate at the base, obtuse or abruptly acute at the apex; lateral veins 2-5 pairs, most commonly 3 or 4 pairs. Flowers axillary, solitary, shortly pedicellate or almost sessile, bracteate; peduncles almost absent; pedicels 2-8 mm. long, densely villous; bracts two, opposite, close to leaf axils, linear or linear-lanceolate, 3-6 mm. long. Sepals ovate or ovate-lanceolate, acute or acuminate at the apex, 9-14 mm. long, 7-12 mm. wide, slightly unequal, or subequal, partially united at the extreme base, densely villous outside, soft-coriaceous or subcoriaceous. Corolla blue or bluish purple, paler on interplicae and lower part, 3.5-5 cm. long, 2.8-4 cm. wide, funnel-form or tubular campanulate, 5-10 lobulate or subentire, hirsute with scattered long hairs on interplicae, glabrous on plicae. Stamens included; filaments with long, frequently interwoven, white hairs, unequal; anthers 3-4 mm. long, cordate at the base. Ovary conical, with long hairs near the apex; styles bifid about one-fourth the length, slightly to distinctly longer than filaments, with scattered and long hairs to nearly glabrous, with unequal stylar branches; stigmas minute. Capsules globose, apiculate, villous near the apex, usually 2- to 4-seeded, rarely 1-seeded by abortion; seeds globose, compressed on the inner side, glabrous, brown. Cotyledons bilobed (being emarginate at the apex and cordate at the base), flat while young, folded when mature.

Type: Mexico: On the Rio Grande below San Carlos, C.C. Parry, October (GH).

Limited to the valley of the Rio Grande River, on deep, sandy, arid plains in Mexico and Texas (Map 5).

The distribution of this species has been extended to New Mexico by House (1907), but no specimen has been seen to authenticate such extension. Further collections of this species are needed, as it is known only from two locations and representative specimens are very rare, even in the larger herbaria.

This species is more closely related to B. multicaulis than to any other known species of the genus. It can, however, be distinguished from the latter by its oval leaves, wiry or thin procumbent stems, filaments with long hairs and longer stylar fusion.

Specimens examined:

MEXICO: Coahuila: Rio Grande, below San Carlos, C.C. Parry, October, Mexican Boundary Survey under the direction of Major W.H. Emory (GH).

UNITED STATES: Texas: Brewster County: Big Bend National Park, arid desert plains and hills, Boquillas Canyon, locally common along edge of slope of deep sand, G.L. Webster 4482, July 22, 1952 (SMU, W).

15. Bonamia multicaulis (Brandg.) House, N.Y. State Mus. Bull. 233-234: 61. 1922.
Breweria multicaulis Brandegee, Univ. Calif. Pub. Bot. 4:185. 1911.

Perennial, woody subshrubs. Roots woody, thick, with pulpy bark. Stems woody, terete, densely sericeous with silvery hairs, numerous annual culms from thick stumps of previous-year shoots, 5-6 mm. near the base, occasionally thicker, 2-6 dm. high. Leaves sessile, rarely with short petioles of 1-2 mm., soft and leathery or subcoriaceous, densely sericeous on both surfaces; blades lanceolate, 1.5-3.5 cm. long, 4-10 mm. wide, mostly cuneate or rarely acute or obtuse at the base, acuminate or acute at the apex; veins inconspicuous except the midrib, rarely lower pair of lateral veins barely visible. Flowers axillary, solitary, shortly pedunculate or shortly pedicellate or almost sessile; bracts two, linear or linear-lanceolate, 4-6 mm. long, 1-1.5 mm. wide, densely sericeous. Sepals ovate or ovate-lanceolate, acuminate at the apex, 10-13 mm. long, 6-8 mm. wide, equal or slightly unequal, densely sericeous or villous, soft-coriaceous or subcoriaceous. Corolla blue, paler on interplicae and lower part, 3-4 cm. long, with limb of about 2.5-3.5 cm. in diameter, tubular-campanulate, entire or subentire, hirsute on interplicae, glabrous on plicae; tube short, about 1 cm. long. Stamens included; filaments glabrous with short, scattered hairs above, pilose on the basal parts adnate to corolla tube; anthers oblong or oblong-ovate, 3-5 mm. long, slightly cordate at the base, rounded at the apex. Ovary long-hirsute or sericeous, conical; styles bifid toward the middle or higher, glabrous above, with scattered hairs near the base, longer than filaments, slightly shorter than corolla; stigmas minute. Fruits valvular capsules, 2- to 4-seeded, or one-seeded due to aborted condition, conical, sericeous, becoming less sericeous in age; seeds glabrous, black or dark brown. Cotyledons oboval or bilobed with emarginate apices; cotyledonary petioles free.

Type: On sand dunes near Sierra del Rey, Coahuila, Mexico, C.A. Purpus 4457, June, 1910 (UC).

From the material examined, it appears that this species is localized in Coahuila in northern Mexico (Map 5).

Brandegee, in describing this species, correctly stated that it is nearest to B. ovalifolia. The two species are similar in

their habit, indumentum, sepals and corolla. However, B. multicaulis can readily be distinguished from B. ovalifolia by its narrow, lanceolate leaves, thicker and erect stems, and nearly glabrous filaments.

Specimens examined:
MEXICO: Coahuila: On sand dunes, near Sierra del Rey, C.A. Purpus 4457, June, 1910 (UC-holotype; BM, F, GH, MO, US-isotypes); 21 mi. west of El Oro, road to Guimbalete, flowers blue, S.S. White 2013, July 24, 1939 (GH, MEXU, MICH).

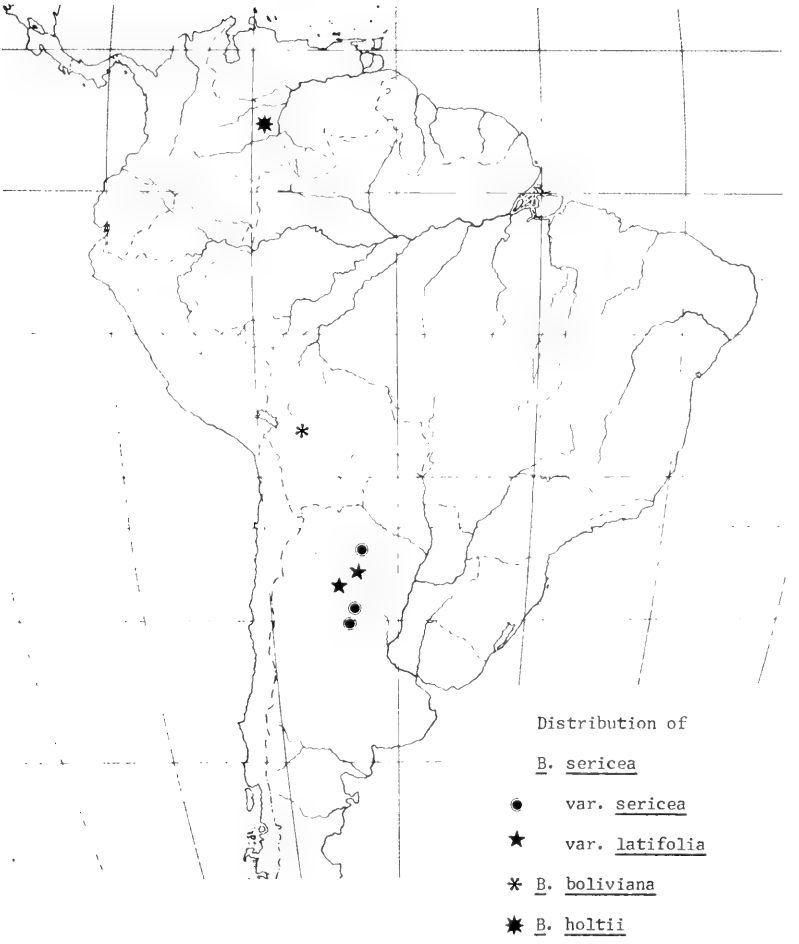
16. Bonamia sericea (Griseb.) Hall. f. Bot. Jahrb. 16:528. 1893.
Breweria sericea Griseb. Pl. Lorentz. 181. 1874.
Convolvulus Breweraceus O. Ktze. Rev. Gen. 3(2):212. 1898.

Perennial shrubby or herbaceous-suffrutescent, erect or procumbent plants. Roots woody, thick near the base. Stems woody at the base, 5-15 mm. thick; new stems herbaceous above, somewhat woody at the base, 15-40 cm. high, 1-3 mm. thick, densely to finely sericeous with soft-appressed short hairs; internodes 5-40 mm. long. Leaves shortly petiolate, coriaceous, subcoriaceous or membranous, sericeous on both upper and lower surfaces; petioles 1-7 mm. long; blades elliptic, elliptic-lanceolate or elliptic-ovate, 8-35 mm. long, 3-20 mm. wide, obtuse, acute or attenuate at the base, obtuse or abruptly acute and mucronate at the apex; midrib prominent with 4-6 pairs of lateral veins. Flowers shortly pedunculate, solitary or in cymes of 2-3, axillary or frequently terminal; peduncles short, 3-10 mm. long, sericeous; pedicels 2-5 mm. long, sericeous; bracts linear or linear-lanceolate, minute, 2-3 mm. long. Sepals ovate or ovate-acuminate, acute or acuminate at the apex, concave, 7-10 mm. long, 3-4.5 mm. wide, pubescent. Corolla white, infundibuliform-campanulate, 15-30 mm. long, ferrugineous-pubescent on interplicae. Stamens included; filaments glandular villous near the base; anthers oblong-sagittate, 3.5-4.5 mm. long. Ovary conical, densely pilose-hirsute near the apex; styles 12-14 mm. long, bifid above the middle; stigmas subglobose-capitate, papilose. Capsules subglobose or conical, 5-6 mm. in diameter, pilose-hirsute at the apex; seeds black, 3-5 mm. long, glabrous. Cotyledons oval, cordate at the base; cotyledonary petioles fused.

Type: Argentina: Cordoba; not available.

Known only from northern Argentina, where it seems to be fairly abundant at an altitude of about 400-500 m. at a few localities (Map 6). Although it has been collected more than other species from southern South America, its habitat is poorly known. One collector (Venturi 2074) noted its habitat as a railroad embankment. It has been collected in flower in October, November and December and in fruit in December.

This species is rather variable in leaf shape and size, and in indumentum of stems and leaves. Mainly on account of these features, O'Donnell separated it into two varieties.


Distribution of
B. sericea
var. sericea
var. latifolia
B. boliviana
B. holtii

Map 6

Key to Varieties

1. Plants densely sericeous; leaves 3-10 mm. wide, 8-20 mm. long, narrowly elliptic to lanceolate. . . . . var. sericea

1. Plants less densely or sparsely sericeous or puberulous, with softer and shorter hairs; leaves 4-20 mm. wide, 15-35 mm. long, elliptic to elliptic-ovate. . . . . .var. latifolia

B. sericea (Griseb.) Hall. f. var. sericea.

Stems 15-30 cm. long, densely pubescent; old stems woody, 5-15 mm. thick; internodes 5-15 mm. long. Leaves shortly petiolate, densely sericeous on both upper and lower surfaces; petioles 1-4 mm. long; blades narrowly elliptic to lanceolate, 8-20 mm. long, 3-10 mm. wide, acute or obtuse and mucronate at the apex. Pedicels 5-14 long; bracts 2-3 mm. long. Sepals 8-10 mm. long, 3-4.5 mm. wide. Corolla 15-30 mm. long.

Specimens examined:
ARGENTINA: Cordoba: Althos del S. Y. O. B.W. Bodenbender 8823 (NY, R); E. Fielding (BM); Ischilin, Quilino al km. 855, T. Meyer 13543, 16. XII. 1947 (W); Ischilin, La Florida, Meyer 13730, 16. XII. 1947 (W); Barrio S. Martin, C.A. O'Donnel y. J.M. Rodriguez 329, 17. III. 1944 (F, UC). Chaco (RA): en los campos, flor. blanco, alt. 250, S. Venturi 9794, November 19, 1929 (BM).

B. sericea (Griseb.) Hall. f. var. latifolia O'Donell, Lilloa 29:31. 1959.

Stems 20-40 cm. long, sparsely sericeous; old stems woody, 5-30 mm. thick; internodes 1-4 cm. long. Leaves shortly petiolate, sparsely sericeous; petioles 2-7 mm. long; blades elliptic to elliptic-ovate, 15-35 mm. long, 4-20 mm. wide, obtuse or occasionally acute and mucronate at the apex. Pedicels 5-8 mm. long; bracts 2-4 mm. long. Sepals 7-10 mm. long, 3-4.5 mm. wide. Corolla 30 mm. long.

Type: Argentina: type specimen not available.

Specimens examined:
ARGENTINA: Sgo del Estero, Ojo de Agua (alrededores), B. Baleguo 1379, 17. XII. 1947 (W); Tucuman, Cruz Alta, saliendo de Las Cejas por el ramal que va a Antilla, C.A. O'Donell 5413, 14. XI. 1947 (W); Las Cejas, Tucuman, 450 m., Schreiter 3956 ("1799"), 18. XL. 1923 (GH, NY, US); Santiago del Estero, El Palomara Pampa Pozo, 400 m., fl. blanca, Schreiter 6706 ("4046"), 15. XI. 1931 (NY); Las Cejas, Cruz Alta, 400 m., blanca, 0.40 m., en campos abiertos, S. Venturi 1525, December 3, 1921 (US); Las Cejas, Cruz Alta, 400 m., flor blanca (Terraplen del F.C. a Antillas), Venturi 2074, October 21, 1923 (A, GH, NY, US).

17. Bonamia boliviana O'Donell, Lilloa 23:458, tab. 1. 1950.

Perennial woody climbers. Stems twining, terete, 1-2.5 mm. in diameter, tomentose, with internodes of 1-4 cm. long. Leaves petiolate, subcoriaceous or soft-coriaceous, tomentose and glabrescent above, more densely tomentose underneath; petioles 2-9 mm. long, tomentose; blades elliptic to ovate, 1-4 cm. long, mostly 7-23 mm. wide, rounded, subcordate or truncate at the base, obtuse-mucronate or acute-mucronate at the apex; midrib impressed above, prominent beneath, with 5-7 pairs of lateral veins. Flowers solitary, in axils of normal or reduced leaves or in axillary racemose inflorescences of few flowers on short branches; peduncles short, 1-4 mm. or rarely longer, tomentose; pedicels 3-9 mm. long, tomentose; bracts linear, alternate or occasionally opposite, 2-4 mm. long, tomentose. Sepals slightly unequal or equal, coriaceous or subcoriaceous; outer ovate to subovate, 5-6 mm. long, 4.5-5 mm. wide, concave, obtuse, tomentose; inner suborbicular, 4.5-5.5 mm. long. 4.5-5 mm. wide, obtuse, tomentose above, glabrous along lateral hyaline margins. Corolla pale yellow, campanulate, 17-18 mm. long, with entire or subentire limb, ferrugineous with long hairs on interplicae. Stamens included, 12-13 mm. long; filaments pilose with long hairs near the base; anthers oblong, 2.5-3 mm. long. Ovary fusiform and attenuate to the stylar base, glabrous; styles free nearly to the base, glabrous, unequal; stigmas reniform. Fruits and seeds unknown.

Type: Bolivia: Cordillera, La Cuesta, 386 m., flor amarillenta, I. Peredo, 8. II. 1946 (F, NY, US, W-isotypes).

Known only by the type collection from Bolivia (Map 6).

This species is poorly known. Since furit and seed are not known, its placement in the section Bonamia is tentative until future collections are available.

In superficial appearance, this species resembles some Brazilian species, particularly B. subsessilis and B. burchellii. However, it is well distinguished from these by its smaller leaves with indistinct intercostal veins, shorter stem and solitary or few-flowered cymes. It is also distinct from B. subsessilis by its pedicelled flowers. Future collections might show that this species should properly be placed in the section Trichantha together with these Brazilian species.

18. Bonamia holtii O'Donell, Lilloa 30:59. 1960.

Perennial twining vines. Stems becoming woody, terete or slightly angular and striated, 1-2.5 mm. thick, sparsely and minutely pubescent; internodes mostly 4-8 cm. long. Leaves shortly petiolate, subcoriaceous or leathery, sparsely pilose or becoming glabrous; petioles 8-17 mm. long, sparsely pilose; blades elliptic or elliptic-ovate, 5-9 cm. long, 3-5 cm. wide, rounded and slightly asymmetrical at the base, acute-mucronate or acuminate at the

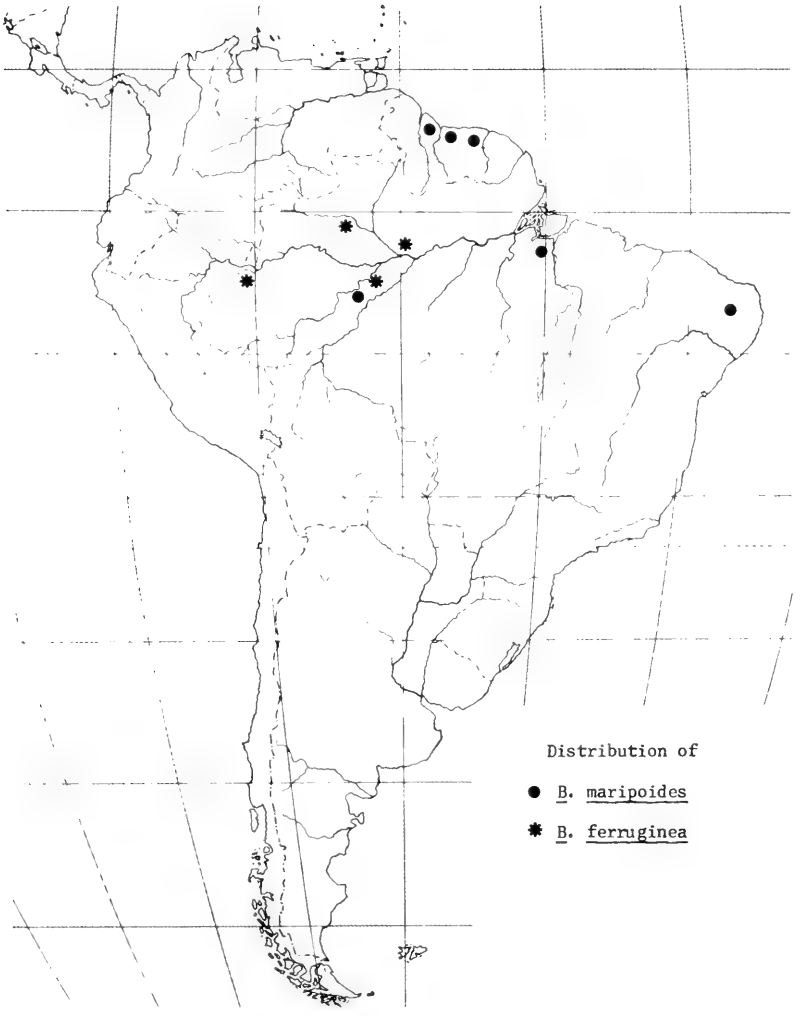
apex; midrib prominent beneath, with 4-6 pairs of lateral veins. Inflorescences shortly pedunculate, axillary, dense-capitate cymes of few to several flowers; peduncles short, 2-9 mm. long, 1-1.5 mm. thick, minutely pubescent or sericeous; bracts foliaceous, elliptic or elliptic-lanceolate, 6-12 mm. long, 1.5-5 mm. broad; bracteoles lanceolate, 3-5 mm. long, sericeous. Sepals coriaceous or subcoriaceous, slightly unequal; outer sepals lanceolate or ovate-lanceolate, 8-10 mm. long, 3-5 mm. wide, acute or acuminate at the apex, appressed-tomentose or finely pubescent outside; inner sepals elliptic, ovate or ovate-elliptic, 6-7 mm. long, 4-5 mm. wide, obtuse or obtuse-acute at the apex, nearly glabrous or somewhat pubescent on the median lines. Corolla white, infundibuliform, 1.2-1.9 cm. long, with 5-lobulate or subentire limb, long-pilose on interplicae. Stamens inserted; filaments 7-14 mm. long, glabrous; anthers oblong, 3 mm. long, dorsifixed, sagittate at the base. Ovary ovoid, long-pilose at the apex, glabrous below; styles fused for lower one-fourth and free above, filiform, glabrous; stigmas capitate. Capsules subglobose, 4 mm. in diameter, long-pilose at the apex, 4-valvular, 4-seeded; seeds black, 3 mm. long, glabrous, rugose. Cotyledons cordate, slightly asymmetrical, rounded at the apex; cotyledonary petioles fused.

Type: Colombia: Rio Orinoco, Boca del Vichada, alt. about 100 m., E.G. Holt and W. Gehriger 223, January 12-24, 1930 (US-holotype; isotype at Caracas, Venezuela, not seen). The labels of the type carried the data, "Venezuela, Amazonas Territory: Rio Orinoco; Boca del Vichada;" thus specifying a location in Colombia at the mouth of the Rio Vichada. The species is endemic to this region and known only by the type collection (Map 6).

This species is different from all other South American species by its capitate inflorescence, acute or acuminate sepals, foliaceous bracts and bracteoles, and slightly twining and somewhat striated stem. It is, however, distantly related to B. umbellata because of the similarity in their inflorescence and indumentum. Bonamia holtii is poorly known and is described from two sheets of the same collection. The specific name is derived from the name of its collector and was first used as an unpublished name under the genus Prevostea by Dr. H. Pittier, a field botanist of Venezuela.

19. Bonamia maripoides Hall. f. Bot. Jahrb. 16:529. 1893.
Maripa spectabilis Choisy, in D. C. Prodr. 9:327. 1845.
Prevostea spectabilis Meissner, in Mart. Fl. Bras. 7:325. 1869.
Calycobolus spectabilis (Choisy) House, Bull. Torr. Bot. Club. 34: 146. 1907.

Perennial, twining liana growing all year around. Stems woody, terete, yellowish or brownish tomentose, glabrescent, climbing to 20 m. or higher. Leaves petiolate, subcoriaceous, glabrous and shing above, golden or yellowish sericeous (with unidirectional hairs) beneath; petioles 8-15 mm. long, sericeous and glabrescent;



Map 7

blades broad-ovate or elliptic, 6-14 mm. long, mostly 3-7.5 cm. broad, shortly acuminate or obtuse at the apex, rounded at the base, with 6-10 pairs of lateral veins. Inflorescences axillary, shortly peduncled, compound, umbelliform cymes, often secund; pedicels distinctly elongate, usually 1-2 cm. long, densely sericeous and glabrescent, ridged; bracts small, lanceolate, often inconspicuous. Sepals coriaceous, mostly equal or slightly unequal in length, the two exterior orbicular or broad-elliptic, acutish and tomentose, the three interior orbicular, obtuse and nearly glabrous. Corolla white, funnel-shaped, mostly 2-2.5 cm. long, yellow-villous on interplicae, glabrous on plicae, entire or subentire. Stamens included; filaments, short, adnate to corolla tube, glabrous; anthers oblong, about 2 mm. long. Ovary hairy; styles bifid or free nearly to the base, longer than filaments; stigmas globose. Capsule ovate, acute, hairy at the apex, 8-valved, 4- (2-) seeded, about 6 mm. long and 5 mm. in diameter. Seeds ovate, compressed on the inner side, 3-4 mm. long, black, glabrous. Cotyledons ovate or obovate.

Type: Brazil: type specimen not available.

Northern Brazil, British Guiana and Surinam (Map 7).

According to the collectors, this species is a high-climbing woody vine to 20 m. on lofty shrubs or in virgin forest. No definite habitat has been recorded by any collector. It has been collected in flower in March, April, August and October, and in fruit in February, March, May, June and July.

Specimens examined:

BRAZIL: Amazonas: Borba, Rio Madeira, R.L. Froes 26109, 28. 11. 1950 (US). Para: Belem do Para, A. Ducke 3304, 5. 3. 1903 (RB, US); Belem do Para, M. Guedes 1602, 28. 5. 1898 (US). Perambuco: Estrada de aldeia, flores alvas, trepadeira, C. Leal e Otavis Silva, 19. 7. 1950 (RB); flowers very numerous, white, abundant at one spot in the matto of Berberibe, climbing over the tops of lofty shrubs, Ridley, Lea and Ramage, October 4, 1887 (BM).

BRITISH GUIANA: Bullet Tree Island: Ebini Experiment Station, Berbice River, margin of jungle, S.G. Harrison 1243, 28. VI. 1958 (K).

SURINAM: M. Berthond-Coulon 219, 1841 (BM); Forest Reserve Zanderiz 1, sand virgin forest, bud brown, liana, J. Lanjouw 362, July 31, 1933 (NY); Saramacca River, liana climbing to 20 m., leaves dark green above, tawny sericeous beneath, bush to rear of Jacob Kondre, Bassett Maguire 23761, June 19, 1944 (BM, F, NY, US); Coppername River near Onobissi, "B.W." 1103, 4. 3. 1915 (L); Coppername River, Raleighfalls, "B.W." 6232, 2. 8. 1923 (NY, US). Location indefinite: Berlyn, Scandens in sylvis Paraensis prope plant, flores albi, F.L. Splitgerber 743 (L); Splitgerber 362 (L).

20. Bonamia brevipedicellata Myint and Ward, sp. nov.

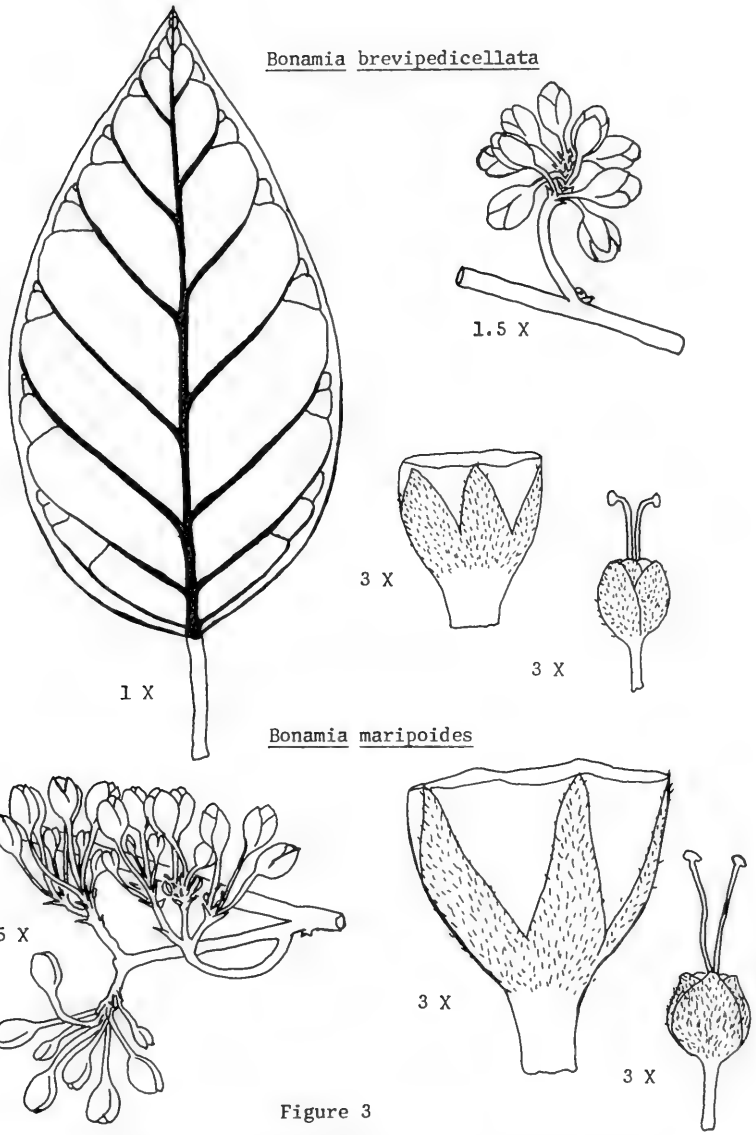


Figure 3

Leaf shape, inflorescence and floral parts of B. brevipedicellata, and inflorescence and floral parts of B. maripoides

Frutex alte scandens, usque 16 m. Folia petiolis 2-3 cm. longis; laminae ellipticae vel ovato-ellipticae, 8-12 cm. longae, 4-7 cm. latae, basi rotundata vel obtusa, apice breviter acuminato, supra glabrae, infra dense tenui-pubescentes. Inflorescentiae cymae breviter pedunculatae, dense multiflorae. Pedunculi breves, plerumque 1-3 cm. longi. Sepalo ovato-orbicularia, subaequalia, 4-5 mm. longa, dense tenui-pubescentia. Corolla campanulata, 1-1.2 cm. longa, limbo angusto, viridi-alba, prompta decidua. Stamina inclusa; fila glabra; antherae basi cordata. Styli libri ad basim, minores quam 1 cm. longi; stigmata peltato-subglobosa. Fructus et semina ignota.

Perennial, woody vines. Stems terete, about 1-2.5 cm. in diameter and 16 m. tall, puberulous or glabrescent. Leaves petiolate, membranous to subcoriaceous, glabrous above, densely fine-pubescent with unidirectional hairs underneath; petioles 2-3 cm. long, 1.5-2.5 mm. thick, finely pubescent or puberulous and glabrescent, canaliculate above; blades elliptic to ovate-elliptic, 8-12 cm. long, 4-7 cm. wide, rounded or obtuse at the base, shortly acuminate or acute at the apex; midrib impressed above, prominent beneath, with 5-6 pairs of lateral veins. Inflorescences shortly pedunculate, dense multiflorous cymes in the axils of young or reduced leaves on short branches; peduncles 4-10 mm. long, finely pubescent; pedicels short, mostly 1-3 mm. long, pubescent; bracts minute, 1-2 mm. long, linear. Sepals ovate-orbicular, subequal, 4-5 mm. long, 3-4 mm. wide, densely fine-pubescent with grey or silvery grey hairs. Corolla greenish tinged, readily dropping off, campanulate, 1-1.2 cm. long, with narrow limb, hirsute on interplicae; tube cylindrical, wide, about 4 mm. long. Stamens included; filaments glabrous; anthers oblong, 2.5-3.5 mm. long, cordate at the base. Ovary conical, with long hairs at the apex, glabrous near the base; styles free to the base, glabrous, equal or slightly unequal, the longer less than 1 cm. long; stigmas peltate-subglobose. Fruits and seeds not known.

Type: British Honduras: Machaca, alt. 50 ft., very tall vine growing in broken forest in swampy places; flowers light green which easily drop off in the process of felling. "Rare," 50 ft., 1 in. diameter, W.A. Schipp 1210, September 11, 1933 (GH).

Although the type material is incomplete, it is clearly distinct from all other known species. The material, even though lacking fruits and seeds, is sufficient to permit a technical description. The name B. brevipedicellata is derived from the very brief pedicels.

This species is superficially very suggestive of B. maripoides, to which it is definitely related because of similarity of leaves, indumentum, sepals, cordate anthers, glabrous filaments, free styles and subglobose stigmas. However, B. brevipedicellata shows a series of distinctive features which appear to offer a sound basis for adjudging it a separate species. The leaves in B. maripoides are densely pubescent with long appressed hairs, whereas the hairs are

shorter and soft in the B. brevipedicellata. The inflorescences in B. maripoides are loose compound cymes, while the cymes in B. brevipedicellata are dense. Individual flowers are long-pedicellate in B. maripoides, while they are short-pedicellate or almost sessile in B. brevipedicellata. The corolla in this species is very small (with a narrow and short limb) compared to the large corolla in B. maripoides and, as described by the collector, is greenish and readily deciduous (Figure 3).

This species probably is a large climber, reaching to a height of 16 m., and is rare according to the collector. It has been misidentified as a species of the Solanaceous genus Lysianthes.

21. Bonamia ferruginea (Choisy) Hall. f. Bot. Jahrb. 16:530. 1893.
Prevostea ferruginea Choisy, Annal. Sci. Nat. 4:498. 1825.
Breweria ferruginea Hook. f. & Jackson, Ind. Kew. 1:337. 1893.
Calycobolus ferruginea (Choisy) House, Bull. Torr. Bot. Club. 34:146. 1907.
Not Trichantha ferruginea Karst. & Triana, Linnaea 28:438. 1856.

Perennial, densely ferrugineous, woody climbers. Stems twining or scandent, terete, densely tomentose-ferrugineous with crisped and brownish hairs, frequently branching. Leaves shortly petiolate, herbaceous, subcoriaceous and soft or leathery, densely ferrugineous on both surfaces, more densely so underneath, with brown or reddish brown hairs; blades broad-ovate or elliptic-ovate, 5-13 cm. long, 3-8 cm. wide (upper leaves subtending inflorescence and on young shoots smaller), abruptly acute or obtuse and mucronate at the apex, rounded or cordate at the base; midrib prominent, with about 6-10 pairs of lateral veins. Inflorescences sessile or pedunculate, multiflorous, capitate cymes in the axils of upper or reduced leaves, frequently on short lateral branches; peduncles, when present, ferrugineous like stems; pedicels absent or very short, frequently somewhat elongate in fruiting stage; bracts linear, 5-10 mm. long, occasionally reduced, ferrugineous. Sepals coriaceous, unequal; the two exterior larger, broad-ovate, 8-10 mm. long, 5-7 mm. wide, occasionally smaller, densely ferrugineous outside, pubescent along recurved margin inside, obtuse and reflexed at the apex; the three interior smaller, orbicular or ovate-orbicular, 4-6 mm. long, 3-5 mm. wide, glabrous or sparsely minute-pubescent, rounded or truncate at the apex. Corolla white, tubular-campanulate, 1.2-1.8 mm. long, with sublobulate limb, pilose outside on interplicae, glabrous on plicae; tube distinct, narrow. Stamens included; filaments glabrous; anthers oblong, 3-4 mm. long, cordate at the base. Ovary globose or conical-globose, apiculate, 4-valved, 2- to 4-seeded; seeds triangular-ovate, brown, glabrous. Cotyledons oval-cordate, rounded or truncate at the apex, broadly cordate at the base, in hard cartilagenous endosperm; cotyledonary petioles fused.

Type: Brazil, Amazonas: type specimen not available.

Judging from the specimens examined in this study, this species appears to be localized in the states of Amazonas, northwestern Brazil, from Manaus and Borba to Tefe (Map 7). A few collectors recorded edge of forest and dry highland as the habitat of this species. It has been collected in flower from May to September and in fruit from August to October.

This species was originally described under Prevostea (=Calycobolus) by Choisy and was accepted by Meissner. Hallier, realizing that its sepals are not accrescent, transferred it to Bonamia. House later transferred the species to Calycobolus because of the unequal sepals which he erroneously thought characterized this latter genus.

Specimens examined:
BRAZIL: Amazonas: Manaos, loco Flores, silva secundaria non inundabili, Frutex scandens, flor. albis, Ducke 210, 30. 5. 1936 (A, R); Tefe, A. Ducke 18017, 15. 6. 1906 (RB); municipality of Borba, near Urucurituba, basin of Tio Madeira, B.A. Kruoff 5952, September 4-6, 1934 (BM), 5953 (G); Ega Amazonas, in Sylvan Margin, Poeppig 2589, September, 1831 (F, GH, W); Manaos, Estrada da Raiz, vine, flower white, R.E. Schultes and G.A. Black 8085, August 7-12, 1946 (GH, MO, NY, US); Manaus, Schwacke 210, 1882 (R); ad oram meridionalem Rio Negro, usque ad coneursum flum. Solimoes, R. Spruce 1568, Maio 1851 (BM, G, W); flowers white, J.W.H. Traill 558, 12. 6. 1874 (K); Rio Negro, Windent auf Gestraiich bei Flores, Manaus, Bluto Weiss, E. Ule 5195, July 29, 1900 (G, HBG, L). Unknown collector: Fragment ex Herbario Musei Parisiensis (F).

22. Bonamia umbellata (Choisy) Hall. f. Bot. Jahrb. 16:530. 1893.
Prevostea umbellata Choisy, Ann. Sci. Nat. 4:497. 1825.
Calycobolus umbellata (Choisy) House, Bull. Torr. Bot. Club 34:146. 1907.

Perennial, ligneous or herbaceous and suffrutescent vines. Stems twining or scandent, 1.5-3 mm. thick, pilose while young, puberulous or becoming glabrous in age; internodes usually 3-8 cm. long, occasionally shorter. Leaves petiolate, soft and herbaceous, rarely leathery, appressed-pilose on upper surface, more densely so underneath, becoming less pilose or nearly glabrous in age; petioles 4-17 mm. long, 1-1.5 mm. thick, pilose or glabrate; blades oblong-ovate, mostly 3.5-8 cm. long, 2-4.5 cm. wide, cordate, subcordate or occasionally rounded at the base, obtuse-mucronate at the apex, with about 5-7 pairs of lateral veins. Inflorescences pedunculate, axillary, subumbellate cymes of few to many flowers (mostly 5-15); peduncles variable in length, mostly 2-7 cm. long, occasionally much shorter, 1.5-2 mm. thick, slightly thicker when fruits mature, pilose as in stems; pedicels 5-15 mm. long, thinner than peduncles, pilose; bracts minute or foliaceous, lanceolate, 2-17 mm. long. Sepals herbaceous or subcoriaceous, puberulous, glabrescent or with scattered hairs; exterior two larger, ovate, 6-10 mm. long, 5-9 mm. wide, obtuse or rounded at the apex; in-

terior three narrower or shorter, usually glabrous (except at the base), ciliate. Corolla white, funnel-shaped, 2.5-3 cm. long, with tube slightly longer than sepals, subentire or lobulate at the limb, long-pilose on interplicae. Stamens included; filaments glabrous, shorter than styles; anthers oblong, about 3.3 mm. long, cordate at the base. Ovary conical, about 3-4 mm. long, glabrous; styles bifid for upper one-fourth or one-fifth, glabrous; stigmas globose-capitate. Capsules globose, 5-6 mm. in diameter, 4-valvular, 2- to 4-seeded; seeds triangular-ovate, 3-4 mm. long, dark brown, glabrous. Cotyledons ovate-cordate, rounded at the apex; cotyledonary petioles fused.

Type: Brazil: type specimen not available.

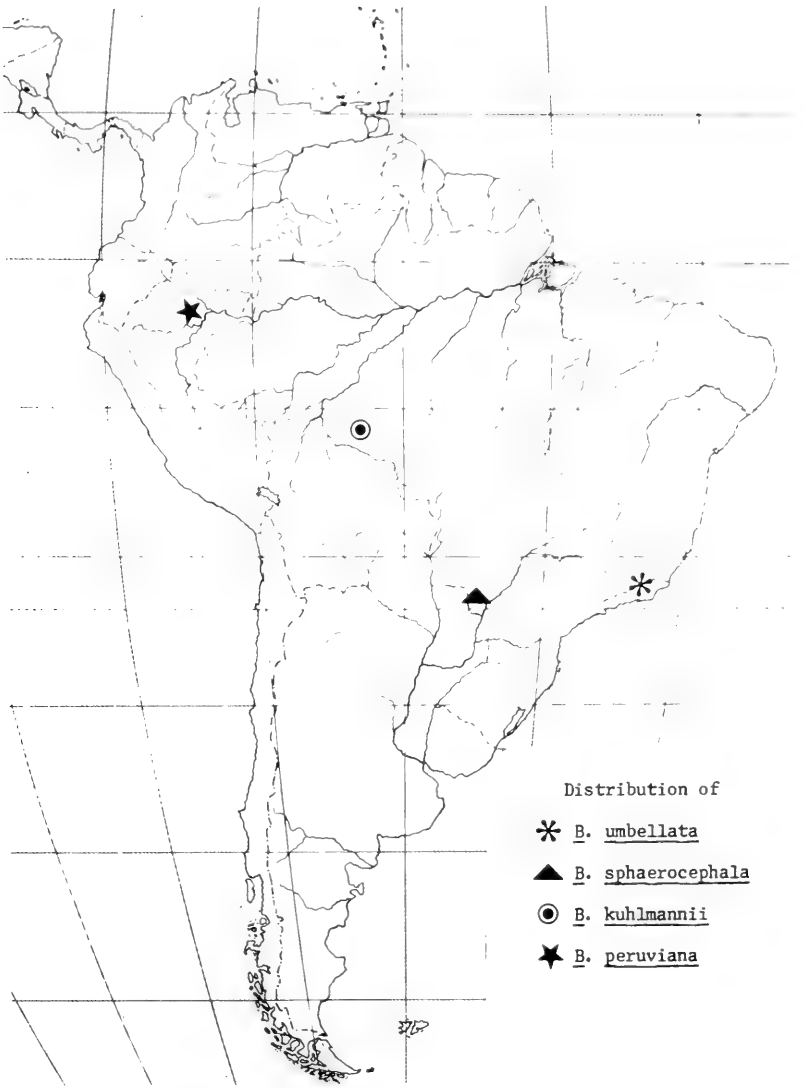
Known only from southern Brazil (Map 8).

Meissner (1869), while treating this species under the genus Prevostea, proposed a new variety in addition to the typical one, mainly based on the length of petioles. This feature, however, is extremely variable and no satisfactory line can be drawn to account for infraspecific segregation in the species. As Hallier did not make a transfer of Meissner's new variety, it is evident that Hallier did not accept it.

Specimens examined:
BRAZIL: Burchell 775 (NY); Burchell 1858 (K); bushy places by Rio de Janeiro, Gardner 5560, July, 1841 (BM); Santa Theresa (Rio de Janeiro) voluvel, flores blanca, r. 26 de Dezembro de 1869, G. Glaziou 4131 (R); Rio de Janeiro, Schott 5462 (W); Rio de Janeiro, Sellow 225 (NY); Rio de Janeiro, G. Staunton (BM, W); Estado de Rio, Morro da Nova, Cintra, Trepadeira, E. Ule 3849, February 25, 1896 (HBG, R).

23. Bonamia sphaerocephala (Dammer) v. Ooststr. Rec. Trav. Bot. Neerl. 33:212. 1936.
Prevostea sphaerocephala Dammer, Bot. Jahrb. 23 (Beibl. 57): 37. 1897.

Perennial shrubby herbs growing erect from the base of old shoot. Stems woody, erect or suberect, about 50-80 cm. long, densely tomentose or lanate with grey or silvery grey soft hairs; young stems 3-4 mm. thick, single or occasionally with one or two lateral branches. Leaves sessile or subsessile, subcoriaceous, lanate or tomentose on upper surface, densely white woolly underneath; blades oblong-elliptic, ovate-elliptic or elliptic-lanceolate, 2-4.5 cm. long, 1-2 cm. wide, sometimes slightly narrower, subcordate or truncate at the base, obtuse-mucronate or acute-mucronate at the apex; revolute at the margin; veins distinctly impressed above, prominent underneath; lateral veins 3-5 (6) pairs. Inflorescence terminal, multiflorous, dense capitate, 2-3.5 cm. in diameter; flowers sessile or shortly pedicellate; bracts linear, as long as and long-pilose as the sepals. Sepals coriaceous or subcoriaceous, unequal; exterior two larger, thicker, lanceolate-acuminate, 6-8 mm. long, 1.5-2 mm. wide, densely long-pilose outside; inner three


Distribution of
B. umbellata
B. sphaerocephala
B. kuhlmannii
B. peruviana

Map 8

smaller and submembranous, lanceolate and shortly acuminate or acute, 4-5 mm. long, 1.5-2 mm. wide, long-pilose outside. Corolla white or blue, tubular-campanulate or funnel-form, slightly longer than outer sepals, mostly 9-12 mm. long, densely long-pilose on interplicae, with narrow, entire or subentire limb. Stamens included; filaments glabrous, slightly shorter than styles; anthers oblong. Ovary conical, with dense, long hairs near the apex; styles bifid for upper half, hairy at the base; stylar branches glabrous; stigmas globose-capitate. Capsules subangular globose, apiculate, finely pubescent near the apex, glabrous below, with coriaceous wall, 2- to 4-seeded, breaking by annular scission at the base; seeds oval, glabrous, dark brown. Cotyledons oval.

Type: Brazil, Haut de la Serra Dourada, a Olha d'Agua pres de Goyaz, M.A. Glaziou 21797, August 13, 1895 (BM-lectotype, R-isotype). Van Ooststroom designated a specimen at Berlin as the type; this material, however, was not included in a recent loan and is presumed to have been destroyed during the war. A duplicate specimen at the British Museum is designated here as the lectotype.

This species is known from southern Brazil (Map 8). Van Ooststroom reported it from Minas Geraes, but no specimen was seen in the present study. Further collections with detailed description of habitat and flower color are to be desired, since its habitat is not recorded by the collectors and flower color is differently recorded by the same collector (Glaziou 21797, BM, R).

The outstanding features of this species are the strongly nerved and lanate leaves with long mucros, the erect and single stem, terminal globose heads, lanceolate-acuminate sepals with long hairs and small corolla. It seems to be related to the African species, B. mossambicensis, because of the following common features: inflorescence dense, unequal sepals with long hairs, and long bracts with long hairs. However, the two can be readily distinguished by their habit, length of stem, shape, size, apices and petioles of leaves and size of sepals and corolla.

Specimens examined:
BRAZIL: Haut de la Serra Dourada, Goyaz, fl. blanc, M.A. Glaziou 21797, August 13, 1895 (BM); Serra Dourada (Goyaz), frutescente, flores azulos, Glaziou 21797, August 13, 1895 (R); Serra Dourada, Goias, subarbusto campestre, Agnes, A. Macedo 3730, 30. VII. 1952 (MO, NY).

24. Bonamia kuhlmannii Hoehne, Anex. Mem. Inst. Butantan 1 (4): 44, tab. 2. 1922.

Perennial, high-climbing, shrubby vines. Stems woody, 2-4 mm. thick, densely short-ferrugineous or subvelutinous. Leaves petiolate, submembranous or soft and leathery, softly velutinous on both surfaces, lighter in color underneath; petioles 1-2.5 cm. long,

1-2 mm. thick, shortly ferrugineous; blades ovate or ovate-cordate, 5-12 cm. long, 3-8 cm. wide, cordate or truncate, rarely rounded at the base, obtuse-mucronate at the apex; midrib slightly impressed above, prominent beneath, with 5-7 pairs of lateral veins. Inflorescences shortly pedunculate, axillary, simple or compound cymes of few to several flowers; peduncles 1-2 cm. long, 1-2 mm. thick, short-ferrugineous as peduncles, bracts small, linear or triangular-acuminate, 1-2 mm. long, ferrugineous. Sepals subcoriaceous or herbaceous, unequal; exterior two larger, ovate or ovate-subcordate, 1.2-2 cm. long, 10-17 mm. wide, occasionally smaller, adnate to pedicels at the base, obtuse at the apex, densely velutinous-ferrugineous outside, shortly ferrugineous inside (except at the glabrous center), interior three ovate-orbicular, 5-7 mm. long, glabrous or sparsely pubescent. Corolla white, narrowly campanulate or funnel-form, 2.5 cm. long, sparsely pilose on interplicae. Stamens included; filaments glabrous; anthers oblong, sagittate at the base. Ovary ovoid-conical, glabrous; styles bifid to the middle or nearly to the base; stigmas globose. Fruits unknown.

Type: Brazil: Mato-Grosso: Comissao Rondon, entre Buriti e Formigueiro, liana do cerrado, fl. alva, J.G. Kuhlmann 2268, 6-1918 (R-isotype).

This is a poorly known species, rarely collected and so far known only by the type collection from southwestern Brazil (Map 8). The type specimen was collected with flowers which mostly are only in bud. Its fruit is unknown and a complete description of the species has to wait future collections.

This species is characterized by its completely ferrugineous parts, large leaves (cordate or subcordate at the base), unequal sepals, short peduncles and nearly free styles. It, however, is distinct in its densely ferrugineous leaves, which are cordate or subcordate at the base and obtuse-mucronate at the apex, larger sepals, shorter peduncles and pedicels, and deeper bifurcation of styles.

25. Bonamia peruviana van Ooststroom, Recu. Trav. Bot. Neerl. 30: 192. 1933.

Perennial liana. Stems woody, scandent, 2-4 mm. thick, densely ferrugineous-tomentose; internodes 2-6.5 cm. long. Leaves petiolate, subcoriaceous or soft and leathery, minutely tomentose above, more densely so underneath; petioles 6-16 mm. long, mostly 1 mm. thick, tomentose similar to stems; blades ovate or ovate-elliptic, 5-7 cm. long, 2.5-4 cm. wide, rounded at the base, shortly and acutely acuminate at the apex; midrib distinctly impressed above, prominent beneath, with 6-8 pairs of lateral nerves. Inflorescences pedunculate, axillary, simple or compound cymes of few to several flowers; peduncles 1.5-4.5 cm. long, sometimes apparently dichotomous due to absence of central flowers; pedicels slender, elongate 1.5-2 cm. long, occasionally longer, minutely

tomentose, bracts linear-subulate, about 2 mm. long. Sepals subcoriaceous or herbaceous, unequal; exterior two larger, broadly ovate, 8-14 mm. long, 7-12 mm. wide, densely ferrugineous-tomentose on both surfaces except glabrous center inside, subcordate at the base, obtuse or subobtuse at the apex; interior three smaller, orbicular, 4-5 mm. long, glabrous. Corolla white, infundibuliform, 2-2.5 cm. long, sparsely pilose on interplicae. Stamens included; filaments filiform, glabrous; anthers oblong, 2.5-3 mm. long, cordate at the base. Ovary ovoid-conical, glabrous; styles bifid for the upper half, with slightly unequal branches; stigmas globose. Fruits glabrous, known only in immature stage; seeds glabrous.

Type: Peru: Loreto: Michuyaeu, near Iquitos, at 100 m., liana, fls. white, clearing (forest) G. Klug 232, October-November, 1929 (F-holotype; NY, US-isotypes; G, L-fragments).

The type collection, the only material available for this study, was collected in flower and in young fruit, and is not sufficient for a description of the fruit. Cotyledons dissected from immature seeds appear to be ovate-cordate with fused cotyledonary petioles.

This species is closely related to B. kuhlmannii of southwestern Brazil; however, it is different from the Brazilian species by its leaf size, form, apex and base, indumentum and smaller sepals. Macbride (1959), in his Convolvulaceae of Peru, added a comment that the differences between B. peruviana and B. kuhlmannii may prove to be due to age and variability in a series of collections. Since both species are known only from type collections, this statement cannot now be verified. From the materials available at present they appear to differ in several features and thus are treated here as distinct species.

II. Section: Breweria (R. Br.) Myint, Burma Jour. Life Sci. 1:31. 1968.
Breweria R. Br. Prodr. Fl. Nov. Holl. 487, 1910.

Stems herbaceous, woody or becoming woody, prostrate, procumbent, twining or erect, usually short, 1-2 m. long, rarely longer, mostly 1-2 mm. thick or slightly thicker. Leaves sessile or short-petiolate, soft, herbaceous, rarely subcoriaceous, mostly thin; blades elliptic, ovate-elliptic, oblong-elliptic, linear, lanceolate, oblong-ovate, ovate, ovate-subcordate or occasionally orbicular, 3 cm. or shorter, rarely somewhat longer, mostly 2 cm. or narrower, rarely 2.5 cm. or slightly wider, with length-width ratio of 1.5 or higher, occasionally lower, rounded, subcordate or truncate at the base; obtuse, rounded or slightly emarginate and mucronate at the apex. Flowers axillary, sessile or shortly pedunculate, solitary or rarely in simple cymes of two or three; bracts linear, small or as long as pedicels or longer, persistent. Sepals herbaceous, subcoriaceous or rarely somewhat coriaceous, equal or unequal, lanceolate, ovate-lanceolate, ovate or ovate-acuminate, acute,

acuminate or rarely obtuse at the apex, mostly 4-8 mm. long, outer sepals 12 mm. long (when unequal). Corolla white, blue, pink or red, 8-15 mm. long, occasionally longer, subentire or 5- to 10-lobulate at the margin. Stamens included; filaments glabrous or sparsely villous or rarely densely villous below and glabrous above; anthers 1-2 mm. long, rarely longer, slightly cordate at the base. Ovary ovoid or oblong-ovoid, sparsely or densely pilose or glabrous; styles free nearly to the base or fused to the middle and readily separable to the base; vascular traces single in the stylar branches, not branched; stigmas globose, subglobose or capitate, usually large. Fruits 4- to 8-valvular, 2- to 4-seeded, thin-walled; septum thin; seeds glabrous, smooth or punctate. Cotyledons ovate, obovate, ovate-cordate or orbicular, flat, folded or somewhat corrugate.

Type: Bonamia linearis (R. Br.) Hall. f. (as Breweria linearis R. Br., 1810.)

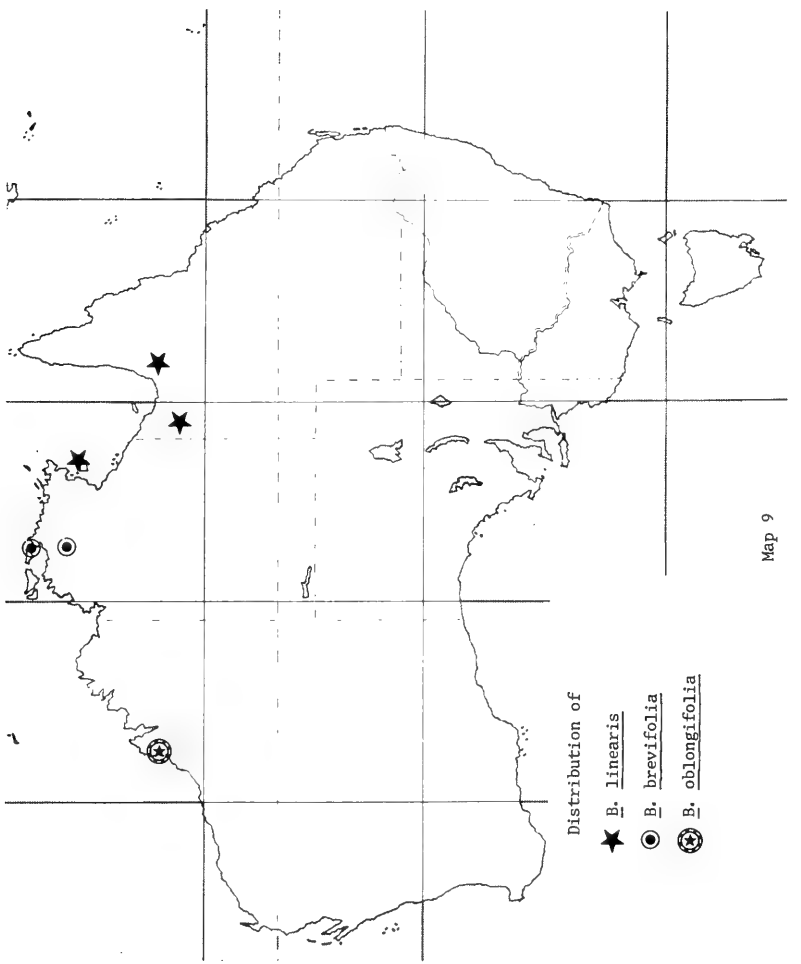
Tropical Australia and southern Africa.

This section is very sharply defined from section Trichantha, but not very distinctly from section Bonamia, from which it differs by its smaller corolla, thin and mostly smaller leaves, smaller sepals, solitary flowers or simple cymes, and peduncles very short or absent.

The circumscription of this section and section Bonamia may necessarily be modified when the morphology of the plants involved is known better.

26. Bonamia linearis (R. Br.) Hall. f. Bot. Jahrb. 16:530. 1893.
Breweria linearis R. Br. Prodr. Fl. Nov. Holl. 488. 1810.
Bonamia linearis (R. Br.) Hall. f. var. genuina Hall. f. Bull. Herb. Boiss. 5:1011. 1897.

Perennial, herbaceous or suffrutescent vines. Stems prostrate or shortly twining, slender terete, becoming 3-9 dm. long, mostly 1-2 mm. thick, soft-pilose or sparsely pilose, becoming almost glabrous in age; old stems 2-4 mm. thick; internodes 1-2.5 cm. long. Leaves shortly petiolate, soft, thin or submembranous, pilose with long and very fine hairs or becoming sparsely so or nearly glabrous; petioles slender, 2-4 mm. long, pilose; blades linear or linear-lanceolate, 1.5-3.5 cm. long, 2-6 mm. broad, occasionally slightly broader, acute or attenuate, rarely rounded or subtruncate at the base, acute or acuminate at the apex; veins indistinct except thin midrib. Flowers axillary, solitary, shortly pedicellate or nearly sessile; peduncles absent; pedicels 0-3 mm., pilose; bracts small, linear or filiform, 1-3 mm. long. Sepals ovate-lanceolate or ovate-acuminate, 5-7 mm. long, 2-3 mm. broad, herbaceous, subcoriaceous near the base, equal or subequal, pilose or sericeous outside, acuminate or acute at the apex. Corolla white, funnel-shaped, 1-1.5 cm. long, long-pilose on interplicae. Stamens included; filaments filiform, glabrous above, scattered-villous on the



Map 9

lower parts adnate to corolla tube; anthers oblong-oval, cordate at the base. Ovary oblong-oval, long-pilose; styles bifid to the middle or lower, filiform, glabrous; stigmas capitate or subglobose-capitate. Capsules ovate-apiculate, pilose at the apex, 2- to 4-seeded, 4-valvular; seeds oblong-ellipsoid, glabrous, black or brown. Cotyledons orbicular.

Type: Australia (Nov. Hollandia tropical), F. Bauer 318, "1801-05" (W-isotype).

Known from northern Queensland and islands of the Gulf of Carpentaria, growing mostly on sandy grounds and coastal dunes (Map 9).

This species has been collected in flower in April and June. Specimens with mature fruits were not available for this study.

This species is closely related to B. media. Specimens (such as F.W. Whitehouse - BRI) with wider leaves are very similar to the typical variety of B. media and are vegetatively hardly distinguishable from the latter. Hallier treated B. linearis and B. media as two distinct species in the first part of his synopsis, but later in the same paper he treated them as varieties of the same species. However, B. linearis seems to be distinct from B. media because of its larger corolla and generally narrower leaves (Figure 4).

Specimens examined:
AUSTRALIA: Northern Territory: On landward edge of coastal dune, Little Lagoon, Groote Eylandt, in the Gulf of Carpentaria, prostrate herb, corolla white, R.L. Specht 230, April 13, 1948 (L, US). Queensland: Gilvert River, Elgrey per N.A.R. Pollock (BRI); Doomadgee Mission, F.W. Whitehouse (BRI). Location indefinite: Stannary Hills, T.L. Bancroft, June, 1909 (BRI); Nova Hollandia tropica, Ferd. Bauer 318 (W).

27. Bonamia oblongifolia Myint, Burma Jour. Life. Sci. 1:32. 1968.

Perennial, herbaceous or suffrutescent, densely ferrugineous plants. Stems terete, erect or suberect, densely ferrugineous with brown hairs, 1.5-2 dm. tall, about 3 mm. thick at the base; branches 1-1.5 mm. thick. Leaves shortly petiolate or subsessile, subcoria-

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Figure 4

Variations in sizes and shapes of leaves in B. media, B. brevifolia, B. oblongifolia and B. linearis

1-9 B. media var. media x 2.
10-13 B. media var. villosa x 2.
14-16 B. brevifolia x 2.
17-21 B. oblongifolia x 2.
22-26 B. linearis x 2.

Figure 4

ceous or leathery, densely ferrugineous on both surfaces; petioles 1-2 mm. long or indistinct; blades oblong or rarely oblong-elliptic, 1-2 cm. long, 3-4 mm. wide, rounded at the base and apex; midrib slightly impressed above, distinct below; lateral veins invisible (because of thick coating of hairs), 4-5 pairs. Flowers axillary, solitary, shortly pedicellate or almost sessile; peduncles absent; pedicels 1-1.5 mm. long, ferrugineous; bracts small, linear, 1-1.5 mm. long, frequently slightly exceeding pedicels in length. Sepals ovate, oblong-ovate, or ovate-acute, equal or slightly unequal, 3-4 mm. long, rarely slightly longer, coriaceous or subcoriaceous, acute or shortly acuminate at the apex, densely ferrugineous or sericeous with brownish hairs outside. Corolla blue, campanulate-funnelform, 6-8 mm. long, subentire or slightly lobulate at the margin, pilose on interplicae. Stamens included; filaments filiform, glabrous; anthers dorsifixed, oblong, 0.5-1 mm. long. Ovary oblong with circular disc at the base, long-pilose near the apex; styles bifid to the middle, filiform, glabrous; stigmas capitate. Capsules ovoid-conical, 5-6 mm. long, pilose at the apex, glabrous below, 2- to 4-seeded, 4-valvular; seeds oblong-ellipsoid, 2.5 mm. long, black or dark brown, glabrous. Cotyledons orbicular or orbicular-ovate.

Type: Western Australia: Ville de Broome, dans le gazon sur le sable "rues" de Broome, alt. ca. 5-10 m., herba, flos. bleue, B.P.G. Hochreutiner 2840, 4. II. 1905 (G).

Known only from the type location, growing on a sandy or gravelly meadow (Map 9).

The collector mentioned that this plant was herbaceous, but gave no actual habit. From the material examined, it appears to be erect. His specimen has been erroneously referred to as B. pannosa, which is very distinct in possessing unequal sepals, long bracts, and broad leaves.

This plant is undoubtedly related to B. media because of similarity of the indumentum and to B. linearis because of narrow leaves (Figure 4). However, B. oblongifolia possesses a series of distinctive features which offers a sound basis for adjudging it a separate species. The stem and its branches in B. oblongifolia are short, stout and thick at the base, and possess short internodes, while they are long, slender and weak in B. media and B. linearis. Leaves in B. oblongifolia are oblong or oblong-elliptic, sessile or subsessile, and rounded at both ends. But leaves in B. media are ovate-lanceolate or ovate-subcordate, shortly petiolate, obtuse, truncate or subcordate at the base, and acute, obtuse or emarginate at the apex. Leaves in B. linearis are linear or linear-lanceolate, distinctly petiolate, attenuate, acute or obtuse at the base and acute at the apex. Sepals in B. oblongifolia are smaller and acute or obtuse at the apex, while they are larger and mostly acuminate at the apex in B. linearis.

B. oblongifolia, as the name signifies, is characterized by oblong leaves. Other distinguishing features of this species are erect or suberect habit, short stems and branches, indumentum of dense brown hairs, smaller sepals, shorter corolla and filiform, glabrous stamens.

28. Bonamia brevifolia (Benth.) Myint, Burma Jour. Life Sci. 1: 33. 1968.
Breweria brevifolia Benth. Fl. Austr. 4:436. 1869.
Bonamia linearis (R. Br.) Hall. f. var. brevifolia (Benth.) Hall. f. Bull. Herb. Boiss. 5:1012. 1897.

Perennial, herbaceous or suffrutescent vines, growing from thick and hard rootstock. Stems prostrate, slender, terete, 8-10 dm. long, long-sericeous or pilose, with grey or silvery grey hairs, becoming less hairy in age; internodes 1-2.5 cm. long. Leaves shortly petiolate, soft, herbaceous or somewhat leathery, rarely subcoriaceous, with scattered long hairs or glabrous above, densely appressed-pilose with silvery grey or light brownish hairs below; petioles slender, 2-7 mm. long, pilose; blades ovate-cordate, 1-1.7 cm. long, 9-14 mm. broad, cordate at the base, acute or acute-mucronate at the apex; veins impressed above, distinct below; lateral veins 3-5 pairs. Flowers axillary, solitary, shortly pedicellate; peduncles very short or absent; pedicels 2-4 mm. long, sericeous or pilose; bracts linear or narrowly subulate, as long as pedicels or longer, mostly 3-4 mm. long. Sepals lanceolate or ovate-lanceolate, 3.5-5 mm. long, 2-3 mm. broad, herbaceous or subcoriaceous, equal or slightly unequal, long-pilose or long-sericeous outside, acuminate or acute at the apex. Corolla blue, funnelform or shortly tubular-campanulate, 8-11 mm. long, pilose on the interplicae. Stamens included, filaments filiform, sparsely villous at the base or nearly glabrous; anthers oblong-ovate, cordate at the base. Ovary ovoid-conical, long-pilose or sparsely long-pilose or nearly glabrous; styles connate for lower one-fourth, readily separable nearly to the base, filiform, glabrous; stylar branches unequal; stigmas globose, rarely subglobose. Capsules not available for study.

Type: Australia, Port Essington, Armstrong (BM-isotype!).

Known only from northern districts of Northern Territory, Australia (Map 9).

Collectors have given no information about the habitat of the plant. It has been collected in flower in February.

Hallier (1897), in the first part of his synopsis, treated this species as belonging to Bonamia media, but later both B. media and B. brevifolia were treated as two different varieties of B. linearis. B. brevifolia is only distantly related to this latter species because of its shorter, broader and cordate leaves (Figure 4), longer bracts, smaller sepals, blue corolla and sparsely pilose ovary, whereas B. linearis possesses long, narrow and linear or

linear-lanceolate leaves, minute bracts, longer sepals, white corolla and densely pilose ovary. B. brevifolia seems to be more closely related to B. media, from which it differs by its distinctly cordate and acute leaves (widest near the base), longer bracts, smaller sepals, sparsely villous filaments and sparsely pilose ovary. These characteristics, in addition to the differences in the general appearance of plant, length of stem and indumentum, appear to offer a sound basis for treating it as a distinct species.

Specimens examined:
AUSTRALIA: Northern Territory: Port Essington, Armstrong, 1840 (BM); Humpty Doo, prostrate, leaves dark green above, light green below, flowers blue, N.S. McKee 8328, February 10, 1961 (BRI).

29. Bonamia media (R. Br.) Hall. f. Bot. Jahrb. 16:528. 1893.
Breweria media R. Br. Prodr. Fl. Nov. Holl. 488. 1810.
Bonamia linearis (R. Br.) Hall. f. var. media (R. Br.) Hall. f. Bull. Herb. Boiss. 5:1011. 1898.

Perennial, herbaceous or suffrutescent vines. Stems prostrate, occasionally procumbent or suberect, slender or stout, terete, becoming 2-15 dm. long, rarely longer, mostly 1-3 mm. thick, soft-sericeous with silvery grey or light brownish hairs and becoming less sericeous in age or nearly glabrous; internodes 1-2 (-3) cm. long. Leaves shortly petiolate, soft and thin to subcoriaceous, sericeous, villous or ferrugineous or nearly glabrous or glabrate; petioles 2-7 (-11) mm. long, slender; blades highly variable, ovate, elliptic-ovate, ovate-subcordate, oblong-ovate, ovate-lanceolate, ovate-emarginate or ovate-cordate, mostly 1-2.5 cm. long, 6-15 mm. broad, usually with length-width ratio of 2 or less, truncate, subcordate or obtuse at the base; obtuse, abruptly acute, truncate, obtuse-mucronate or slightly emarginate at the apex; veins impressed above and distinct beneath to scarcely perceptible because of dense coating of hairs; lateral veins 3-5 pairs. Flowers shortly pedicellate or nearly sessile, axillary, solitary or occasionally in simple cymes of two or three; peduncles very short or absent; pedicels 1-5 mm. long, sericeous; bracts small, linear, 1-2 mm. long. Sepals ovate-lanceolate or ovate-elliptic, mostly 5-7 mm. long, 2.5-3.5 mm. broad, herbaceous, subcoriaceous near the base, equal or slightly unequal, sericeous, densely sericeous or villous outside, acute or acuminate at the apex. Corolla blue, light blue, or often white, shortly tubular-campanulate or funnelform, 8-15 mm. long, pilose on interplicae. Stamens included; filaments filiform, glabrous; anthers oblong or oblong-oval, cordate at the base. Ovary ovoid, long-pilose near the apex, with scattered hairs or glabrous below; styles bifid to the middle or lower, filiform, glabrous; stigmas subglobose-capitate. Capsules ovoid-apiculate, pilose at the apex, glabrous or rarely with scattered, minute hairs below; seeds brown or black. Cotyledons orbicular or ovate-cordate, folded.

Type: Australia (Nova Hollandia tropical), F. Bauer 321, "1801-05" (W-isotype).

Red sand, yellow sand, sandy loam, lateritic or nonlateritic soils in open Eucalyptus forest, dry banks, gullies, timbered flats or desert from Northern Territory to Queensland and New South Wales (Map 10).

This is the most wide-ranging species in Australia. It has been collected in flower in January, February, March and October, and in fruit in January, March, June and December. One collector noted the flowering period from summer to winter.

This species has been treated as a variety of Bonamia linearis by Hallier, who treated it as a distinct species in his earlier work. However, B. media is distinct, characterized by elliptic, ovate-elliptic, ovate-subcordate or ovate-cordate leaves, mostly obtuse at the apex.

Although Hallier (1897) has pointed out the similarity of leaf tissue of B. media with those of B. spectabilis and B. sericea, it is most closely related to B. linearis and B. brevifolia.

This species is quite variable in leaf shape, size and pubescence (Figure 4). It is clearly separable into three varieties.

29a. Bonamia media (R. Br.) Hall. f. var. media.
Bonamia linearis (R. Br.) Hall. f. var. media (R. Br.) Hall. f. Bull. Herb. Boiss. 5:1011. 1897.

Stems long, slender, finely soft-sericeous or pilose or occasionally sparsely so, rarely dense-sericeous. Leaves sericeous, pilose, with scattered hairs or almost glabrous on the upper surface, sparsely pilose, sericeous or rarely densely sericeous below, with clearly visible lateral veins, obtuse or obtuse-mucronate at the apex.

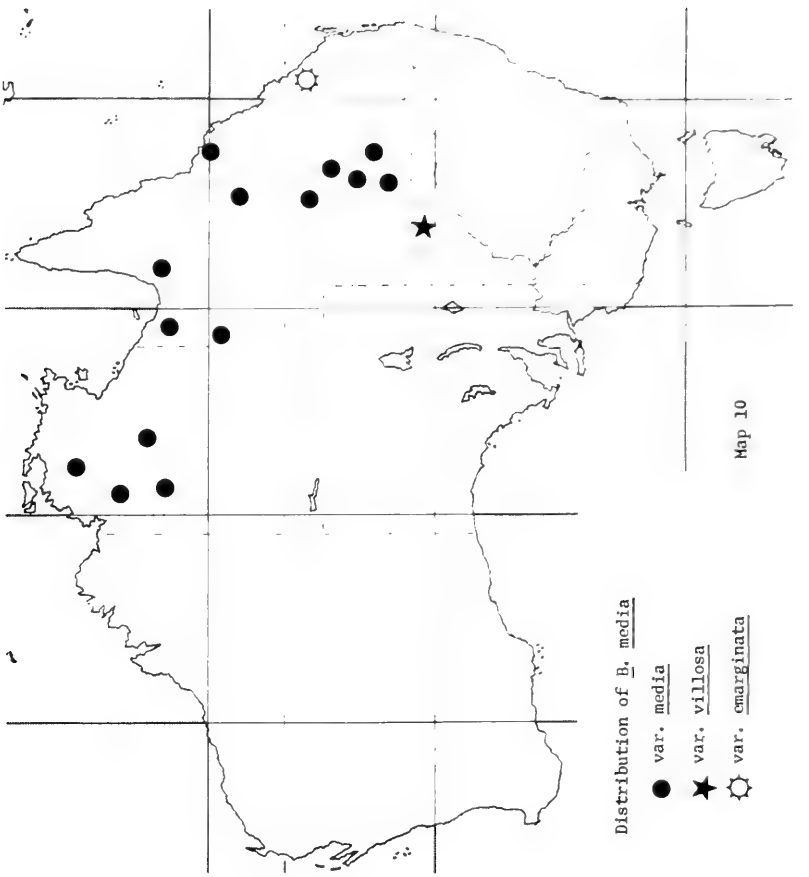
This variety is inconsistent in several features and future studies may find it to be composed of more than one variety. Since the material available at present is scanty, it is treated here as a large, polymorphic group. The following specimens are worth describing briefly to show the variations within this variety:

Bauer 321 (W): Leaves narrower, with length-width ratio exceeding 2, glabrous on the upper surface, sparsely long-pilose on the lower surface.

Collector unknown; "129" Settlement Ck., N.T. (BRI): Leaves larger, with leaf blades as long as 3 cm., glabrous on the upper surface, sparsely long-pilose or glabrescent on the lower surface; bracts 2-3 mm. long.

R.A. Perry 3433 (BRI, US): Leaves very small, 14 mm. or shorter and 9 mm. or narrower (thus erroneously annotated as B. brevifolia), sericeous on both surfaces.

S.L. Everist 2903 (BRI): Numerous slender stems from a single rootstock; leaves with longer petioles, somewhat attenuate at the base, truncate or slightly emarginate at the apex; upper flowers in cluster of two or three.


Distribution of B. media
var. media
var. villosa
var. emarginata
Map 10

James Keys 637 (BRI): Slender and frequently branching stems; leaves smaller, dense long-sericeous or densely pilose on the lower surface.

M.S. Clemens, October 16, 1945 (BRI, L): Leaves densely sericeous; corolla blue.

S.L. Everist 1910 (GH): Stems and leaves densely sericeous—thus somewhat intermediate between the two varieties, media and villosa.

Specimens examined:

AUSTRALIA: Northern Territory: 31 mi. north of Devil's Marbles, prostrate herb, white flowers, rare in red sand, G. Chippendale 949, 8. 3. 1955 (BRI); 21 mi. south of Elliott, prostrate spreading herb, flowers white, common in light red sand, Chippendale 1024, 9. 3. 1955 (BRI); 6 mi. north of Katherine, in limestone pavement country with red soil, prostrate, leaves grey green, flowers white, H.S. McKee 8515, February 17, 1961 (BRI); 15 mi. north of Victoria River Down Station, creeping greyish plant common on skeletal soils on cherts with E. brevifolia and Plectrachne sp., R.A. Perry 2111, 10. 6. 1949 (BRI, US); 30 mi. south-southwest of Wavehill Station, common near edge of truncated lateritic desert, prostrate creeping plant with runners several feet long, Perry 2217, 21. 6. 1949 (BRI, US); 20 mi. northwest of Ooratippa Station, prostrate, grey plant, trailing for several feet with white flowers, common on red tertiary nonlateritic soil with Eucalyptus gamophylla, Perry 3433, 14. 3. 1953 (BRI, US). Unknown collector: Settlement Ck., 129, February, 1922 (BRI). QUEENSLAND: Sandy place, race course, Charleville, Warrego Dist., M.S. Clemens, October 6, 1945 (G); Cemetry, Charleville, Warrego Dist., flower blue, Clemens, October 16, 1945 (BRI, L); Yalleroi-Jericho and vicinity, Mitchell Dist., stems prostrate, Clemens, April 1, 1946 (F, UC); Nive River, about 30 mi. north of Augathella, prostrate plant, common in yellow sand, leaves silvery, silky tomentose, flowers white, S.L. Everist 1910, October, 1939 (GH); Boatman Station, Maranoa Dist., in red sandy soils, herb with many slender prostrate stems, radiating from woody rootstock, flowers white, Everist 2903, 24. 3. 1947 (BRI); "Curragh" Station near Cunnamulla, around bore in paddock in brown loam, prostrate herb, greyish green leaves, white corolla, alt. 620 ft., C.E. Hubbard and C.W. Windero 6220, 4. 1. 1931 (BRI); Adel's Grove, via Camooweal, trailing perennial herb, stems to 6 ft. long, fls. white, summer to winter, dry banks, gullies and timbered flats, A. De Lestang 162, 20. 1. 1946 (BRI); Ayr. Rev. N. Michael 1522 (BRI); Gilbert River, N.A.R. Pollock (US). Torrens Creek, common in sandy soil, open Eucalyptus forest, fls. white, C.T. White 8931, 18. 3. 1933 (BRI, US); Carbean near Cunnamulla, Warrego Dist.; numerous prostrate stems from a long taproot, flowers white, White 12014, 26. 3. 1941 (A, BRI); Doomadgee Mission, W. Whitehouse (BRI); Charleville, "J.F.B." March, 98 (BRI). Locations indefinite: Nova Hollandia tropica, Ferd. Bauer 321 (W); "Bustarst Hern, James Keys 637" (BRI).

29b. Bonamia media (R. Br.) Hall. f. var. villosa (Benth.) Myint, Burma Jour. Life Sci. 1:33. 1948.

Breweria media R. Br. var. villosa Benth. Fl. Austr. 4: 436. 1869.
Bonamia linearis var. media subvar. villosa (Benth.) Hall. f. Bull. Herb. Boiss. 5:1011. 1897.

Differs from the typical variety by densely sericeous and stouter stems frequently branching; densely sericeous and thicker leaves, truncate or slightly emarginate at the apex; the hairs on all parts turning to brown on drying, thus appearing to be ferrugineous; lateral veins indistinct.

Type: Australia: Victoria River, F. Mueller (presumably at BM, not seen).

Known from Northern Territory and New South Wales, growing on red sandy soil (Map 10).

This variety was described by Bentham (1869), who questioned its validity, and later was treated as a subvariety by Hallier (1897). However, it appears to be a very distinct variety because of the dense coating of hairs over the entire plant. Future study of more materials may modify the circumscription of this variety.

Specimen examined:
AUSTRALIA: New South Wales: 30 mi. west of Uantabulla, red sandy soil, N.C.W. Beadle 36308, 1. XII. 1944 (US).

29c. Bonamia media (R. Br.) Hall. f. var. emarginata Myint & Ward, var. nov.

Differt a var. media et var. villosa foliis apice emarginato, basi distincte cordata vel subcordata, sparse pilosis, 1.2plo longioribus quam latioribus vel paulo; venis lateralibus plerumque 3 binis; bractis 1.5-2.5 mm. longis; stigmatibus depresso-capitatis vel peltatis.

Differs from var. media and var. villosa by leaves emarginate at the apex, distinctly cordate or subcordate at the base, sparsely pilose, with length-width ratio of 1.2 or less; lateral veins mostly 3 pairs; bracts 1.5-2.5 mm. long; stigmas depressed-capitate or peltate.

Type: Australia: Queensland: Gladstone, unknown collector (BRI).

Known only by a single collection from the east coast of Queensland, Australia (Map 10).

The collector gives no information on the habit, flower color and habitat of this variety. It is quite distinct from the other two varieties of the species and it may be found to be a separate species in future studies, when more specimens of better condition become available. Because the only available specimen is fragmen-

tary, it is treated here as a variety of B. media.

This variety is more closely related to var. media than to var. villosa because of its indumentum, and smaller leaves.

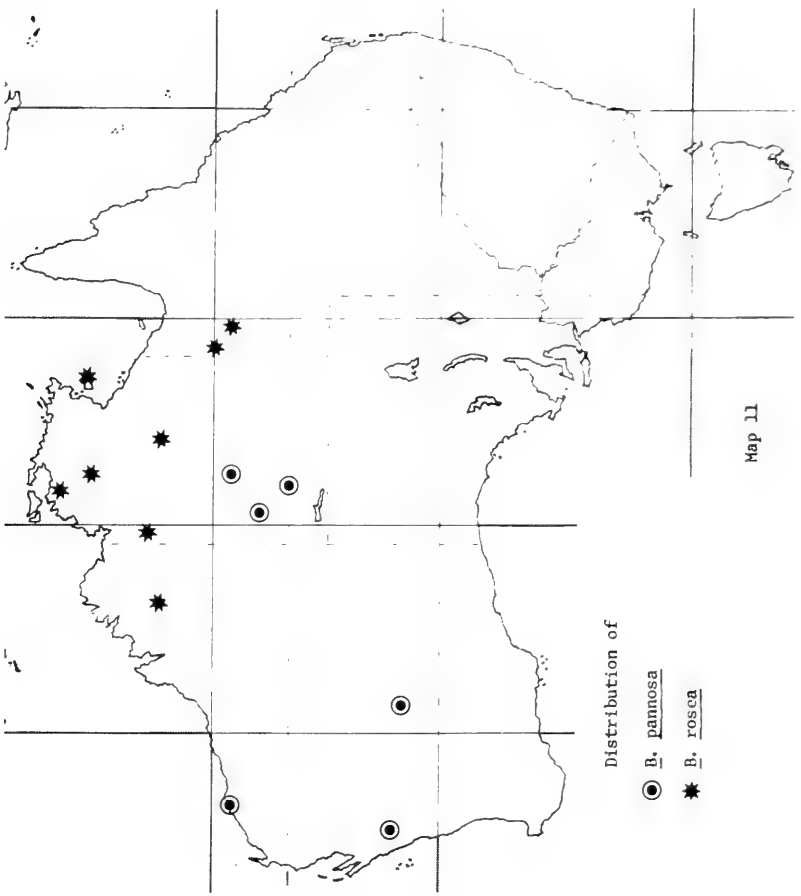
30. Bonamia rosea (F. v. Muell.) Hall. f. Bot. Jahrb. 16:528. 1893.
Breweria rosea F. v. Muell. Fragon. Phytogr. Aust. 1:233. 1889.

Perennial, erect subshrubs or undershrubs of 3-9 (10) dm. tall. Roots thick, woody, deep-penetrating. Stems terete, densely tomentose, hirsute or ferrugineous with grey or brownish hairs; main stems about 2-5 mm. thick, with pulpy bark near the base, readily branching, thus having numerous culms; older stems becoming less tomentose. Leaves shortly petiolate or frequently subsessile, thick, leathery, subcoriaceous or coriaceous, densely ferrugineous or hirsute on both upper and lower surface; petioles 1-5 mm. long or almost absent, 1-1.5 mm. thick, densely ferrugineous or hirsute; blades orbicular, ovate or obovate, mostly 7-15 mm. long, about 6-13 mm. wide, with length-width ratio of mostly one, entire at the margin, rounded or slightly cordate at the base, truncate, slightly emarginate, obtuse or obtuse-mucronate at the apex, with about 3-5 pairs of indistinct lateral veins. Flowers, axillary, sessile or shortly pedunculate, solitary or occasionally in cymes of two or three, frequently aggregated near the terminal ends of branches; peduncles, when present, up to 15 mm. long, mostly 1 mm. thick, densely ferrugineous; bracts linear or linear-lanceolate, as long as 6 mm. or very small and inconspicuous. Sepals ovate-lanceolate, 5-9 mm. long, acute or abruptly acute, rarely obtuse, densely long-hirsute outside, the inner ones smaller or narrower. Corolla pink or white, tubular-campanulate, or broadly urceolate, 1-1.8 cm. long, with limb of 8-15 mm. broad, long-hirsute on interplicae, glabrous on plicae, 5-10-lobulate at the margin; tube broad, cylindrical and distinct, stamens included; filaments adnate and hairy at the base, free and glabrous above; anthers broadly oblong. Ovary hirsute with long hairs near the apex, glabrous below, conical; styles bifid above two-thirds or lower, filiform, glabrous except near the base; stylar branches unequal; stigmas large globose. Capsule valvular, 2- to 4- seeded, conical, hirsute at the apex. Seeds ovate or ovate-oblong, glabrous. Cotyledons ovate or ovate-orbicular.

Type: West Australia; type specimen not available.

Western and central Australia from Nichol Bay and Dampier Archipelago south to Lake Moore and east to southern districts of the Northern Territory (Map 11).

Collectors note "coarse sandy desert or grassland," "spinifex sand plain," "bushes on sands," "deep red sands in area of burnt Triodia pungens" and "sand heath" as the habitat of this species.


Distribution of
B. pannosa
B. rosea
Map 11

Specimens recently collected from central Australia by Chippendale and Lazarides are distinct in certain morphological features, particularly in minute or inconspicuous bracts, smaller corolla, completely sessile flowers and numerous stems from a single shoot. These morphological characteristics (especially the minute vs. long bracts and small vs. large corolla) seem to support the supposition that the central Australian plants deserve a distinct taxonomic status, at least at the varietal level. But, with just a handful of material available at this time, it is not described here.

The leaves vary relatively little (Figure 5).

Specimens examined:
AUSTRALIA: Northern Territory: Near Ulambaura Spring, Haast Bluff, subshrub 1 ft., infl. white, infrequent in Triodia pungens assoc., G. Chippendale 2568, 23. 8. 1956 (BRI); 31. 6 m. northwest of Mt. Patricia, grey perennial herb 1 ft., common in small area in deep red sand, in area of burnt Triodia pungens, Chippendale 4297, 5. 5. 1958 (BRI); 65 m. northwest of Willowra H.S., dwarf shrub 1 ft., buds brown green, common in deep red sand, in area of burnt Triodia pungens, Chippendale 4792, 31. 7. 1958 (BRI); 59 mi. northwest of Mt. Doreen Station, dominant in patches in coarse sandy desert dominated by Plectrachne schinzii grassland, low hairy grey subshrub to 12 in. high and as wide, flowers white, culms numerous, branching and spreading, M. Lazarides 6020, 17. 9. 1957 (BRI, US). Western Australia: Dampiers Archipelago, B.F. von Mueller (BM); Greenoughs River, Mueller (GH, US); Nichol Bay, Mueller (BM); Murchison River, Oldfield (W); in fruticetis arenosis inter flumina Moore et Murchison, E. Pritzel 606, IX, 1901 (HBG, W), 616, IX, 1901 (A, BM, GH, L, MO, US); northeast of Melrose, N.H. Speck 1388, 8. 9. 1958 (MO); 13 mi. northwest of Albion Downs, woolshed, Eremean Province, spinifex sandplain, Speck 1477, 17. 9. 1958 (BRI, MO).

31. Bonamia pannosa (R. Br.) Hall. f. Bot. Jahrb. 16:530. 1893.
Breweria pannosa R. Br. Prodr. 488. 1810.

Prostrate or twining vines growing from perennial rootstock. Stems terete, soft and herbaceous while young, soon becoming woody, mostly 2-3 mm. thick, densely hirsute with soft ferrugineous or silky hairs. Leaves shortly petiolate, herbaceous or soft-coriaceous, densely hirsute on both upper and lower surface; petioles 3-20 mm. long, densely hirsute; blade ovate or orbicular, rarely ovate-oblong, 2-4 cm. long, mostly (1-) 1.2-3 cm. broad, truncate, subcordate or rounded at the base (lower leaves sometimes attenuate at the base), obtuse, rounded or obtuse-acute at the apex. Flowers axillary, solitary or in cymes of two to few flowers, rarely several flowers (forming dense cluster), sessile or shortly pedunculate and/or shortly pedicellate; bracts subulate 5-10 mm., becoming slightly longer in age, hirsute. Sepals soft and thick or subcoriaceous, unequal; outer two sepals large, ovate, 8-11 mm. long, 7-8 mm. broad, hirsute on the back, hirsute inside except glabrous center, acute at the apex; in-out sepal (third sepal) oblique-ovate, as

long as outer two sepals, 4-6 mm. broad, hirsute as outer sepals; inner two sepals smaller, ovate-acuminate or broadly lanceolate, 6-7 mm. long, 3-4 mm. broad, hirsute outside, glabrous inside, acuminate at the apex. Corolla blue or violet blue, rarely white, funnel-shaped, 1.2-1.5 cm. long, with spreading and sublobulate or nearly entire limb, hirsute or pilose on interplicae, glabrous on plicae. Stamens inserted; filaments villous, slightly broadened at the base; anthers oblong, 1-1.5 mm. long, dorsifixed, cordate at the base. Ovary ovoid-conical, long-hirsute at the apex; styles bifid to the middle, with unequal stylar branches; stigmas globose-capitate. Capsules thin-walled, 4- to 8-valved, 4-seeded, ovoid, 5-6 mm. long, 4-5 mm. in diameter, hirsute at the apex, glabrous below; seeds glabrous, ovate-triangular, 2-3 mm. long. Cotyledons ovate-cordate, rounded or slightly emarginate at the apex; cotyledonary petioles fused.

Type: (Nova Hollandia tropica) Tropical Australia, Bauer 325 (BM-lectotype?; W-isotype!)

Sandy soil, gravelly sand, limestone, shale and dry ridges, rarely in wet ground in tropical regions of Australia from Queensland to the northeastern districts of western Australia (Map 11).

This species has been collected in flower from February to June and in fruit from April to July. The isotype at Vienna has been mislabelled as Polymeria lunata presumably by R. Brown.

Specimens examined:

AUSTRALIA: Northern Territory: 28 mi. south of Elliott, prostrate spreading herbs, corolla blue, common on gravelly sand, C. Chippendale 1021, 9. 3. 1955 (BRI); Spring Vale, Port Darwin, Alfred Giles (BRI); 5 mi. from Katherine, on Wyndham Road in wet ground, prostrate, leaves pale green, flowers bright blue, H.S. McKee 8536, February 18, 1961 (BRI); 12 mi. southwest of Katherine Township, prostrate grey bush several feet long, common on sandy soil with E. miniata open forest, R. A. Perry 1978, 2. 6. 1949 (BRI, US); 6 mi. south of Limbunya Station, prostrate plant with grey foliage, common on limestone outcrop, Perry 2337, 4. 7. 1949 (BRI, US); Groote Eylandt, S.H. Wilkin 98, February, 1929 (BM). Queensland: Adel's Grove via Camooweal, trailing plant, young stems erect to 9 in. high, flower dark blue, velvety, rather pretty, grows on dry ridges, A. De Lestang 5 (BRI); Mt. Isa, Burke District,

---

Figure 5

Variations in sizes and shapes of leaves in B. pannosa, B. dietrichiana and B. rosea

1-5 B. pannosa x 2.
6-8 B. dietrichiana x 2.
9-13 B. rosea x 2.

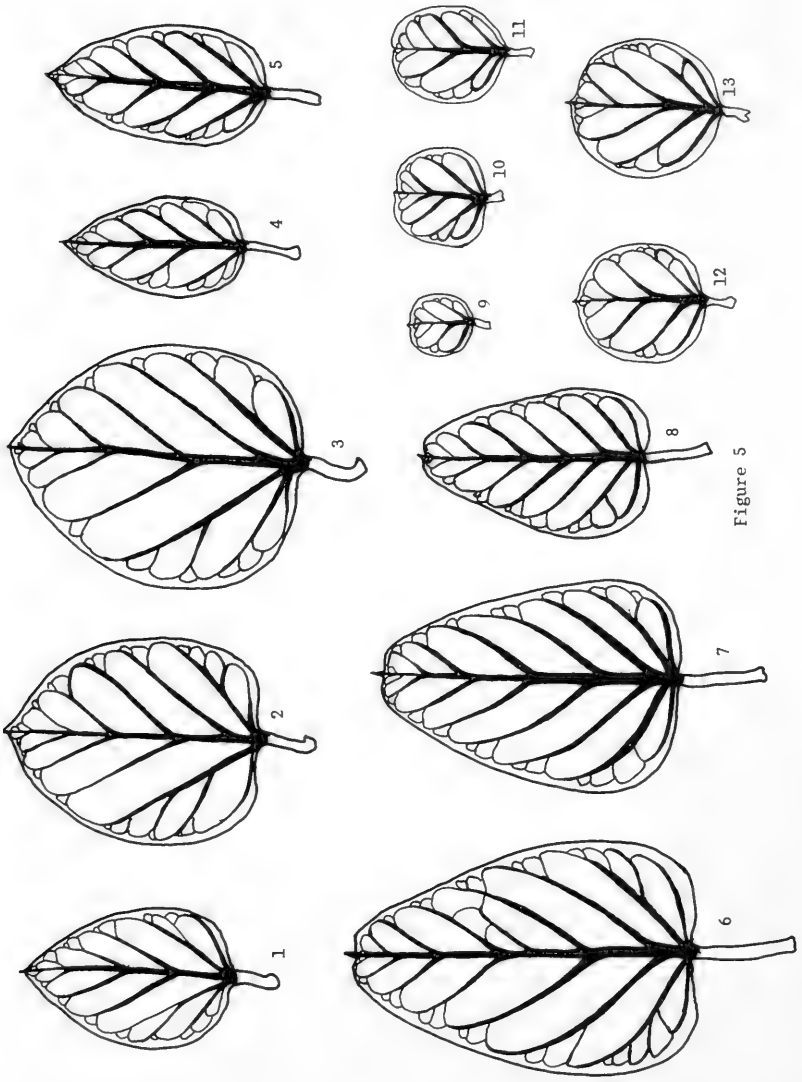


Figure 5

Mrs. M. Morris, May, 1952 (BRI). Western Australia: Slatey Creek, 16 mi. northwest of Glenroy Meatworks, prostrate, grey green, hairy plant with runners several feet long and blue flowers, common in shaley bed of creek, M. Lazarides 5155, 22. 4. 1955 (BRI). Location indefinite: Nova Hollandia tropica, Bauer 325 (W-isotype).

32. Bonamia velutina Verdcourt, Kirkia 1:27, tab. III. 1961.

Perennial, erect or suberect subshrubs. Stems woody or becoming woody, terete, tomentose, or densely appressed-sericeous, as high as 9 dm., 1-3.5 mm. thick, frequently branching; internodes 5-25 mm. long. Leaves shortly petiolate, or subsessile, soft and herbaceous or leathery, rarely subcoriaceous, densely velutinous with silvery grey or brownish hairs on both surfaces; petioles 1.5-4 mm. long, densely velutinous; blades elliptic or elliptic-oblong, 1.2-4.5 (-6) cm. long, 4-15 mm. broad, upper leaves smaller and lower leaves somewhat larger, rounded or subtruncate at the base; acute-mucronate or rarely obtuse-mucronate at the apex; veins impressed above, prominent underneath; lateral veins 4-6 pairs. Flowers shortly pedunculate or sessile, axillary, solitary or in cymes of two or three; peduncles 0-3.5 (-6) mm. long; pedicels 0-1.5 mm. long; bracts linear, 2-4 mm. long, velutinous. Sepals ovate-lanceolate, obovate or spathulate, subcoriaceous at the base, foliaceous at the apex, slightly unequal; outer three spathulate with oblong base as long as 3 mm. and 1.5 mm. wide, with dilated apex 3.5-4 mm. long and 2.5-3.5 mm. wide, densely velutinous outside; inner two ovate-lanceolate, 6.5 mm. long, 2.5 mm. wide, acute at the apex, not dilated, velutinous outside. Corolla white, infundibuliform, 9-12 mm. long, 13 mm. wide at the apex, slightly 5-lobulate, densely pilose on interplicae. Stamens inserted; filaments filiform, dilated at the base, glabrous; anthers 1 mm. long, cordate at the base. Ovary ovoid, densely long-pilose; styles bifid, shortly connate (1-2 mm.) at the base, glabrous; stigmas lobulate-peltate. Capsules ellipsoid or globose-ellipsoid, 6 mm. long, subacute, minutely appressed-pilose, 2- to 4-seeded, 4-valvular; seeds angular-ellipsoid, 2-3 mm. long, glabrous, minutely punctate. Cotyledons orbicular or ovate-orbicular; cotyledonary petioles short or absent.

Type: Southern Rhodesia: Nuanetsi District, 0.4 km. within Southern Rhodesian border opposite Malvernia, in Guibourtia - Mopane Woodland on Umkondo sands, 450 m., K. Wild 4688, November 1, 1955 (K-holotype, SRGH-isotype-not seen).

Known only from Southern Rhodesia, southeastern border in Nuanetsi District (Map 1).

According to the collectors this is an erect herb or subshrub in mopane or mixed woodland on sandstone, Umkondo sand or sandstone plateau. It has been collected in flower in November and in fruit in April.

This species was originally annotated as Seddera sp., presumably because of its smaller flowers and shrubby habit. Although this species possesses certain morphological features and the habit of that genus, it is definitely a species of Bonamia as pointed out by Verdcourt. It seems to be more closely related to some Australian species of that genus than to the other African species, because of its erect habit, shorter stems, sessile or very shortly pedunculate flowers (mostly solitary or in simple cymes), smaller sepals and shorter corolla.

Specimens examined:
SOUTHERN RHODESIA: Nuanetsi District: Combretum Mopane, sandstone, 1650 ft., herb 2-3 ft., R. Davis 1629, November, 1955 (EA-paratype); Clarendon Cliffs, mixed woodland on sandstone plateau, erect 2 ft., perennial, corolla white, R.B. Drummond 7809, April 29, 1962 (EA).

III. Section: Trichantha Myint, Burma Jour. Life Sci. 1:34, 1968.
Trichantha Karst. et Triana, Limnaea 28:437. 1856, not Trichantha Hooker, Icon. Pl. tt. 666, 667. 1844.

Stems woody, twining or scandent, usually long and high-climbing, rarely short and suberect or erect, mostly 3 mm. or thicker. Leaves distinctly petiolate, often long-petiolate, soft, herbaceous, subcoriaceous or leathery, not membranous; blades mostly ovate, ovate-acuminate, or ovate-subcordate, rarely broadly elliptic, usually large, 3.5 cm. or longer, 2.5 cm. or wider, with length-width ratio of 1-1.5, rarely slightly higher, rounded, truncate, subcordate or cordate at the base; acute, obtuse, acuminate, rounded or emarginate and distinctly mucronate at the apex. Inflorescences axillary compound or simple cymes of few to numerous flowers or terminal panicles, rarely uniflorous, pedunculate or sessile; bracts small, never foliaceous, deciduous or persistent. Sepals coriaceous, rarely subcoriaceous, mostly equal or slightly unequal, ovate, oblong-ovate or orbicular, obtuse, rounded or emarginate, rarely acute at the apex, mostly 3-6 mm. long. Corolla white, yellowish white, yellow or purple, 2-2.5 cm. long, rarely slightly shorter, subentire or 5- to 10-lobulate at the margin. Stamens included; filaments mostly villous or sparsely villous below, glabrous above; anthers 2 mm. or longer, sagittate or cordate at the base. Ovary conical, ovoid-conical or ovoid-oblong, pilose, sparsely pilose or glabrous; styles free nearly to the base, fused to the middle or slightly higher; vascular traces branched into two in the upper part of stylar branches; stigmas reniform or obscurely bilobed, large. Fruits mostly 4- or rarely 2-valvular, thick-walled, (0.5-1 mm. or thicker); septum hard, not membranous. Seeds densely villous or woolly, with long, soft hairs; hairs 1-3 mm. or shorter on the dorsal and ventral surfaces, 5 mm. or longer along the edges of seeds. Cotyledons ovate, ovate-cordate or obovate, corrugate or multiplicate when mature; non-corrugate or flat when young.

Type: Bonamia trichantha Hall. f. (as Trichantha ferruginea Karst. & Triana, 1856).

Tropical America from Panama to Brazil and Paraguay.

This section is very distinct from the other two sections and is characterized by ligneous fruits, villous seeds, a branched vascular strand in each stylar branch, reniform or obscurely bilobed stigmas, and orbicular or ovate-orbicular sepals.

33. Bonamia trichantha Hall. f., Bot. Jahrb. 16:528. 1893.
Trichantha ferruginea Karst. & Triana, Linnaea 28:438. 1856.
Breweria mollis Pittier, Jour. Wash. Acad. Sci. 17:284. 1927.
Breweria longipaniculata Pittier, Jour. Wash. Acad. Sci. 17:284. 1927.

Perennial, woody climber, apparently growing all year around. Stems twining, terete, smooth or warty, tomentose while young and becoming glabrous in age; about 1 cm. in diameter, becoming 10 m. long or longer. Leaves petiolate, coriaceous or submembranous, glabrous or sparsely pubescent above and densely tomentose or glabrate on the lower surface, more densely so on the veins (especially in the glabrate forms); petioles 1-3 cm. long, 1-2 mm. thick, round or canaliculate above, minutely appressed pubescent or becoming glabrous; blades ovate, oblong or ovate-oblong, entire at the margin, obtuse or cordate at the base and acute, obtuse, attenuate or obtuse-mucronate at the apex; nerves slightly impressed above, prominent below; about 5-8 pairs of lateral veins. Inflorescences axillary cymes of few to many flowers or terminal pseudopanicles; cymes pedunculate; peduncles and pedicels minutely appressed pubescent or becoming glabrous; bracts small or inconspicuous. Sepals orbicular or orbicular-ovate, subequal or slightly unequal; outer two ferrugineous or pubescent-glabrescent; inner ones sparsely pubescent-glabrescent, with hyaline margins, 5-7 mm. long, 4-5 mm. wide. Corolla white, 1.2-2 cm. long, about 1-1.5 cm. wide, tubular-campanulate, entire; outside surface with long hairs on interplicae, glabrous on plicae; tube short, about 3-5 mm. Stamens inserted, epipetalous; filaments glabrous or villous, incurved or straight; anthers oblong or ovate, dorsifixed, emarginate or slightly cordate at the base, narrow at the apex. Ovary ovoid, with circular disc at the base, glabrous or villous at the apex; styles shortly connate at the base, glabrous or with scattered hairs; stigmas globose or capitate, mostly sub-bilobed. Fruit capsule, valvular with thick and ligneous wall, dehiscing mostly into two or four valves; partition wall thin, coriaceous. Seeds ovoid, plano-compressed, densely villous, with longer marginal hairs. Cotyledons obovate or orbicular, emarginate at the apex; cotyledonary petioles fused.

Type: Colombia: Magdalena: Piedras, Vallee du Magdalena, Nouvelle-Grande, prov. de Mariquita, J. Triana 2146, 1851-1857 (G-lectotype, BM, W-isotypes).

Distribution of B. trichantha
var. trichantha
var. oblonga
var. ovata f. ovata
var. ovata f. glabrata

Map 12

From sea level to 600 m. in Panama, Colombia and Venezuela (Map 12).

The collectors recorded this species as occurring in light forests on rocky hills, borders of forests, thickets on open rocky slopes or hill sides, river banks, arid bushy slopes and valleys. This species is separable, though not very clearly, into three varieties of which one may be divided into two forms.

33a. Bonamia trichantha Hall. f. var. trichantha.
Bonamia trichantha Hall. f. var. typica v. Ooststroom, Rec. Trav. Bot. Neerlandais 33:213. 1936.

This variety is characterized by broadly elliptic leaves, obtuse, rounded or slightly emarginate at the apex and densely ferrugineous underneath. (Figure 6).

Restricted to Colombia, from Magdalena south into Tolima and Huila departments (Map 12).

Specimens examined:
COLOMBIA: Huila: Natagaima, rocky hill at gorge above N. Altitude 450-500 m., light forest, shrubby vine, H.H. Rusby and F.W. Pennell 1159, August 12, 1917 (GH). Magdalena: Piedras, Vallee du Magdalena, Nouvelle-Grande, prov. de Mariquita, 500 m. J. Triana 2146, 1851-1857 (BM, G, W); Nouvelle-Grande, prov. de Jequendema, Triana 3801, 1853 (BM). Tolima: E.P. Arbelaez 2173, XII. 1932 (US).

33b. Bonamia trichantha Hall. f. var. oblonga v. Ooststroom, Rec. Trav. Bot. Neerlandais 33:213. 1936.

This variety is characterized by its oblong or oblong-lanceolate leaves, mostly 5-8 cm. long and 2-2.5 cm. wide (Figure 6), and loose cymes of fewer flowers which usually are in terminal panicles.

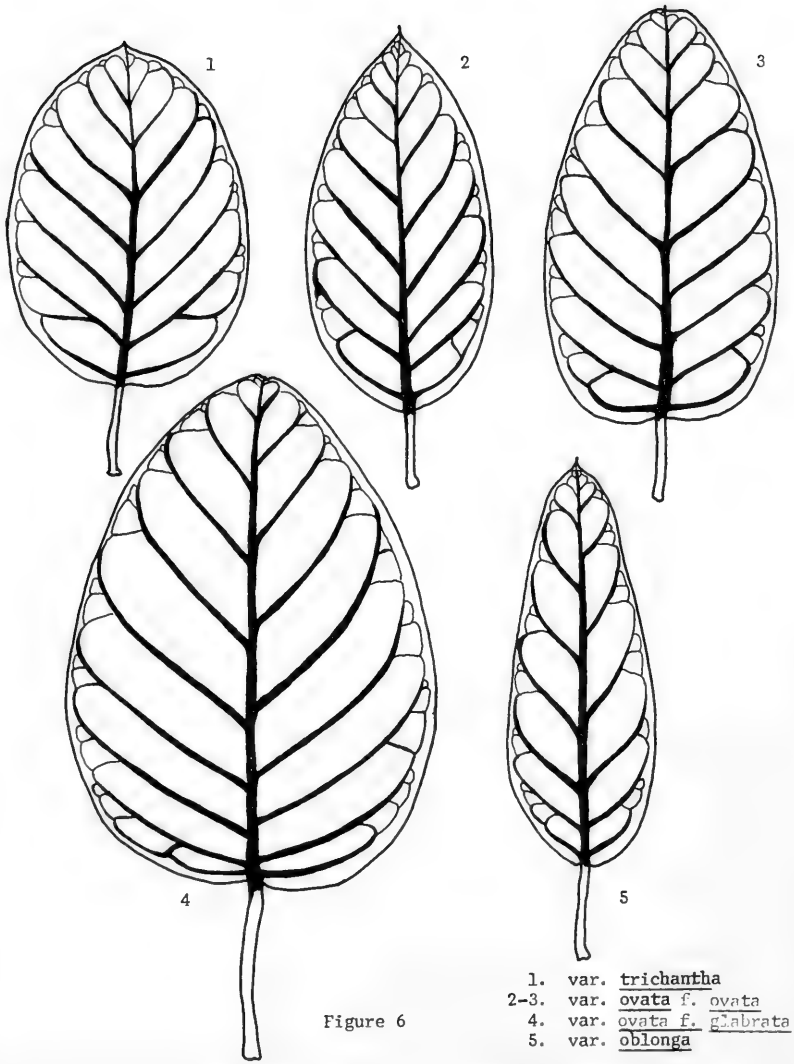
Type: Colombia: Santa Marta, Herbert H. Smith 1871, 1898-1899 (US-holotype, F, GH-isotypes).

This variety is apparently endemic to northern Colombia and is known only from the type collection (Map 12). Its habitat is not known and the collector gives no more than the location. A description of fruit and seed has to await future collections.

33c. Bonamia trichantha Hall. f. var. ovata v. Ooststroom, Rec. Trav. Bot. Neerlandais 33:213. 1936.

This variety is characterized by its ovate or ovate-acuminate leaves, rarely emarginate at the apex, and much varied in size and pubescence (Figure 6).

Type: Colombia: Tolima: Honda, open rocky slope, alt. 300-400 m., F.W. Pennell 3575, January 3-4, 1918 (US-holotype, GH-isotype).



1. var. trichantha
2-3. var. ovata f. ovata
4. var. ovata f. glabrata
5. var. oblonga

Figure 6

Leaf shapes and sizes in Bonamia trichantha

This variety ranges from Panama and Colombia east into eastern Venezuela. It is separable into two forms.

B. trichantha var. ovata f. ovata.

This form is characterized by its ovate leaves, densely villous underneath, and distinctly ferrugineous sepals.

Known from Colombia and Venezuela.

Specimens examined:
COLOMBIA: Cundinamarca: Hillside east of Apulo, thickets along trail to Anapoima, alt. 460-600 m., woody vine, E.P. Killip, A. Dugand and R. Jaramillo 38147, May 4, 1944 (US). Magdalena: Valle de Magdalena, R. Carsten (?) (W); Bond, Enredadera, Caliz Verde, Velloso, Anteras Verdes, dorsimelifijas, biloculares, Ovario blanco en la base y verde en el apice, Fruto globoso, verde, R. Romero-Castaneda 703, February, 1948 (F); Santa Marta: alt. 500, Herbert H. Smith 876, December, 1898-1899 (GH, K, US); Santa Marta, a twiner to 20 ft., rare on border of forest below 1000 ft., fl. October-November, leaves subcordate at base, Smith 877, November 21, 1890-1901 (GH). Tolima: Honda, open rocky slope, alt. 300-400 m., shrubby vine, corolla white, F.W. Pennell 3575, January 3-4, 1918 (GH, US).
VENEZUELA: Lara: Entre Carora y Trentino, Jose Saer 724, Enero, 1931 (F). Portuguesa: Vine on Calvario Hill, Guanare, H. Pittier 12046, December 28, 1925 (NY, US). Trujillo: Loma de Moron near Valera, a vine, flower white, Pittier 10733, November 18, 1922 (GH, NY, US). Yaracuy: Iboa, 450 m. trailing on bushes, a woody vine, fl. white, Pittier 13074, January 1, 1929 (F, GH, US).

B. trichantha var. ovata f. glabrata Myint & Ward, f. nov.

Differt a forma typica var. ovatae foliis glabratis, sepala et pedicellis minus dense pubescentibus vel fere glabris, et pedicellis parum longioris.

This form is characterized by its much varied, usually large, glabrate leaves, less densely pubescent or nearly glabrous sepals and pedicels, and slightly longer pedicels.

Type: Colombia: Atlantico, entre Baranoa y Galapa, A. Dugand 5643, April 2, 1961 (US).

This form is known from Panama, Colombia and eastern Venezuela, thus covering the whole range of the species.

Specimens examined:
COLOMBIA: Atlantico: Entre Baranoa y Galapa, 100 m. bosque marginal de un arroyo temporario, bejuco 10 m. long tallo lenoso delgad, 1 cm. diam., A. Dugand 5643, April 2, 1961 (US); entre Lena y Candelaria, alt. 30-50 m., Dugand and R. Jaramillo 2789,

Enero 11, 1941 (US). Bolivar: Vicinity of Turbaco, Bro. Heriberto 448, November 1920 (US); north of Arjona, alt. 30-50 m., thickets, vine, corolla white, E.P. Killip and A.C. Smith 14532, November 15, 1926 (GH, US). Cundinamarca: Bejuco trepador, frutos armarillos, Ferrocarril a Salgar, rio Guaduero, alt. 450 m., H. Garcia-Barriga 12296, July 23, 1947 (US). Santander: Rio Surata valley near Bucaramanga, alt. 400-600 m., woody vine, corolla white, thicket, Killip and Smith 16218, December 28, 1926 (GH); river bank, upper Rio Lebrija valley, northwest of Bucaramanga, alt. 400-700 m., vine somewhat woody, corolla white, Killip and Smith 16300, December 29, 1926 (GH). Doubtful specimen (no leaves nor flowers); Boyaca: Los Llanos, Rio Meta, Orocue, alt. 140 m., Sabana, J. Cuatrecasas 4438, November 3, 1938 (US).

PANAMA: Toboquilla Island, vine, G.S. Miller, Jr. 2000, March 30, 1937 (US); Penonome and vicinity, 50-1000 ft. elevation, climbing over bushes, R.S. Williams 93, February 23 - March 22, 1908 (NY).

VENEZUELA: Delta Amacuro: Curiapo, alt. 0 m., enredadera, flores blanca, Hermano Gines 4945, December, 1952 (US).

34. Bonamia balansae Hall. f. Bull. Herb. Boiss. 5:1002. 1897.

Perennial, woody climbers. Stems twining, terete, 7 m. long, 2-5 mm. thick, glabrous, minutely striated; older branches with whitish lenticels; young branches sparsely punctate. Leaves petiolate, coriaceous or submembranous, glabrous, shining above, dull underneath; petioles, 5-14 mm. long, canaliculate above, glabrous or sparsely pubescent when young; blades ovate-acuminate, 3-6 cm. long, 2-3.5 cm. wide, rounded or subcordate at the base, subcuspidate-acuminate or acute mucronate at the apex; midrib impressed above, prominent underneath, with 5-7 pairs of lateral veins; finer veins distinct underneath. Flowers axillary, in few-flowered cymes or solitary, frequently in pseudo-racemes on short lateral branches; peduncles terete, rigid, 4-20 mm. long, glabrous or sparsely pubescent, pedicels 4-7 mm. long, turning to black when dry; bracts subulate, 1 mm. long, deciduous. Sepals coriaceous, equal or slightly unequal, orbicular, 5-6 mm. long, glabrous, turning to black when dry, subscarious along narrow margin, finely ciliate. Corolla yellow, campanulate-infundibuliform, 2 cm. long, long-pilose on interplicae, glabrous on plicae, with entire or subentire limb. Stamens included; filaments puberulous or villous, adnate to corolla tube for 6 mm.; anthers oval-oblong, 3 mm. long, sagittate at the base. Ovary with narrow annular disc, conical, 2 mm. long, glabrous; styles bifid for upper one-third, glabrous; stigmas orbicular-subbilobed. Capsules ovoid-quadrangular, 14-15 mm. long, 12-13 mm. in diameter, subacute or obtuse at the apex, glabrous, with ligneous wall of 0.5-1 mm. thick, 4-seeded, breaking into two valves (really 4-valved); septum hard; seeds 5-6 mm. long, short-villous on ventral sides, densely fulvous-villous with white or yellowish white, long hairs on dorsal sides and along the edges. Cotyledons cordate-bilobed, emarginate at the apex; cotyledonary petioles fused.

Type: Paraguay, San Salvador, dans les campos, Balansa 1078, May 26, 1876 (G!).

Known only from a few collections made at a high elevation in Paraguay (Map 13). According to one collector, this species grows in forest on calcareous black soil. It has been collected in flower in January and February.

Bonamia balansae is closely related to B. corumbaensis of southern Brazil, from which it differs by its longer stem, glabrous leaves, longer petioles, acuminate or cuspidate leaf tip, ciliate sepals, and shorter stylar branches.

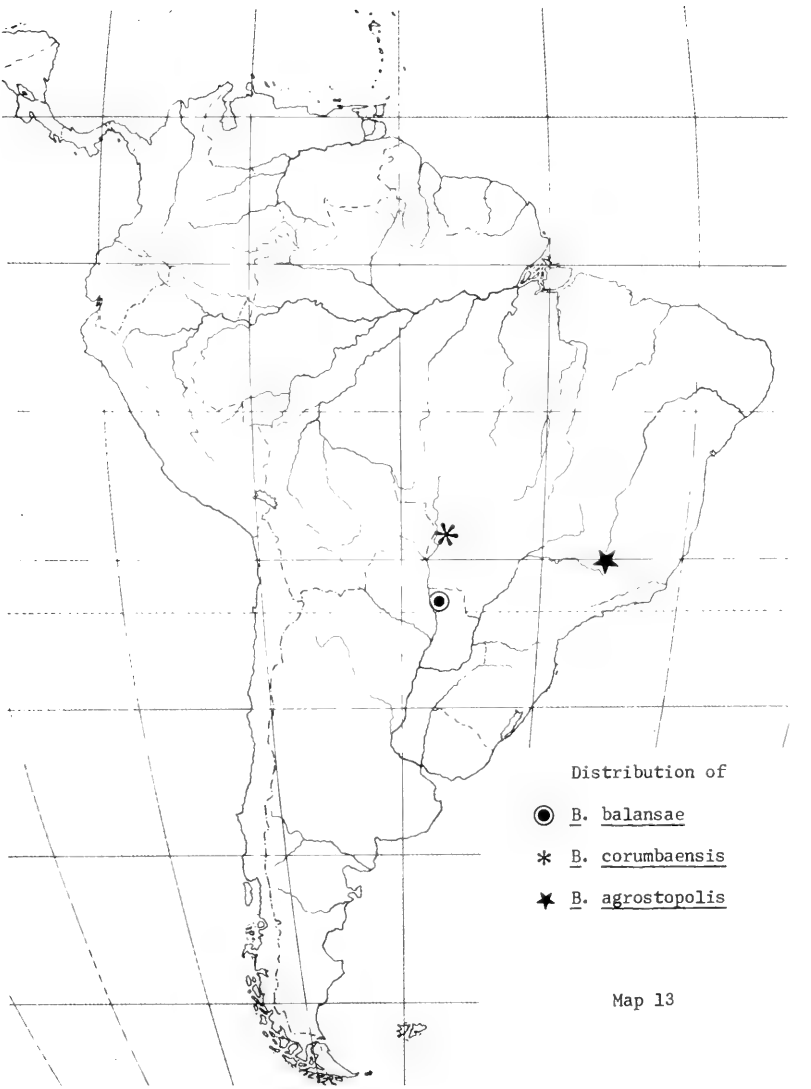
Specimens examined:
PARAGUAY: San Salvador, dans les campos, B. Balansa 1078, May 26, 1876 (G); Zwischen Rio Apa und Rio Aquidaban, goldgelb, 7 m. hochsteigend, Waldparcelle, Kalkahaltiger, schwarzer Boden, Hugel, K. Fiebrig 4531, January 1908-1909 (BM, G, GH, L, W); San Salvador, F. Rojas 3028 (1802), II, 1917 (GH).

35. Bonamia corumbaensis Hoehne, Anex. Mem. Inst. Butantan 1 (4):45, tab. 3. 1922.

Perennial, suberect, shrubby plants, 30-60 cm. high; stems woody, suberect or scandent and slightly twining at the top; old branches rigid, with white lenticels, glabrous; young branches smooth, sparsely pubescent, becoming striated in age. Leaves shortly petiolate, subcoriaceous or leathery and soft, sparsely pilose; becoming glabrous; petioles 3-10 mm. long; blades ovate-lanceolate or ovate-elliptic, 3-7 cm. long, 1.5-3 cm. broad, rounded or slightly cordate at the base, obtuse-mucronate or acute-mucronate at the apex; midrib impressed above, with 5-7 pairs of lateral veins. Inflorescences pedunculate, axillary cymes or racemes of two to few flowers, rarely solitary; peduncles short, 1-2 cm. long, sparsely pilose; pedicels 4-6 mm. long or sometimes longer; bracts small, scale-like, triangular, 1-1.5 mm. long, glabrous. Sepals coriaceous or subcoriaceous, slightly unequal glabrous; outer sepals frequently smaller, oblong or suborbicular-oblong, 5-7 mm. long, rounded at the apex; inner sepals slightly larger, suborbicular, 6-8 mm. long, ciliate, rounded or emarginate at the apex. Corolla yellow or yellowish white, campanulate, 2 cm. long, 5-lobulate, densely ferrugineous-pilose on interplicae. Stamens inserted; filaments glabrous above, villous near the base; anthers oblong, 3.5-4.5 mm. long. Ovary ovoid-conical, glabrous; styles bifid to the middle or lower, filiform, glabrous; stigmas globose-capitate. Capsules conical-acuminate, glabrous, 4-seeded, slightly exceeding the length of sepals; seeds fulvous-villous (according to Hoehne). Cotyledons not known.

Type: Brazil: Commissao Rondon: Corumba, Mato-Grosso, Campo seco, F.C. Hoehne 3042, 2, 1911 (R-isotype); Corumba, Mato-Grosso, parto do paiol de polvora, F.C. Hoehne 3044, 2, 1911 (R-paratype).

Endemic to dry soil in southwestern Brazil near the borders of Bolivia and Paraguay (Map 13). It is represented by only two collections from the same location. The color of the corolla was not



Map 13

recorded by the collector and it is doubtful whether it is yellow or yellowish as it seems to be on the dry specimen.

Although Hoehne stated that this species closely resembles B. burchellii, it seems to be more closely related to B. balansae of northern Paraguay, from which it differs in its erect habit, sparsely pubescent leaves, at least on the veins, obtuse or obtuse-mucronate leaves, and longer stylar branches (or shortly connate styles).

36. Bonamia agrostopolis (Vell.) Hall. f. Bot. Jahrb. 16:529. 1893.
Convolvulus agrostopolis Vell. Fl. Flum. 68, tab. 51. 1825.
Breweria venulosa Meissn. in Martius, Fl. Bras. 7:326. 1869.
Breweria agrostopolis (Vell.) Roberty, Candollea 14:30. 1952.

Perennial, woody vines. Stems scandent or twining, terete, slender or 3-5 mm. thick, finely tomentose or puberulous while young, becoming glabrous in age, longitudinally rugose, rugulose or verruculose, rarely smooth; internodes variable in length, mostly 2-8 cm., occasionally longer. Leaves petiolate, herbaceous or subcoriaceous, occasionally submembranous, thin; upper surface sparsely or rarely densely appressed-pilose while young, becoming glabrous in age; lower surface pilose or tomentose while young, becoming sparsely pilose in age; petioles 2.5-5 cm. long, finely tomentose or sericeous while young, becoming sparsely pilose or nearly glabrous in age, distinctly canaliculate above; blades elliptic, elliptic-ovate or elliptic-acuminate, 10-16 cm. long, 5-9 cm. broad (slightly smaller on the upper leaves), mostly entire, occasionally somewhat undulate or wavy at the margin, obtuse, acute or rounded at the base, acuminate-mucronate or acute-mucronate at the apex; veins distinctly impressed above, prominent below; lateral veins mostly 9-13 pairs, with distinct intercostal veins. Inflorescences axillary or terminal, long, multiflorus panicles, composed of numerous cymes; individual cymes 3- to 5-flowered, occasionally 1- to 2-flowered or rarely 7-flowered, shortly pedunculate; peduncles variable in length, slender or stout; pedicels short, mostly 2-4 mm. long, tomentose; bracts small, scale-like, linear or linear-lanceolate, 2-3 mm. long, deciduous; bracteoles similar to bracts, smaller. Sepals coriaceous, slightly unequal or subequal; outer two slightly shorter and narrower, ovate or ovate-orbicular, 5-6 mm. long, 3.5-4.5 mm. broad, obtuse or rounded at the apex, tomentose and glabrescent; inner three larger, orbicular, orbicular-obovate, 5.5-7 mm. long, 5.5-8 mm. broad, slightly emarginate or truncate at the apex, tomentose outside. Corolla purplish white (according to Velloso) or purple (according to Meissner), funnelform or subcampanulate, mostly 2 cm. long or slightly shorter, with entire limb, brown-sericeous or pilose on the interplicae. Stamens included; filaments filiform, short; anthers moderate in size, introrse, cordate at the base (according to Hallier). Ovary ellipsoid-conical or ovoid, glabrous, with obscure disc; styles bifid to the middle, filiform, unequal, glabrous; stigmas obscurely bilobed or globose. Capsules ovoid-conical or ellipsoid-conical, 1.5-2 cm. long, glabrous, brown or dark brown, hard-walled, 4-valvular, rarely 2-valvular, 4-seeded,

with thin or thick septum; seeds oval-oblong, or ellipsoid, 9-15 mm. long, densely pilose with soft and brown hairs along the edge, brown-tomentose on the dorsal and ventral sides. Cotyledons ovate-cordate, multiplicate or corrugate and folded against radicle; cotyledonary petioles free for upper one-fourth.

Type: Brazil: "Habitat silvis arenosis maritimis ad Agrostopolim;" type specimen not seen. presumably not extant.

Known only from southeastern Brazil (Map 13).

According to Meissner, this is the plant of highland regions. Flowering, according to Velloso, is in June and July. The only fruiting specimen examined in the present study was collected in late August. No flowering specimen was available for study. This was the first species of the genus described from South America, but under Convolvulus, and as such has been much confused with B. burchellii, to which it seems to be closely related. Large, glabrate, elliptic or oblong-elliptic leaves with impressed veins are its most distinctive feature.

Choisy (1845) included this species under his Breweria burchellii. Hallier realized its distinction from Bonamia burchellii, but its limits, as conceived by him, are somewhat doubtful because of his inclusion of Gaudichaud 567 as var. velutina, a specimen which should properly be assigned to B. burchellii because of its pilose ovary and tomentose leaves.

Specimen examined:
BRAZIL: Minas Geraes: Dist. Ilheu, Fazenda da Tabunha, main road to northwest in cut-over woods, alt. 210 m., woody vine climbing trees, green fruit, Ynes Mexia 4999, August 24, 1930 (BM, F, G, GH, MO, NY, UC, US).

37. Bonamia burchellii (Choisy) Hall. f. Bot. Jahrb. 16:529. 1893.
Breweria burchellii Choisy, Mem. Soc. Phys. Hist. Nat. Geneve 6:493. 1833.
Ipomoea terminalis Choisy, Mem. Soc. Phys. Hist. Nat. Geneve 8:54. 1838.
Ipomoea lundii Choisy, Mem. Soc. Phys. Hist. Nat. Geneve 8:56. 1838.
Bonamia agrostopolis var. velutina Hall. f. Bull. Herb. Boiss. 5:1005, 1897. Type: Gaudichaud 567 (G!).
Convolvulus agrostopolis var. burchellii (Choisy) O. Ktze. Rev. Gen. 3 (2):212. 1898.

Perennial, woody climbing vines. Stems twining or scandent, terete, 1.5-1.9 m. long (according to Meissner, 1869), slender or as thick as 4-5 mm., tomentose, villous or puberulous when young, glabrous or rarely puberulous in age, sparsely white-dotted, more densely so on older region; internodes mostly 4-7 (-10) cm. long, shorter on younger branches. Leaves petiolate, herbaceous, densely tomentose or velutinous on both surfaces, dark green above, light

green below; petioles 8-25 mm. long, tomentose, canaliculate above; blades ovate or ovate-acuminate, mostly 3-10 cm. long, 2.5-7 cm. broad, slightly shorter or narrower on the upper leaves, slightly undulate or subundulate at the margin, rounded, truncate or rarely subcordate at the base, acuminate, shortly acuminate-mucronate or acute-mucronate, rarely obtuse-mucronate at the apex; veins obscure or rarely slightly impressed above, prominent below; lateral veins 4-7 pairs; intercostal veins more distinct below, subparallel. Inflorescences multiflorus, pedunculate panicles, axillary to the leaves or terminal on the lateral branchlets; peduncles slender, variable in length, tomentose; pedicels 3-5 mm. long, slender, tomentose; bracts and bracteoles small, scale-like, linear or linear-lanceolate, 2-3 mm. long, deciduous. Sepals coriaceous, ovate, orbicular or ovate-orbicular, slightly unequal or subequal; outer two are smaller, mostly 3-4 mm. long, 2-3 mm. broad, sericeous or glabrate, obtuse, rounded or rarely broadly acute at the apex; inner sepals orbicular, 3.5-4.5 mm. long, densely sericeous outside at the center, glabrous at the margin, rounded or emarginate at the apex. Corolla white and with purplish or dark-colored eye or purple, infundibuliform, 2-2.5 cm. long, densely fulvous-sericeous (while young) and becoming fine-sericeous (in age) on interplicae. Stamens included; filaments filiform, shorter than styles, glabrous above, villous below; anthers oblong 2-3 mm. long, dorsifixed. Ovary ovoid-conical, pilose or sericeous at least near the apex; styles bifid to the middle or lower, filiform, glabrous, rarely with soft, scattered hairs on the lower part, longer than filaments; stigmas reniform or subbilobed. Capsules ovate-conical, 1-1.5 cm. long, brown or dark-brown, with hard thick wall, opening into two or four valves, 4-seeded, rarely 2-seeded; seeds ovoid or ellipsoid, 5-7 mm. long, densely long-pilose along the edge, densely sericeous or tomentose on the dorsal and ventral sides. Cotyledons ovate-cordate, corrugate.

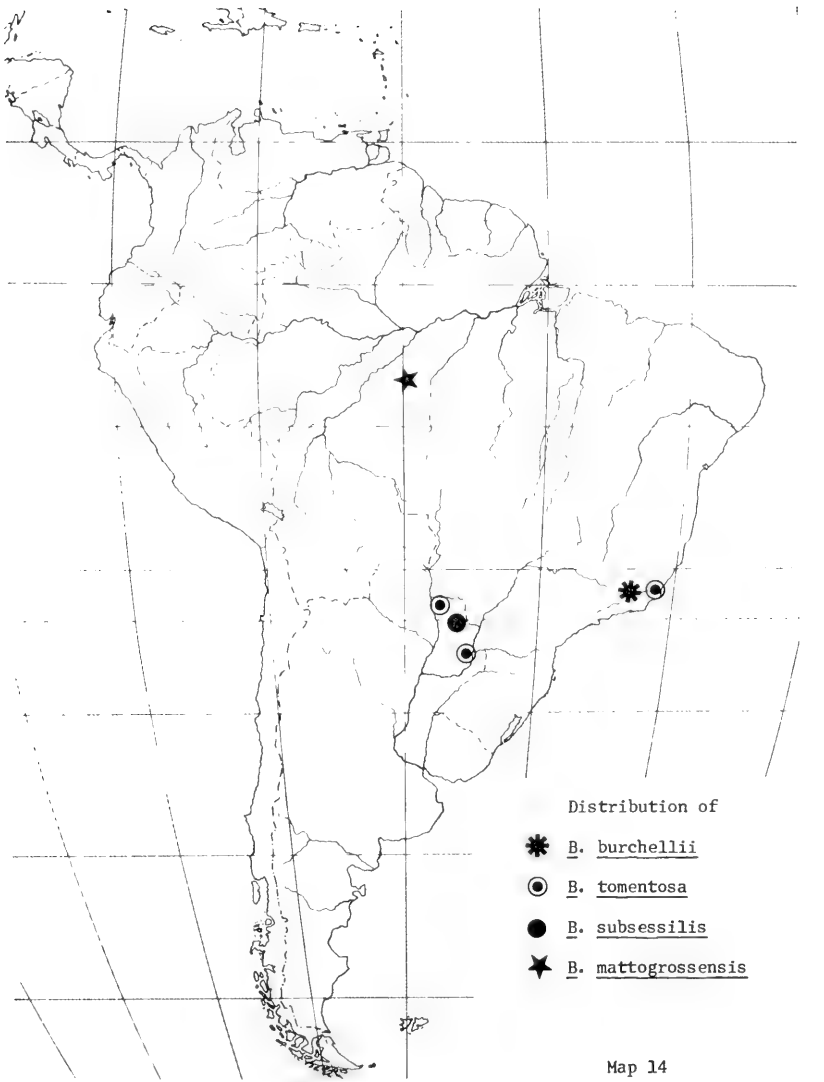
Type: Brazil, Burchell 2778 (K-lectotype-not seen, GH-isotype!).

From the specimens examined, this species seems to be localized in coastal regions of southeastern Brazil (Map 14). Its habitat is not known except for shallow sandbanks (restinga) recorded by one collector. It has been collected in flower from December to April; fruiting specimens bear no date of collection.

This species is closely related to B. agrostopolis and B. tomentosa, from both of which it is poorly defined. Future study may find these three merely as varieties of a single species.

Specimens examined:

BRAZIL: Rio de Janeiro, Burchell 2778 (F, GH, L, NY): Rio de Janeiro, Jacarepagua in fruticetis, P. Dusen 1985, 22. 3. 1903 (F, GH, US); Rio de Janeiro, M. Gaudichaud 567, 1833 (G); Cosme Velho a' Laranjeiras (Rio de Jan.), cipo, flores rosadas, Glaziou 4142 (BM, NY, R); Env. de Rio de Janeiro, Glaziou 13027, 1882 (G); Flore des environs de Rio de Janeiro, Glaziou 13037 (G); Environs of Rio de Janeiro, Glaziou 14127, 1882 (K); Morro da Babylonia (R. J.) cipo, fl. blancas, Glaziou 18381, March 29, 1891 (NY, R);


Distribution of
B. burchellii
B. tomentosa
B. subsessilis
B. mattogrossensis

Map 14

Forest, Lindley, 1840 (K); Restinga da Tijuca, Estado da Guanabara, Othon Machado, 21. 12. 1943 (RB); Restinga da Gavea, Estado da Guanabara, Othon Machado (RB); Schling pflanze bei Jacarepagua, E. Ule 4675, May, 1898 (HBG).

38. Bonamia tomentosa Hassler, Repert. Sp. Nov. 9:148. 1911.

Perennial, woody, high-climbing vines. Stems scandent or twining, terete, 6-8 m. long (according to Hassler), slender or as thick as 4-6 mm., densely fulvous-tomentose while young, sparsely puberulous or nearly glabrous in age; bark smooth or warty-plicate, with few or numerous lenticels; internodes mostly 3-6 cm. long, occasionally shorter or reduced on the younger branches. Leaves petiolate, herbaceous, densely tomentose, fulvous-tomentose or velutinous on both surfaces, dark green and occasionally glabrescent above, pale green below; petioles 10-30 (-40) mm. long, canaliculate above, densely tomentose or rarely becoming sparsely tomentose; blades ovate, ovate-elliptic or occasionally suborbicular, or subcordate, mostly 5-11 cm. long, 4.5-10 cm. broad, entire or slightly undulate at the margin, subcordate or truncate at the base, obtuse-mucronate, emarginate, rounded-mucronate or rarely short-acuminate at the apex; veins very prominent below; lateral veins 6-8 pairs; intercostal veins obscure above, prominent below. Inflorescences axillary or terminal pseudopanicles or panicles, multiflorus; peduncles short, variable in length, densely tomentose; pedicels short, 3-5 mm. long, tomentose, bracts linear or linear-lanceolate, 2-3.5 mm. long, deciduous; bracteoles similar to bracts, smaller, persistent or deciduous. Sepals coriaceous, ovate or ovate-orbicular, slightly unequal or subequal; outer two smaller 4-6 mm. long, 3-4 mm. broad, tomentose or glabrescent near the margin, obtuse or rounded at the apex; inner three larger, suborbicular, 5-8 mm. long, densely sericeous or tomentose outside, emarginate at the apex, scarious at the margin. Corolla white, infundibuliform-campanulate, 2.3-2.8 cm. long, lobulate or subentire, soft-sericeous or short pilose on interplicae. Stamens included; filaments short, glabrous above, villous or puberulous below; anthers oblong, 2-3 mm. long, dorsifixed. Ovary conical or ellipsoid-conical, glabrous or sparsely pilose; styles bifid to the middle or lower, filiform, longer than filaments, glabrous; stigmas reniform or capitate-subbilobed, papillose-verrulose. Fruits not known.

Type: Paraguay: In viciniis Caaguazu, E. Hassler 9038, 1905 (G-lectotype, BM, F, MO, NY, W-isotypes!)

Known from southeast coastal region of Brazil to Paraguay (Map 14).

According to Hassler, this is a plant of calcareous areas. It has been collected in flower in March but its fruiting period is not known. One is struck by the close relationship of this species to B. burchellii, and study of future collections may show it to be only a variety of the latter. From this species, it seems to

differ by its emarginate, obtuse-mucronate or rounded leaves (subcordate or truncate at the base), slightly larger sepals and distinctly white corolla. Hassler, in describing B. tomentosa, noted a supposed close relationship to B. agrostopolis.

Specimens examined:
BRAZIL: Ilha do Governador, Distrito Federal, G. Pabst (4.424) 4908, 30. 3. 1958 (F).
PARAGUAY: Hernandarias, Sta. Teresa, Bertoni 4887, 9. III. 1950 (L, W); In viciniis Caaguazu, frutex scandens 6-8 m., corolla alba, E. Hassler 9038, 1905 (BM, F, G, MO, NY, W); Regio calcarea cursus superioris fluminis Apa, alt. 5-8 m., petala blanca, Hassler 11044, 1912-13 (A, G, MO, NY, UC, US).

39. Bonamia subsessilis Hassler, Repert. Sp. Nov. 9:149. 1911.

Perennial, high climbing vines. Stems woody, twining, terete, 2-4 mm. thick or slightly thicker, about 4 m. long, densely brown villous or tomentose when young, becoming glabrous or minutely puberulous in age; old branches with purplish bark, minutely verruculose-punctate, longitudinally plicate-rugose; internodes 4-10 cm. or slightly longer. Leaves petiolate, soft, subcoriaceous or submembranous, dark green and softly tomentose above, grey-green and densely tomentose on the lower surface; petioles 5-20 mm. long, canaliculate above, fulvous-tomentose; blades ovate or ovate-orbicular, 7-13 cm. long and 6-10 cm. wide (upper leaves subtending individual cymes much smaller), subcuneate or obtuse-acute at the base, obtuse-mucronate, rounded-mucronate, acute-mucronate or emarginate-mucronate at the apex; lateral veins 6-9 pairs; intercostal veins conspicuous, subparallel. Inflorescences axillary, racemes or panicles, composed of sessile or subsessile cymes of 1-5 flowers; raceme rachis 10-60 mm. or longer, tomentose with brown hairs; individual cymes sessile or subsessile; pedicels and peduncles very short or absent; bracts and bracteroles small, lanceolate, 2-3 mm. long-tomentose. Sepals coriaceous or subcoriaceous, equal or slightly unequal, orbicular, ovate or ovate-orbicular; outer sepals 4-5 mm. long, 3-4 mm. broad, densely tomentose or ferrugineous outside, glabrous inside, obtuse or rounded at the apex; inner sepals 5-6 mm. long, 5 mm. broad, sparsely tomentose or nearly glabrous outside, glabrous inside, rounded or emarginate at the apex. Corolla white, campanulate-infundibuliform, about 2 cm. long, entire or subentire at the margin, fulvous-pilose on interplicae. Stamens included; filaments villous; anthers oblong, 2-3 mm. long, dorsifixed. Ovary ovoid-conical, glabrous; styles bifid to the middle or lower, glabrous; stigmas reniform or subbilobed. Capsules not known.

Type: Paraguay: Caballero-cue (Zwischer Rio Apa und Rio Aquidaban), Trochnen Camp, mit Bursch bewaldete Anhohe, bis 4 m. hoch, kletternd, Weiss, K. Fiebrig 4764, February, 1908-1909 (G-lectotype, BM, GH, L-isotypes!).

Dry highland of northern Paraguay near the Brazilian border (Map 14). It is known only from the type collection, which was collected in flower.

Although the author of this species stated that it is related to B. tomentosa, it seems to be more closely related to the Brazilian species, B. mattogrossensis, from which it differs only by a white corolla and sepals glabrous inside. Future study might prove B. subsessilis and B. mattogrossensis to be conspecific.

40. Bonamia mattogrossensis Hoehne, An. Mem. Inst. Butantan 1 (fasc. 4): 45, tab. 4. 1922.

Perennial, high climbing vines. Stems woody, terete, twining or scandent, 2-4 mm. thick or thicker, densely brown-tomentose or ferrugineous when young, becoming glabrous in age; old branches sparsely punctate or with scattered, white lenticels. Leaves petiolate, soft, thick, subcoriaceous, densely soft-velutinous and dark green above, densely brown-tomentose or ferrugineous and light green underneath; petioles 1-2 cm. long, mostly 1.5-2 mm. thick, canaliculate above, densely tomentose or becoming sparsely puberulous in age; blades ovate, ovate-elliptic or ovate-acuminate, 5-12 cm. long, 3.5-8 cm. broad (slightly smaller on upper leaves), attenuate, subattenuate, obtuse or rarely subcordate at the base; acuminate, obtuse-mucronate or rounded-mucronate at the apex; lateral veins 6-10 pairs, with distinct intercostal veins. Inflorescences axillary, sessile cymes of 3-7 flowers or on axillary short branches forming panicles composed of sessile cymes or axillary racemes; individual flowers sessile or subsessile; bracts and bracteoles small, 1-3 mm., lanceolate-linear, deciduous. Sepals coriaceous, equal or slightly unequal; outer two sepals ovate, 4-5 mm. long, 3.5-4.5 mm. wide, densely tomentose or ferrugineous outside, densely sericeous inside except glabrous center, obtuse-acute or broadly acute at the apex; in-out sepal (third sepal) oblique or orbicular-oblique, densely tomentose outside except glabrous inner margin, densely soft-sericeous inside on the outer margin, glabrous at the center and on the inner margin; inner two sepals orbicular or obovate-orbicular, sparsely or densely tomentose outside at the center, nearly glabrous at the margin, glabrous inside, rounded, truncate or slightly emarginate at the apex. Corolla purple, pale purple or violet, campanulate-infundibuliform, mostly 2 cm. long, subentire, entire or slightly lobulate at the margin, brown-pilose or villous with brownish long hairs on interplicae. Stamens included; filaments villous, at least lower parts; anthers oblong or narrowly elliptic-oblong, 2-3 mm. long, dorsifixed. Ovary oblong-conical or ovoid-conical, glabrous; styles bifid to the middle or lower, with distinct stylopodia, glabrous or with scattered hairs; stigmas reniform or subbilobed. Capsules not known.

Type: Brazil: Mato-Grosso: Commissao Rondon, Coxipo da Ponte, Cuiaba. flor. alvo-arroxeada, F.C. Hoehne 4655, em Marco (1911) (R-lectotype!).

Known only from the type location in the northern part of Mato-Grosso in western Brazil (Map 14). According to the author of the species, the plant grows in dry regions. Further collections are desired, since fruit, seeds and definite flowering and fruiting

periods are not yet known. The only material available for the present study was collected in flower.

The outstanding features of this species are (1) sessile flowers, (2) large leaves, slightly cuneate at the base, (3) outer sepals sericeous inside and (4) corollas purple. It is closely related to B. subsessilis or Paraguay, from which it differs only by its outer sepals being sericeous inside and a purple corolla. This species is separable, although not clearly, into two varieties.

40a. Bonamia mattogrossensis Hoehne var. mattogrossensis.

This variety is characterized by ovate-acuminate or ovate-elliptic leaves, acute, acuminate or rarely obtuse-acuminate and mucronate at the apex, cuneate or subcuneate at the base, and long raceme-rachis.

Known only from the type collection.

40b. Bonamia mattogrossensis Hoehne var. obtusifolia Hoehne, An. Mem. Inst. Butantan 1 (fasc. 4):46, tab. 5. 1922.

This variety differs from the typical variety by its smaller, ovate, obovate or broadly elliptic leaves, rounded, truncate or obtuse and mucronate at the apex, and short raceme-rachis or inflorescence axillary and sessile.

Type: Brazil: Mato-Grosso: Commissao Rondon, Coxipo da Ponte, Cuiaba, flor roxa, F.C. Hoehne 3039, 3. 1911 (R-lectotype!).

Known only from the type collection from western Brazil.

Little-Known Species

The following species are poorly known and no specimens were available for study. The descriptions given here are based on the original descriptions. If material becomes available for comparison, they may prove to be merely abnormal forms or local variants of the other species covered previously. They are included here to make this study as complete as possible.

41. Bonamia abscissa (Choisy) Hall. f. Bull. Herb. Boiss. 5:812. 1897.
Breweria abscissa Choisy, in DC. Prodr. 9:438. 1845.

Stems elongate, ferrugineous. Leaves petiolate, slightly ferrugineous or glabrate; petioles 2.5 cm. long, ferrugineous; blades cordate-ovate, 5-7.5 cm. long, entire at the margin, slightly acuminate at the apex. Flowers axillary, mostly solitary; peduncles not equalling petioles; pedicels ferrugineous. Sepals ovate-orbicular, 6-8 mm. long, subequal, ferrugineous outside, acutish at the apex. Corolla red, campanulate, 2.5-3.2 cm. long, truncate or

entire at the margin. Ovary villous; styles bifid almost to the base. Capsules glabrous.

Type: Madagascar, Bojer.

Reported from woods at Mooza in eastern Madagascar.

In many characteristics this species resembles B. semidigyna, to which it must be closely related. Hallier treated B. abscissa under B. semidigyna in his earlier paper (1893), but later (1897) he treated the two as distinct species. According to Hallier, this species differs from B. semidigyna by its red corolla with truncate or entire limb and uniflorous inflorescence.

42. Bonamia boivinii Hall. f. Bot. Jahrb. 18:91. 1894.

Stems woody, elongate, twining, terete, glabrous; lower internodes 10 cm. long. Leaves shortly petiolate, glabrous; blades ovate, 4 cm. long, 15 mm. broad, gradually smaller toward the apex of stem, falcate-recurved and folded, subacute at the base, acute and mucronate at the apex. Inflorescences dense, multiflorous, terminal, composed of dichasial cymes or subumbellate, shortly pedunculate; flowers small; peduncles short, 2 cm. long, longer than petioles, finely subsericeous; bracteoles small, aggregate, scale-like. Sepals coriaceous, orbicular, equal, glabrous, black, ciliate at the margin. Corolla (not yet unfolded) sericeous outside.

Type: Northwest Madagascar: Ins. Nossi-be, Boivin, 1853.

This species was offered by Hallier as new with an accompanying description far too brief for satisfactory comparison with other species. From the description, it seems to be similar to B. densiflora, except in leaves. Hallier designated the type specimen as deposited at the herbarium of Boissier; this specimen cannot be located.

43. Bonamia langsdorffii (Meissn.) Hall. f. Bull. Herb. Boiss. 5:814. 1897.
Breweria Langsdorffii Meissn. in Martius, Fl. Bras. 7:325. 1869.

Stems slender, perhaps twining, adpressed-pilose or glabrate. Leaves petiolate, subcoriaceous; petioles 2-6 mm. long, slender, canaliculate; blades ovate or oblong-elliptic, 2.5-4.2 cm. long, 1.7-2.5 cm. broad, entire or slightly wavy at the margin, slightly cordate at the base, obtuse-mucronate at the apex. Flowers solitary, axillary, pedunculate; peduncles unequal with the leaves, pubescent; pedicels as long as peduncles, the two together 1.8-2 cm. long; bracts two, opposite, minute, about 2 mm. long, acute. Sepals ovate, 8 mm. long, 4-5 mm. broad, coriaceous-herbaceous, equal, obtuse, glabrous. Corolla white (?), broadly infundibuliform, 2-2.5 cm. long, slightly less than 2.5 cm. in diameter at the limb, pilose outside on interplicae. Styles shorter than corolla, filiform, bifid, connate for lower 4 mm.

Type: Brazil: Rio de Janeiro, Langsdorff.

This species is very closely allied to, and perhaps conspecific with, B. burchellii, B. agrostopolis or B. tomentosa, from which it differs by its solitary flowers.

44. Bonamia capitata (Dammer) v. Ooststroom, Rec. Trav. Bot. Neerl. 33:212. 1936.
Prevostea capitata Dammer, Bot. Jahrb. 23 (Beibl. 57):36. 1897.

Shrubby plants; branches tomentose. Leaves closely spaced, sessile, coriaceous, pubescent above, grey-tomentose below, the margin revolute; blades lanceolate, rounded at the base, mucronate at the apex; nerves scarcely prominent below. Inflorescences terminal, of densely compacted, subglobose cymes. Sepals lanceolate, setose-acuminate at the apex, the outer somewhat larger, densely pilose, ciliate on margins. Corolla blue, densely pilose on upper part (interplicae?). Styles bifid to the middle, pilose at the base; stigmas reniform, capitate. Fruits not known.

Type: Brazil: "Civitate Goyaz ad Fazenda da Boa Vista in Campo," Glaziou 21799, Jan. 14, 1895; not seen.

Known only from south-central Brazil.

As noted by Dammer, this species appears well marked by its distinctive inflorescences. It would seem allied to B. tomentosa and B. subsessilis.

45. Bonamia sedderoides Rendle, Jour. Bot. 46:178. 1908.

Spreading undershrub. Stem 4-6 dm. long, 2 mm. thick, slender, covered with silky, whitish hairs. Leaves 1.3 cm. long, 3 mm. wide. Bracteoles 7-8 mm. long. Sepals 1.1-1.2 cm. long, 5 mm. broad. Corolla probably 2.5 cm. long. Stamens 8 mm. long; anthers linear-oblong, 3 mm. long. Styles free nearly to the base.

Type: Southeast Angola, in shrub-grown pasturage on sandy alluvial soil at the foot of the Serra Ferreire de Amiral, western side, Gossweiler 2888, February 9 (BM-holotype, K-isotype); not available.

Doubtful and Excluded Species

Doubtful Species

Bonamia vignei Hoyle, Kew Bull. 1934:188. 1934.

Although the author of this species stated that it is related to B. cymosa (=B. thunbergiana of the present treatment), it appears to be quite different from the latter in several features, especially

by its accrescent sepals, which are not characteristic of the genus Bonamia. Since no specimen was available for the present study, its transfer to the genus Calycobolus is not attempted here.

Excluded Species

Bonamia althoffiana Dammer, Pflanz. Ostafr. C:329. 1895.
=Convolvulus kilimandschari Engler, Hochgeb. Trop. Afr. 348. 1892.

Bonamia angustifolia (Nash) Wilson, Jour. Arnold Arb. 41:306. 1960.
=Stylisma patens (Desr.) Myint, ssp. angustifolia (Nash) Myint, Brittonia 18:112. 1966.

Bonamia aquatica (Walt.) Gray, Man. ed. 5. 376. 1867.
=Stylisma aquatica (Walt.) Raf. Fl. Tell. 4:83. 1838.

Bonamia capensis (Baker) Burtt Davy, Ann. Trans. Mus. 3:121. 1912.
=Seddera capensis (Meyer) Hall. f. Bot. Jahrb. 18:86. 1893.

Bonamia glomerata (Balf. f.) Hall. f. Bot. Jahrb. 18:90. 1893.
=Seddera glomerata (Balf. f.) O. Schwartz, Mitt. Inst. Allgemeine Bot. Hamburg 10:1971. 1939.

Bonamia humistrata (Walt.) Gray, Proc. Am. Acad. 5:337. 1862.
=Stylisma humistrata (Walt.) Chapm. Fl. S. U. S. ed. 1, 346. 1860.

Bonamia michauxii (Fern. and Schub.) Wilson, Jour. Arnold Arb. 41: 306. 1960.
=Stylisma aquatica (Walt.) Raf. Fl. Tell. 4:83. 1838.

Bonamia patens (Desr.) Shinners, Castanea 27:75. 1962.
=Stylisma patens (Desr.) Myint, Brittonia 18:110. 1966.

Bonamia pickeringii (Torr. ex Curtis) Gray, Man. ed. 5. 376. 1867.
=Stylisma pickeringii (Torr. ex Curtis) Gray, Man. ed. 2. 335. 1856.

Bonamia poranoides Hall. f. Bull. Herb. Boiss. 5:1007. 1897.
=Metaporana densiflora (Hall. f.) N.E. Brown, Kew Bull. 1914: 169. 1914.

Bonamia schizantha (Hall. f.) Meeuse, Bothalia 6:665. 1957.
=Seddera schizantha Hall. f. Bull. Herb. Boiss. 6:532. 1898.

Bonamia spinosa Vierhapper, Oesterr. Bot. Zeitschr. 287. 1904.
=?Seddera sp. or ?Convolvulus socotranus Verdcourt, Kew Bull. 1957:344.

Bonamia suffruticoa (Schinz) Burtt-Davy, Ann. Transvaal Mus. 3:121. 1912.
=Seddera suffruticosa (Schinz) Hall. f. Bot. Jahrb. 18:88. 1893.

Bonamia villosa (Nash) Wilson, Jour. Arnold Arb. 41:306. 1960.
=Stylisma villosa (Nash) House, Bull. Torr. Bot. Club 34:149. 1907.

Bonamia volkensii Dammer, Pflanz. Ostafr. C:329. 1895.
=Hewittia sublobata (L.f.) O. Ktze. Rev. Gen. Pl. 2:441. 1891.

Breweria africana (G. Don) Benth. and Hook. f. Gen. Pl. 2:877. 1876.
=Calycobolus africanus (G. Don) Myint, comb. nov.

Breweria alsinoides Merrill, Interpr. Rumph. Herb. Amboin. 46. 1917.
=Evolvulus alsinoides (L.) L. Sp. Pl. ed. 2. 392. 1762.

Breweria alternifolia Radlk. Abhandl. Nat. Ver. Bremen 8:413. 1884.
=Calycobolus africanus (G. Don) Myint, supra.

Breweria angustifolia Nash, Bull. Torr. Bot. Club 22:155. 1895.

=Stylisma patens (Desr.) Myint, var. angustifolia (Nash) Myint, Brittonia 18:112. 1966.

Breweria aquatica (Walt.) Gray, Syn. Fl. N. Am. 2 (1):217. 1878.
=Stylisma aquatica (Walt.) Raf. Fl. Tell. 4:83. 1838.

Breweria argentea Terrace, Ann. Inst. Bot. Roma 5:104. 1893.
=Seddera latifolia Hochst. and Steud. Flora 27, Beil. 8, t. 5. 1844.

Breweria baccharoides Baker, Kew Bull. 1894:68. 1894.
=Seddera suffruticosa (Schinz) Hall. f. Bot. Jahrb. 18:88. 1893.

Breweria campanulata Baker, Kew Bull. 1894:68. 1894.
=Calycobolus campanulatus (Baker) Myint, comb. nov.

Breweria capensis (Meyer) Baker, in Dyer, Fl. Cap. 4 (2):80. 1904.
=Seddera capensis (Meyer) Hall. f. Bot. Jahrb. 18:86. 1893.

Breweria choisyana Steud. Nomencl. ed. 2, 1:224. 1840.
=Seddera evolvuloides (Choisy) Wight, Icon. 4 (2):13, t. 1369. 1848.

Breweria Codonanthus Baker ex Oliver, Hook. f. Icon. pl. 23.
=Calycobolus africanus (G. Don) Myint, supra.

Breweria conglomerata Baker, Kew Bull. 1894:68. 1894.
=Seddera conglomerata (Baker) Hall. f. Bull. Herb. Boiss. 5:1008. 1897.

Breweria evolvuloides R. Br. Salt. Abyss. App. 65. 1814.
=Seddera arabica (Forsk.) Choisy, in DC., Prodr. 9:441. 1845.

Breweria evolvuloides Choisy, Mem. Soc. Phys. Genev. 6:494. 1833.
=Seddera evolvuloides (Choisy) Wight, Icon. 4 (2):13, t. 1369. 1848.

Breweria evolvuloides Vatke, Linnaea 43:523. 1882.
=Seddera latifolia Hochst. et Steud. Flora, Beil. 8, t. 5. 1844.

Breweria fastigiata Balf. f. Proc. Roy. Soc. Edin. 12:83. 1883.
=Convolvulus socotranus Verdcourt, Kew Bull. 1957:344. 1957.

Breweria glaucata Peter, in Engler and Prantl., Naturl. Pflanzenfam. 4 (3a):17. 1897.
=Seddera glomerata (Balf. f.) O. Schwartz, Mitt. Inst. Allgemeine Bot. Hamburg 10:1971. 1939.

Breweria glomerata Balf. f. Proc. Roy. Soc. Edin. 12:83. 1883.
=Seddera glomerata (Balf. f.) O. Schwartz, l. c. 1939.

Breweria Hassleriana Chod. Bull. Herb. Boiss. Ser. II. 5:683.
=Convolvulus hasslerianus (Chod.) O'Donell, Lilloa 23:430. 1950.

Breweria heudelotii Baker, Kew Bull. 1894:68. 1894.
=Calycobolus heudelotii (Baker) Myint, comb. nov.

Breweria hispida Franchet, Sert. Somal. p. 43. 1882.
=Seddera somalensis (Vatke) Hall. f. Bot. Jahrb. 18:90. 1893.

Breweria humistrata (Walt.) Gray, Syn. Fl. N. Am. 2 (1):217. 1878.
=Stylisma humistrata (Walt.) Chapm. Fl. S. U. S. ed. 1, 346. 1860.

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=Seddera intermedia Hochst. et Steud. Flora 27, Beil. 8. 1844.

Breweria latifolia Hochst. Flora 27, Beil. 8. 1844.
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=Evolvulus rotundifolius (Watson) Hall. f. Bot. Jahrb. 16:530. 1893.
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=Seddera suffruticosa (Schinz) Hall. f. Bot. Jahrb. 18:88. 1893.
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Appendix

New Names and Combinations

New species:

B. brevipedicellata Myint & Ward

New varieties:

B. media var. emarginata Myint & Ward
B. menziesii var. rockii Myint & Ward

New forms:

B. trichantha var. ovata forma glabrata Myint & Ward

New combinations:

B. elliptica (Smith & Schubert) Myint & Ward
B. semidigyna var. semidigyna f. ambigua (Hall. f.) Myint & Ward
B. sulphurea (Brandg.) Myint & Ward

New combinations in Calycobolus:

C. africanus (G. Don) Myint
C. campanulatus (Baker) Myint
C. heudelotii (Baker) Myint

ADDITIONAL NOTES ON THE GENUS VITEX. X

Harold N. Moldenke

VITEX Tourn.

Additional bibliography: J. F. Gmel. in L., Syst. Nat., ed. 13, pr. 1, 2: 890 (1789) and pr. 2, 2: 890. 1796; Steud., Nom. Bot. Phan., ed. 1, 228 & 888. 1821; Guinet & Sauvage, Trav. Inst. Scient. Chérif., ser. gén., 2: 121. 1954; J. Bush-Brown, Shrubs & Trees Home Landsc. 161, 195, & 197. 1963; Martínez-Crovetto, Bonplandia 1: 177 & 198. 1963; E. Lawrence, South. Gard., ed. 2, 139, 219, & 261. 1967; Doolittle & Tiedebohl, Southwest. Gard., ed. 2, 90, 170, & 171. 1967; Vyas, Journ. Bombay Nat. Hist. Soc. 64: 219. 1967; Anon., Biol. Abstr. 49: 390 (1968) and 49 (8): S. 185. 1968; Moldenke, Phytologia 16: 487--502, 507, 509, & 512 (1968) and 17: 8--56 & 114--120. 1968; Moldenke, Résumé Suppl. 16: 1--5, 7--13, 21, 25, 29, & 30. 1968.

Doolittle & Tiedebohl (1967) point out that members of this genus when cultivated in the southwestern United States need care in transplanting, should be pruned in January, and tend to remain dormant until very late in the spring.

VITEX UNIFLORA J. G. Baker

Additional bibliography: Jacks. in Hook. f. & Jacks., Ind. Kew., pr. 1, 2: 1214 (1895) and pr. 2, 2: 1214. 1946; Moldenke in Humbert, Fl. Madag. 174: 71, 109--111, & 273, fig. 16 (5 & g). 1956; Moldenke, Phytologia 6: 203--204. 1958; Moldenke, Résumé 157 & 479. 1959; Jacks. in Hook. f. & Jacks., Ind. Kew., pr. 3, 2: 1214. 1960.

Illustrations: Moldenke in Humbert, Fl. Madag. 174: 109, fig. 16 (5 & 6). 1956.

VITEX URCEOLATA C. B. Clarke

Additional bibliography: Forbes & Hemsl., Fl. Sin. 2: 259. 1890; Jacks. in Hook. f. & Jacks., Ind. Kew., pr. 1, 2: 1213 & 1214. 1895; Dunn & Tutcher, Kew Bull. Misc. Inf. Addit. Ser. 10: 204. 1912; Lam. & Bakh., Bull. Jard. Bot. Buitenz., ser. 3, 3: 55. 1921; H. N. Ridl., Fl. Malay Penins. 633. 1923; P. Dop in Lecomte, Fl. Indochine 4: 826. 1935; Fletcher, Kew Bull. Misc. Inf. 1938: 432 & 434. 1938; Jacks. in Hook. f. & Jacks., Ind. Kew., pr. 2, 2: 1213 & 1214. 1946; Anon., Kew Bull. Gen. Index 1929-1956, 293. 1959; Jacks. in Hook. f. & Jacks., Ind. Kew., pr. 3, 2: 1213 & 1214. 1960; Moldenke, Phytologia 8: 92. 1961; Hegnauer, Chemotax. Pfl. 3: 39. 1964.

Krukoff describes this species as a tree, 75 feet tall, the trunk 12 inches in circumference, fruiting in November. Material has been misidentified and distributed in herbaria as Teijsmanniodendron coriaceum (C. B. Clarke) Kosterm.

Additional citations: INDONESIA: GREATER SUNDA ISLANDS: Sumatra:

Krukoff 4244 (N, W--1750656), 4339 (N, W--1750719).

VITEX VANSTEENISI Moldenke

Additional bibliography: Moldenke, Biol. Abstr. 27: 3121. 1953; G. Taylor, Ind. Kew. Suppl. 12: 151. 1959; Moldenke, Phytologia 8: 92. 1961.

VITEX VAUTHIERI P. DC.

Additional bibliography: Jacks. in Hook. f. & Jacks., Ind. Kew., pr. 1, 1: 296 (1893) and 2: 1214 (1895), pr. 2, 1: 296 (1946) and 2: 1214 (1946), and pr. 3, 1: 296 (1960) and 2: 1214. 1960; Moldenke, Phytologia 8: 93. 1961.

An isotype of this species -- Vauthier 193 -- deposited in the herbarium of the Conservatoire et Jardin Botaniques at Geneva, was photographed there by Macbride as his type photograph number 7882.

Additional citations: BRAZIL: Rio de Janeiro: Sampaio 7949 (Ja--114100); Vauthier 193 [Macbride photos 7882] (W--photo of isotype).

VITEX VELUTINA (Koord. & Val.) Koord.

Additional synonymy: Vitex velutina Koord. apud Stapf, Ind. Lond. 6: 479. 1931.

Additional bibliography: A. W. Hill, Ind. Kew. Suppl. 6: 219. 1926; Moldenke, Phytologia 8: 93 (1961) and 17: 30. 1968; Moldenke, Résumé Suppl. 16: 30. 1968.

VITEX VENULOSA Moldenke

Bibliography: Moldenke, Phytologia 4: 64--65 (1952) and 6: 210--211. 1958; Moldenke, Résumé 143 & 479. 1959; G. Taylor, Ind. Kew. Suppl. 12: 151. 1959.

VITEX VERMOESENI DeWild.

Additional bibliography: A. W. Hill, Ind. Kew. Suppl. 8: 249. 1933; Moldenke, Phytologia 8: 93. 1961; Moldenke, Résumé Suppl. 12: 6 & 7. 1965; Moldenke, Phytologia 15: 254. 1967.

Recent collectors describe this plant as a tree, 20 m. tall, called "mebassa" or "mevassa", growing in forests, and fruiting in March. The corollas on Monteiro & Murta 209 are described as having been "clear green".

Additional citations: ANGOLA: Cabinda: Monteiro & Murta 209 (Ul); Murta 39 (Ul).

VITEX VERTICILLATA A. Chev.

Additional bibliography: Prain, Ind. Kew. Suppl. 5, pr. 1, 273. 1921; Moldenke, Phytologia 6: 213. 1958; Moldenke, Résumé 140 & 479. 1959; Prain, Ind. Kew. Suppl. 5, pr. 2, 273. 1960.

Regardless of whether or not one considers Chevalier's description of this taxon as adequate, his binomial is apparently invalidated by the Vitex verticillata of DeCandolle & Lamarck, Fl. Franc. 2: 363 (1778), and will have to be replaced if the taxon proves to

be distinct.

VITEX VESTITA Wall.

Additional synonymy: Vitex vestita "Wall. ex Kurz" apud Anon., Kew Bull. Gen. Index 1929-1956, 293. 1959. Vitex vestita "Wall. ex Schau." apud Backer & Bakh., Fl. Java 2: 605. 1965. Vitex vestita Vahl ex Moldenke, Résumé Suppl. 13: 7, in syn. 1966.

Additional & emended bibliography: Bocq., Adansonia 3: [Rev. Verbenac.] 253. 1863; Jacks. in Hook. f. & Jacks., Ind. Kew., pr. 1, 2: 1213 & 1214. 1895; C. B. Clarke in J. Schmidt, Bot. Tidsskr. 26: 172. 1904; A. W. Hill, Ind. Kew. Suppl. 7: 252. 1929; P'ei, Mem. Sci. Soc. China 1 (3):[Verbenac. China] 112 & 114, pl. 22. 1932; A. W. Hill, Ind. Kew. Suppl. 9: 297. 1938; Fletcher, Kew Bull. Misc. Inf. 1938: 432 & 436. 1938; Worsdell, Ind. Lond. Suppl. 2: 500. 1941; Jacks. in Hook. f. & Jacks., Ind. Kew., pr. 2, 2: 1213 & 1214. 1946; Anon., Kew Bull. Gen. Index 1929-1956, 293. 1959; Jacks. in Hook. f. & Jacks., Ind. Kew., pr. 3, 2: 1213 & 1214. 1960; Moldenke, Phytologia 8: 93. 1961; Moldenke, Dansk Bot. Arkiv 23: 92. 1963; Backer & Bakh., Fl. Java 2: 605. 1965; Moldenke, Résumé Suppl. 13: 7. 1966; Moldenke, Phytologia 15: 111. 1967; Moldenke, Résumé Suppl. 16: 30. 1968.

Illustrations: P'ei, Mem. Sci. Soc. China 1 (3): [Verbenac. China] pl. 22. 1932.

Recent collectors describe this plant as a shrub or small tree, 1.5—5 m. tall, with yellowish-green fruit, growing on granite, in thickets, in primary forests, and "scattered by stream", at altitudes of 150—7000 feet, called "kajoe giak noenik", and fruiting in January, August, and September. Backer & Bakhuizen van den Brink (1965) describe the plant as follows: petioles 3.5—10.5 cm. long; leaflets 3, elliptic-ovate-oblong, long-acuminate at the apex, short-pubescent above, villous and copiously gland-dotted beneath, the median leaflet 11.5—20 cm. long, 4.5—11 cm. wide, on a petiolule 1.5—3.5 cm. long, the other leaflets smaller and on shorter petiolules; cymes 1—4 in each axil, tawny-pubescent; calyx and corolla with numerous rather large yellow glands on the outer surface; corolla yellow, its tube about 8 mm. long, glabrous except for a ring of hairs rather far below the insertion of the stamens and near the base inside. They comment that while the species has been recorded from Java "no Javan localities are known. Probably the plant was collected in the Bogor Botanic Garden, where it was formerly cultivated." They give its distribution as the "Western part of Malesia". In my 1963 work the distribution is given as "India, Burma, Indo-China, Thailand, and Malaya, north into southern China, east to the Lingga Archipelago, Sumatra, Java, Borneo, and the Lesser Sunda Islands".

Chand states that it is a "rare forest tree" in Assam. The corolla is described as "whitish" on A. Henry 12310, as "yellow" on Toroes 284, and "with a yellow spot in throat" on Chand 3428. The Boesa 7049 and Toroes 284 & 1236 collections are accompanied by wood sample at the University of Michigan. Toroes 1497 has

leaves that approach those of f. glabrescens Moldenke. The Boeea 8501, distributed as V. vestita, is actually V. gamosepala var. kunstleri King & Gamble.

Additional citations: INDIA: Assam: Chand 3428 (Mi), 3573 (Mi). BURMA: Shan States: Khalil s.n. [Laikaw, 1893] (W--369589). Upper Burma: Kingdon-Ward 22501 (Bm). CHINA: Yünnan: A. Henry 12310 (W--459020, W--459021); J. F. Rock 7212 (W--1758335). THAILAND: Hansen, Seidenfaden, & Smitinand 10808 (Ac, Cp); Sørensen, Larsen, & Hansen 5209 (Cp). MALAYA: Selangor: Kloss s.n. [3.8. 1914] (W--2318001). INDONESIA: GREATER SUNDA ISLANDS: Banka: Anta 608 (A). Sumatra: Boeea 7049 (Mi, Mi), 9827 (Mi, Mi); Toroes 284 (Mi, Mi), 1236 (Mi, Mi), 1497 (Mi); Yates 1648 (Mi, Mi), 2140 (Mi).

VITEX VESTITA f. GLABRESCENS Moldenke

Additional bibliography: Moldenke, Phytologia 3: 489 (1951) and 8: 93. 1961.

Soepadmo calls this plant a treelet, 4 m. tall, with yellowish-green fruit, growing in sandy-loam soil on hillsides. The Toroes 1497 collection, cited under typical V. vestita Wall., has leaves which almost approach those of f. glabrescens in their pubescence.

Additional citations: INDONESIA: GREATER SUNDA ISLANDS: Sumatra: Soepadmo 181 (S).

VITEX VESTITA f. MILLSII (Henderson) Moldenke

Additional bibliography: A. W. Hill, Ind. Kew. Suppl. 8: 249. 1933; Moldenke, Phytologia 3: 489 (1951) and 6: 216—217. 1958; Moldenke, Résumé 181, 386, & 479. 1959.

VITEX VESTITA var. SIAMICA Moldenke

Bibliography: Moldenke, Phytologia 4: 65 (1952) and 6: 217. 1958; Moldenke, Résumé 179. 1959.

VITEX VESTITA f. WINKLERI Moldenke

Additional bibliography: Moldenke, Phytologia 3: 489 (1951) and 8: 94. 1961.

VITEX VILLOSA Sim

Additional bibliography: Prain, Ind. Kew. Suppl. 4, pr. 1, 248 (1913) and pr. 2, 248. 1958; Moldenke, Phytologia 6: 217--218. 1958; Moldenke, Résumé 151 & 479. 1959.

VITEX VOLKENSII Gürke

Additional & emended bibliography: Durand & Jacks., Ind. Kew. Suppl. 1, pr. 1, 457. 1906; Prain, Ind. Kew. Suppl. 4, pr. 1, 248. 1913; A. W. Hill, Ind. Kew. Suppl. 8: 249. 1933; Durand & Jacks., Ind. Kew. Suppl. 1, pr. 2, 457. 1941; Prain, Ind. Kew. Suppl. 4, pr. 2, 248. 1958; Durand & Jacks., Ind. Kew. Suppl. 1, pr. 3, 457. 1959; Moldenke, Phytologia 8: 94. 1961; Hocking, Excerpt. Bot.

A.4: 592. 1962.

VITEX VONDROZENSIS Moldenke

Additional bibliography: Moldenke, Biol. Abstr. 27: 3121. 1953; Moldenke in Humbert, Fl. Madag. 174: 75, 121--123, & 273, fig. 18 (4). 1956; Moldenke, Phytologia 6: 219--220. 1958; Moldenke, Résumé 157 & 479. 1959; G. Taylor, Ind. Kew. Suppl. 12: 151. 1959.

Illustrations: Moldenke in Humbert, Fl. Madag. 174: 121, fig. 18 (4). 1956.

VITEX WATERLOTI Danguy

Additional & emended bibliography: A. W. Hill, Ind. Kew. Suppl. 7: 252. 1929; Moldenke in Humbert, Fl. Madag. 174: 76, 133--136, & 273, fig. 21 (3--5). 1956; Moldenke, Phytologia 6: 220—222. 1958; Anon., U. S. Dept. Agr. Bot. Subj. Index 15: 14361. 1958; Moldenke, Résumé 157, 391, & 479. 1959.

Illustrations: Moldenke in Humbert, Fl. Madag. 174: 135, fig. 21 (3—5). 1956.

VITEX WELLENSI DeWild.

Additional bibliography: A. W. Hill, Ind. Kew. Suppl. 8: 249. 1933; Moldenke, Phytologia 6: 222—223. 1958; Moldenke, Résumé 143 & 479. 1959.

VITEX WELWITSCHII Gürke

Additional bibliography: Durand & Jacks., Ind. Kew. Suppl. 1, pr. 1, 457. 1906; A. W. Hill, Ind. Kew. Suppl. 7: 252. 1929; F. R. Irvine, Pl. Gold Coast 437. 1930; Durand & Jacks., Ind. Kew. Suppl. 1, pr. 2, 457 (1941) and pr. 3, 457. 1959; Moldenke, Phytologia 8: 94. 1961; Moldenke, Résumé Suppl. 12: 7. 1965; Moldenke, Phytologia 15: 246—247. 1967.

Recent collectors describe this plant as a shrub or small tree, 0.5--35 m. tall, often rhizomatous, with green or dark wine-colored fruit, growing in sandy soil, in wet or dense secondary forests, Brachystegia woods, or regenerated forests after cultivation, at 1630--1700 m. altitude, flowering also in January, April, and November, fruiting in April and August, and called "munterengue". The corollas are said to have been "white with the lip blue inside" on F. A. Mendonca 2856, "with a violet lip" on Torre 2096, and "lilac with yellow throat" on E. J. Mendes 2057. Irvine (1930) remarks that Thompson 37 represents a species "near V. welwitschii". Herbarium material has been misidentified and distributed as V. grisea J. G. Baker.

Additional citations: CONGO LEOPOLDVILLE: Louis 421 (B), 2163 (B). ANGOLA: Benguela: Gossweiler 12185 (Ul). Cabinda: Monteiro, Santos, & Murta 259 (Ul). Huambo: E. J. Mendes 566 (Ul). Huila: Antunes or Dekindt s.n. (Ul); E. J. Mendes 2057 (Ul, Z); R. Santos 458 (Ul). Luanda: Teixeira 10 (Ul). PORTUGUESE EAST AFRICA: Lourenço Marques: F. A. Mendonca 2856 (Ul); Torre 2096 (Rf, Ul), 6417 (Ul), 7678 (Ul).

A NOTE ON BAUHINIA HAGENBECKII HARMS

R. P. Wunderlin *

Bauhinia hagenbeckii Harms is an interesting and variable species which occurs in the Cacho region of Paraguay and Brazil. The Cacho is an arid region composed of alluvial soil of unconsolidated sands and clays which supposrts a vegetation composed of thickets of thorny scrub trees and openings of course grasses. Until this study was conducted, this species was known only from photographs of the type specimen. The type collection was made in "Gran Cacho, Brazil" by Hagenbeck in April, 1895. The only known existing type was destroyed by allied bombs and fire during World War II. A photograph and a fragment (4 leaflets) of the type housed in the Field Museum of Natural History were examined by the author. This material is therefore designated as the lectotype of the species.

Bauhinia hassleriana was described by Chodat in 1904, one year after B. hagenbeckii, from the Cacho region of Paraguay. It was segregated into four forms (f. angustifolia, f. intermedia, f. latifolia, and f. acuminata) and a variety (var. marginata) by Chodat and Hassler in the same paper. Several of these taxa are known to the author only from the ample type materials and others from the description only. The forms angustifolia, intermedia, and latifolia were segregated on the basis of leaf width, the dimensiona of which apparently were arbitrarly selected and overlap on the type material examined by the author. Forma acuminata is differentiated by having the lobes of the leaflets acuminate, but this also is too variable for formal taxonomic designation. Variety marginata is differentiated by having the leaflets distinctly marginate. This character is also not clear-cut and quite evident margins are found on other taxa of the species as well as on the type material of B. hagenbeckii.

In vegetative and floral characters B. hassleriana is not separated from B. hagenbeckii and is best considered as being conspecific with it.

The following is the synonymy of B. hagenbeckii and a description of the species as I know it:

BAUHINIA HAGENBECKII Harms, Engl. Bot. Jahrb. 33. Beibl. 72:21. 1903. (T: Hagenbeck s.n.!).

Bauhinia hassleriana Chod. in Chod. & Hassl. Bull. Herb. Boiss. ser. 2. 4:690. 1904, ex char.

Bauhinia hassleriana Chod. forma acuminata Chod. & Hassl. Bull. Herb. Boiss. ser. 2. 4:690. 1904. (T: Hassler 7076!).

Bauhinia hassleriana Chod. forma angustifolia Chod. & Hassl. Bull. Herb. Boiss. ser. 2. 4:690. 1904, ex char.
Bauhinia hassleriana Chod. forma intermedia Chod. & Hassl. Bull. Herb. Boiss. ser. 2. 4:690. 1904. (T: Hassler 7898!).
Bauhinia hassleriana Chod. forma latifolia Chod. & Hassl. Bull. Herb. Boiss. ser. 2. 4:690. 1904. (T: Hassler 7656).
Bauhinia hassleriana Chod. var. marginata Chod. & Hassl. Bull. Herb. Boiss. ser. 2. 4:690. (T: Hassler 6958!).

A much branched shrub or small tree. Branches pubescent, soon glabrescent. Leaves bifoliolate; leaflets obliquely ovate to linear-oblong, apices obtuse to subacute, 2-6 cm long, 0.5-2.0 cm wide, upper leaflets generally narrower than lower, puberulent or subglabrous below, usually pubescent near petiole, glabrous above, 1-to 4-nerved (depending on width of leaflets), veins conspicuously reticulate below, less so above, margins often distinct; petioles slender, 1-2 cm long, puberulent to subglabrous. Flowers solitary to few in axillary clusters, appressed puberulent; buds 5-6 cm long at maturity; calyx cylindrical, tube 2.5-4.0 cm long, lobes 2.5-3.5 cm long, splitting and reflexed at maturity; petals lanceolate to elliptic-lanceolate, clawed, 2.0-2.5 cm long, 6-8 mm wide, white; anthers 10, alternately long and short, filaments glabrous, 2.0-2.5 cm long; pistils slightly longer than stamens, glabrous or sparingly pilose; pedicels 10-12 mm long. Mature legume dimensions unknown, light tan, dehiscent.

Type: Hagenbeck s.n. (F) from "Gran Cacho, Brazil" is selected as the lectotype.

SPECIMENS EXAMINED: BRAZIL: "Gran Cacho", Hagenbeck s.n. (F-type; photo-US, MO). PARAGUAY: Amambay: In rocks along Rio Apa near Bella Vista, Hassler 7898 (MO, MICH, US, UC, F). Boqueron: In sand along bank of Rio Yacare, Hassler 7076 (F, GH, UC). Cordilleras: In dry rocky area near Valenzuela, Hassler 6958 (photo-MO, US, F; MICH, F, MO, UC).

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A NEW SPECIES OF PIRIQUETA AUBLET (TURNERACEAE) FROM MATO GROSSO, BRAZIL

Carlos Alberto F. de Moura
Instituto de Botânica, São Paulo

Piriqueta corumbensis C. Moura sp. nov. - Herba caule 25 - 35 cm alt., cylindrico, simplici v. pauciramoso, pilis stellaribus (radius centralis longissimus, radiis basalibus brevioribus) flavo-aureis, dense vestito; pilis simplicibus brevissimis tenuibus, albidis, intermixtis. Stipulae nullae. Folia petiolis 2 - 4 mm longis; lamina elliptica v. fere late lanceolata, 3 - 6 cm longa, 2 - 3 cm lata, 1.1/2 - 2-plo longiora quam latiora, basi obtusa v. subrotundata, apice obtusa, in ambitu crenata basi excepta, undique pilosa, superne pilis pluriradiatis, radio intermedio maiore, flavescentibus, inferne densissime pilosa, pilis brevioribus, multiradiatis, radio intermedio non v. vix longiore, pallido-flavescentibus, utrimque ad nervos pilosa, nervis superne impressis, inferne prominentibus. Flores axillares solitarii, dolichostyli. Pedunculi longissimi, 35 - 50 mm longi, pedicelli 5 - 8 mm longi; bracteolae nullae. Calyx 15 - 17 mm longus, vix in 1/4 alt. coalitus, extus dense hirsutus, flavo-aureus; tubus calycinus obconicus, intus glaber; lobi lanceolati breviapiculati, tri- v. pentanervibus. Petala calycem vix ca. 1 mm longe superantia, violacea, glabra, obovata, 13 - 14 mm longa, 7 - 8 mm lata, basi obtusa, apice rotundata v. subtruncata, sub insertione in calycis tubum marginibus decurrentia; corona vix 1 mm longa, in parte anteriore lacerato-fimbriata. Filamenta basi vix 1 mm longe tubo calycino adnata, glabra, 4 - 6 mm longa; antherae effloratae lanceolatae, 2 - 2,5 mm longae, dorso in 1/3 alt. affixae. Ovarium ovatum, 2,5 mm longum, dense pilosum, 30-ovulatum. Stili glabri, erecti, 3 - 5 mm longi, apice breve 4-partiti; stigmata multiflagellata digitata, 1 - 1,3 mm longa. Fructus globulosus, pilosus, 6 mm longus, 6 mm diametro, dorso sub pube tuberculatus. Semina immatura.

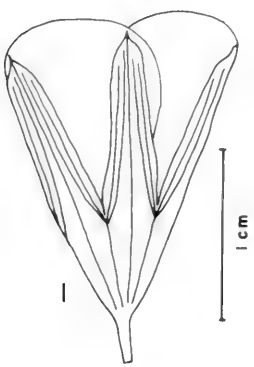
Holotype in the Jardim Botânico do Rio de Janeiro, accession nº 85714, collected at Fazenda Aguassuzinho, Municipality of Corumbá, State of Mato Grosso, Brazil, October 17, 1953, by E. Pereira, W. Egler & Graziela Barroso 388.

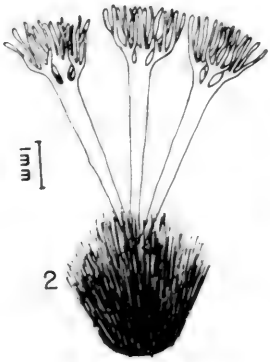
This specimen is similar to Piriqueta aurea (Camb.) Urban. However, a more detailed examination shows that the specimen in question has certain characteristics which distinguish it from that species. Thus, in P. aurea, the hairs of the stem and leaves are identical in being irregularly stellate with all of the rays well-developed; the peduncles do not exceed 27 mm in length; the petals are oblanceolate-cuneate and surpass the calyx lobes by 8 - 15 mm; the style is divided irregularly to form the thin stigmatic branches. In the new species the stem hairs possess a central ray much longer than the other rays; these other rays remain at the base as a low crown surrounding the central ray. The leaf hairs are shorter than the stem hairs. The hairs of the upper surface of the leaf resemble those of the stem in having a long cen-

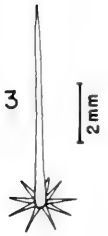
tral ray with short basal rays, whereas those of the lower surface have a shorter central ray and a larger number of basal rays. The peduncles are very long, 35 - 50 mm. The petals are obovate and do not surpass the calyx lobes by more than 1 mm. The style is divided at the tip into 4 regular short branches; each of these then divides into 4 - 5 digitate stigmatic branches.

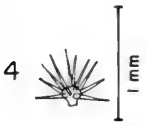
Because of the above differences I am describing it as a new species, naming it for the municipality in which it was collected.

I wish to extend my thanks to Dr. George Eiten who reviewed the English text and to Dr. Gerhard Gottsberger for inking in my drawings.









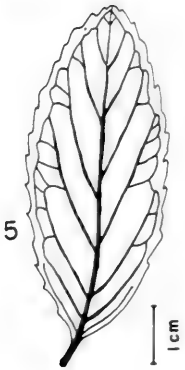


Fig. 1. Piriqueta corumbensis. Diagramatic drawing of a flower showing the relative length of corolla and calyx lobes.
Fig. 2. Pistil with hairy ovary, 3 styles and stigmatic branches.
Fig. 3. Stem hair.
Fig. 4. Hair on lower face of leaf.
Fig. 5. Leaf showing venation.

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INDEX THELYPTERIDIS

Clyde F. Reed *

Thelypteris Schmidel has been proposed for conservation by Holttum (1968) over Thelypteris Adanson (= Pteris). In so doing he has presented a brief historical outline of the problems involved in establishing Thelypteris Schmidel. Fernald and Weatherby (1929) early presented the pros and cons regarding Schmidel's publication of Thelypteris and gave reasons why the name was legitimately published as a generic name. Schott (1834) was the first to use the binomial Thelypteris palustris, thus establishing the genotype.

Ferns with "thelypteroid" characteristics have been described originally in many different genera, mainly in Nephrodium, Aspidium, Polypodium, Dryopteris, Lastrea, Cyclosorus, Meniscium, Gymnogramma, Abacopteris, Phegopteris and Stegnogramma. They have been transferred to Dryopteris, Thelypteris, Phegopteris, Lastrea, Cyclosorus, or have also most recently been put into numerous new genera by Ching (1963).

Nieuwland (1910) presented Dryopteris as a synonym of Thelypteris and thereby started a long line of confusion. Not only were palustris, simulata and noveboracensis put into Thelypteris, but also fragrans, marginalis, filix-mas, goldiana, bootii, cristata and spinulosa were added. Christensen (1913 and 1920) in his Monograph of the genus Dryopteris treated the genus as a large one, including in it those ferns with "thelypteroid" characteristics.

Ching (1936), in his Revision of the Genus Dryopteris in the Sikkim-Himalayan Region, accepted the ferns with "thelypteroid" characteristics as a separate genus, Thelypteris, and included in it species described in Lastrea, Glaphyropteris, Leptogramma and other genera. Thus he made Thelypteris a large genus, describing many new species and transferring about 80 species into the genus at that time.

Christensen (1938) in the Manual of Pteridology recognized the essential differences between the dryopteroid and thelypteroid ferns by dividing his subfamily (XII) Dryopteridoideae into two tribes: Dryopterideae and Thelypterideae. In the Thelypterideae he included Thelypteris Schmidel (Lastrea Bory, Dryopteris

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part. auctt.) with about 500 species, Phegopteris Fée (= Gymnocarpium Newman), Glaphyropteris Presl, Steiropteris C.Chr., Parapolystichum Keyss., Pteridrys C.Chr. et Ching, Monachosorum Kunze, Monachosorella Hayata, Cyclosorus Link (Meniscium Schreber, Leptogramma J.Sm., Stegnogramma Blume, Sphaerostephanos J.Sm.) and Goniopteris Presl.

H. Itô (1939) emended Thelypteris Schmidel and divided the genus into several sections: Euthelypteris H. Itô (Type: Th. palustris Schott), Parathelypteris H. Itô (Type: Th. glanduligera Ching), Metathelypteris H. Itô (Type: Th. gracilescens Ching) and Macrothelypteris H. Itô (Type: Th. oligophlebia Ching). However, he maintained the genera Glaphyropteris Presl (Type: Gl. decussata Presl), with sect. Euglaphyropteris H. Itô and sect. Cyclogramma H. Itô (Gl. simulans H. Itô); Phegopteris Fée (Type: Ph. polypodioides Fée), with sect. Euphegopteris Christ and sect. Lastrella H. Itô (Type: Ph. decursive-pinnata Fée); Gymnocarpium Newm. (Type: G. dryopteris Newm.), with sect. Eugymnocarpium and sect. Currania Ching (Type: Gymnocarpium gracilipes Ching); Leptogramma J.Sm. (Type: L. totta J.Sm.); Cyclosorus Link (Type: C. gongylodes Link) and Meniscium Schreb. (Type: M. reticulatum Swartz), with sect. Eumeniscium H.Itô and sect. Goniopteridopsis H. Itô (Type: M. urophyllum H. Itô).

Ching (1940) established the family Thelypteridaceae, with twelve genera and about 800 species. He divided the family into three tribes: Thelypterideae, Goniopterideae and Dictyoclineae. In the tribe Thelypterideae he placed Thelypteris Schmidel (Type: Th. palustris Schott), Lastreopsis Ching (Type: L. recedens (J.Sm.) Ching), Hypodematium Kunze (Type: H. crenatum (Forsk.) Kuhn), Glaphyropteris Presl (Type: Gl. decussata (L.) Presl), Parapolystichum (Keyserling) Ching (Type: P. effusum (Sw.) Ching) and Leptogramma J.Sm., emend. Ching (L. totta (Willd.) J.Sm.). In the tribe Goniopterideae he placed Cyclosorus Link (Type: C. gongylodes (Schkuhr) Link), Stegnogramma Blume (Type: S. aspidioides Blume), Goniopteris Presl (Type: G. crenata (Sw,) Presl), Abacopteris Fée, emend. Ching (Type: A. lineata (Blume) Ching) and Meniscium Schreb. (Type: M. reticulatum (L.) Swartz). In the tribe Dictyoclineae he placed Dictyocline Moore (Type: D. griffithii (Hook. et Thoms.) Moore. He placed Sphaerostephanos J.Sm. (Type: S. polycarpa (Blume) Copel.) in the monotypic family Sphaerostephanaceae Ching.

Copeland (1947) in Genera Filicum established the family Aspidiaceae (S.F.Gray) Copel., including in it several families established by Ching (1940), as Dictyoxiphiaceae, Thelypteridaceae, Sphaerostephanaceae, Woodsiaceae, Hypoderriaceae, Didymochlaenaceae, and Elaphoglossaceae. On the basis that Thelypteris Schmidel was invalidly published, Copeland took up Lastrea Bory and transferred many species to this genus, using Polypodium oreopteris Ehrh. as genotype. This arrangement also permitted Lastrea thelypteris (L.) Bory to become usable. The concept of Lastrea presented by Copeland

included Leptogramma J.Sm. (Type: L. totta (Willd.) J.Sm.), Amauropelta Kunze (Type: A. breutelii Kunze), Glaphyropteris Presl (Type: Gl. decussata (L.) Presl), Phegopteris Fée (Type: Polypodium polypodioides L.), Oochlamys Fée (Type: O. rivoirei Fée), Steiropteris C.Chr., Cyclogramma Tagawa (Type: Thelypteris simulans Ching).

Copeland in Genera Filicum also maintained the following genera: Cyclosorus Link, including Abacopteris Fée (Type: C. gongylodes (Schkuhr) Link) and transferred many species into this genus; Currania Copel. (Type: C. gracilipes Copel.); Ampelopteris Kunze (Type: A. elegans Kunze); Sphaerostephanos J.Sm. in Hook. et Bauer (Type: S. asplenioides J.Sm.); Stegnogramma Blume (Type: S. aspidioides Blume); Goniopteris Presl (Lectotype: G. viviparum (Raddi) Brack.); Meniscium Schreber (Type: M. reticulatum (L.) Swartz); and Dictyocline Moore (Type: D. griffithii Moore).

Pichi-Sermolli (1953) argued that since the legitimacy of Thelypteris Schmidel was uncertain, the best solution was to give up the name and to protect Lastrea versus Thelypteris. Fuchs (1963) also proposed using Lastrea, using L. thelypteris (L.) Presl and L. limbosperma (Allioni) Holub et Pouzar apud Holub (1961) as representatives (Flora of Hungary). Fuchs also maintained the generic names Dryopteris, Gymnocarpium and Phegopteris.

Holttum (1954) distinguished four genera in the family Thelypteridaceae: Thelypteris, Cyclosorus, Abacopteris and Ampelopteris.

Ching (1963) in his reclassification of the family Thelypteridaceae divided the family into the three tribes he had established in 1940 and then subdivided these into subtribes, allowing for 18 genera, transferring the Asiatic mainland species previously (1936) placed in Thelypteris. Many of the sections Ching elevated to genera, especially those of H. Itô (1939), leaving only three species in Thelypteris.

Tribe Thelypterideae Ching (1940): Subtribe Thelypteridinae Ching: Thelypteris Schmidel, Lastrea Bory, Parathelypteris (H.Itô) Ching, Metathelypteris (H.Itô) Ching and Hypodematium Kunze; Subtribe Phegopteridinae Ching: Macrothelypteris (H.Itô) Ching, Phegopteris Fée, Pseudophegopteris Ching, Cyclogramma Tagawa, and Leptogramma J.Sm.

Tribe Goniopterideae Ching (1940): Subtribe Pseudocyclosorinae Ching: Glaphyropteris Ching, Pseudocyclosorus Ching, and Mesoneuron Ching; Subtribe Cyclosorinae Ching: Cyclosorus Link and Stegnogramma Blume; Subtribe Goniopteridinae Ching: Ampelopteris Kunze; Subtribe Menisciinae Ching: Abacopteris Fée, emend. Ching.

Tribe Dictyoclineae Ching (1940). Dictyocline Moore.

Morton (1963) on the other hand widened the concept of Thelypteris Schmidel by including the generic segregates proposed by Ching, Copeland, Alston, Holttum and Tardieu-Blot up to that time. Therefore, Morton's ultimate concept of Thelypteris is much like that of Ching in 1936. However, Morton divided the genus into the following subgenera and sections.

Thelypteris Schmidel is divided into three subgenera: Subgenus Thelypteris (Lectotype: Th. palustris Schott); Subgenus Lastrea (Bory) Alston (Type: Polypodium oreopteris Ehrh.), with sect. Lastrea and sect. Glaphyropteris (Presl) Morton (Type: Polypodium decussatum L.); and subgenus Cyclosorus (Link) Morton (Type: Aspidium gongylodes Schkuhr), with sect. Cyclosorus, sect. Steiropteris (C.Chr.) Morton (Lectotype: Polypodium deltoideum Swartz), sect. Leptogramma (J.Sm.) Morton (Lectotype: L. totta J.Sm. = Th. pozoi (Lagasca) Morton), sect. Goniopteris (Presl) Morton (Lectotype: Polypodium crenatum Swartz = Th. poitiana (Bory) Proctor), and sect. Meniscium (Schreber) Morton (Type: Polypodium reticulatum L.).

Momose made extensive studies of many genera of ferns and of species-complexes within genera. His studies dealt mainly with the gametophyte stage. His studies are reflected in the Studies on the Gametophyte of Ferns, I-XXIX, published in the Journal of Japanese Botany, volumes 13-18, 1937-1942. The prothalli of the Thelypteroid ferns are reported in parts XVI and XVII (1941). Most of the species studied are those found in Japan.

Iwatsuki (1964-1965) presented his classification of Thelypteris Schmidel, based upon his studies of the thelypteroid ferns of Japan and adjacent regions. His studies have been quite extensive and quite thorough. He recognizes the following genera in the Thelypteridaceae: Stegnogramma Blume, with three sections; Thelypteris Schmidel, with 14 subgenera; and Meniscium Schreber, with 4 sections.

1. Stegnogramma Blume (1828). (Type: St. aspidioides Bl.).
   a. Sect. 1. Leptogramma (J.Sm.) K.Iwats. (1963) (Type: Polypodium tottum Willd., non Thunb. = St. pozoi (Lagasca) K.Iwats.).
   b. Sect. 2. Stegnogramma. (Type: St. aspidioides Bl.).
   c. Sect. 3. Dictyocline (Moore) K.Iwats. (1963). (Type: St. griffithii (Moore) K.Iwats.).
2. Thelypteris Schmidel (1763). (Type: Acrostichum thelypteris L.).
   a. Subgen. 1. Phegopteris (Presl) Ching (1936). (Type: Polypodium phegopteris L.).
      1. Sect. 1. Phegopteris. (2 species).
      2. Sect. 2. Lastrella (H.Ito) K.Iwats. (1964). (Type: Polypodium decursive-pinnatum van Hall) (50 species).

b. Subgen. 2. Cyclogramma (Tagawa) K. Iwats. (1964). (Type: Thelypteris simulans Ching = Th. auriculata). (7 species).
c. Subgen. 3. Thelypteris. (Lastrea Bory, Type: Polypodium oreopteris Ehrh.).
1. Sect. 1. Metathelypteris H.Ito (1939). (Type: Aspidium gracilescens Blume). (14 species).
2. Sect. 2. Thelypteris. (Type: Acrostichum thelypteris L. = Th. palustris Schott). (300 species).
d. Subgen. 4. Cyclosoriopsis K. Iwats. (1964). (Type: Polypodium dentatum Forsk.). (150 species).
e. Subgen. 5. Glaphyropteris (Presl) Alston (1958). (Type: Polypodium decussatum L.). (110 species).
f. Subgen. 6. Glaphyropteridopsis (Ching) K.Iwats. (1964). (Type: Polypodium erubescens Wall. ex Hook.). (20 species).
1. Sect. 1. Glaphyropteridopsis. (3 species).
2. Sect. 2. Mesoneuron (Ching) K.Iwats. (Type: Aspidium crassifolium Blume). (10 species).
3. Sect. 3. Neocyclosorus K. Iwats. (1964). (Type: Aspidium heterocarpon Blume). (Several species).
g. Subgen. 7. Steiropteris (C.Chr.) K. Iwats. (1964). (Type: Polypodium deltoideum Swartz). (13 species).
h. Subgen. 8. Cyclosorus (Link) Morton (1963). (Type: Aspidium goggilodus Schkuhr. (100 or more species).
i. Subgen. 9. Sphaerostephanos (J.Sm.) K. Iwats. (1964). (Type: Sph. asplenioides J.Sm. = Th. polycarpa (Blume) K.Iwats. (6 species).
j. Subgen. 10. Haplodictyum (Presl) K. Iwats. (1964). (Type: H. heterophyllum Presl, 1849).
k. Subgen. 11. Pneumatopteris (Nakai) K. Iwats. (1964). (Type: Aspidium callosum Blume).
1. Sect. 1. Pneumatopteris. (20 species).
2. Sect. 2. Macrocyclosorus K. Iwats. (1964). (Type: Aspidium megaphyllum Mett. (20 species).
l. Subgen. 12. Abacopteris (Fée) K.Iwats. (1964). (Type: Aspidium lineatum Blume, 1828).
m. Subgen. 13. Dimorphopteris (Tagawa et K.Iwats.) K. Iwats. (1 species).
n. Subgen. 14. Cyrtomiopsis K. Iwats. (1964). (Type: Aspidium boydiae Eaton). (1 species).
3. Meniscium Schreber (1791). (Type: Polypodium reticulatum L. (80 species).
a. Sect. 1. Asterochlaena (C.Chr.) K.Iwats. (1964). (Type: Polypodium reptans Gmel.). (50 species).
b. Sect. 2. Goniopteris (Presl) K.Iwats. (1964). (Type: Polypodium crenatum Swartz = Meniscium poiteanum (Bory) K.Iwats.) (20 species).
c. Sect. 3. Ampelopteris (Kunze) K.Iwats. (1964). (Type: A. elegans Kunze = Meniscium proliferum (Retz.) Sw.).
d. Sect. 4. Meniscium. (12 species).

Thelypteridaceae may or may not be a natural family of ferns separate from the rest of the dryopteroid ferns. Perhaps it is still best to treat the thelypteroid ferns as a subfamily of the Aspidiaceae. Christensen had proposed Subfamily Dryopteridoideae Tribe Thelypterideae (1938) and Copeland placed the family Thelypteridaceae Ching in the Aspidiaceae Copel. (1947.

Aspidiaceae subfam. Thelypteridoideae Reed, subfam. nov. Basionym: Polypodiaceae subfam. Dryopteridoideae tribe Thelypterideae Christensen, Manual of Pteridology, 544. 1938; Thelypteridaceae tribe Thelypterideae Ching, Sunyatsenia, 5: 238. 1940; Acta Phytotax. Sinica, 8(4): 295. 1963. Type genus: Thelypteris Schmidel.

Whether the Thelypteridaceae or the subfamily Thelypteridoideae is composed of many genera as proposed by Ching (1963), or by a few genera as proposed by Iwatsuki (1964-1965), or by one large genus, as originally proposed by Ching (1936) and as emended and enlarged by Morton (1963), due to the wide range of variability of venation, of sporangial and indusial characteristics and of frond shape, and due to the gradual intergradation of all segregates as more species are put into Thelypteris, it seems to this author best to treat Thelypteris as one large genus with numerous subgenera and sections. Iwatsuki's treatment presents the genus in the most coherent form. However, I do agree with Morton (1963) and Ching (1963) that the Meniscium-Goniopteris-Stegnogramma-complex belongs with the Cyclosorus-complex and place them as additional subgenera or sections under Thelypteris.

Thelypteris subgen. Stegnogramma (Blume) Reed, stat. nov. Basionym: Stegnogramma Blume, Enum. Pl. Jav., 172. 1828. (Type: St. aspidioides Blume).

Thelypteris subgen. Leptogramma (J.Sm.) Reed, stat. nov. Basionym: Leptogramma J. Sm., Journ. Bot., 4: 51. 1841. (Type: Polypodium totta Willd., non Thunb. = Th. pozoi (Lagasca) Morton. Syn.: Thelypteris subgen. Cyclosorus sect. Leptogramma (J.Sm.) Morton, Amer. Fern Journ., 53: 153. 1963.

Thelypteris subgen. Dictyocline (Moore) Reed, stat. nov. Basionym: Dictyocline Moore, Gard. Chron., 1855: 854. 1855. (Type: D. griffithii Moore).

Thelypteris subgen. Meniscium (Schreber) Reed, stat. nov. Basionym: Meniscium Schreber, in Linn. Gen. Pl., ed VIII, 2: 757. 1791. (Type: Polypodium reticulatum L.). Syn.: Thelypteris subgen. Cyclosorus sect. Meniscium (Schreber) Morton, Amer. Fern Journ., 53: 154. 1963. (80 species).

sect. 1. Meniscium. (12 species).

sect. 2. Asterochlaena (C.Chr.) Reed, stat. nov. Basionym: Dryopteris subgen. Goniopteris sect. Asterochlaena C.Chr., Biol. Arb. til. Eug. Warm., 84. 1911. (Type: Polypodium reptans Gmel., 1791). (50 species).

sect. 3. Goniopteris (Presl) Reed, stat. nov. Basionym: Goniopteris Presl, Tent. Pterid., 181. 1836. (Type:

Polypodium crenatum Swartz = Th. poiteana (Bory) Proctor). Syn.: Thelypteris subgen. Cyclosorus sect. Goniopteris (Presl) Morton, Amer. Fern Journ., 53: 154. 1963, p.p. (20 species).

sect. 4. Ampelopteris (Kunze) Reed, stat. nov. Basionym: Ampelopteris Kunze, Bot. Zeit., 6: 114. 1848. (Type: A. elegans Kunze). (1 species).

Most of the fossil species which belong in Thelypteris have been described in the genera Aspidium, Goniopteris, Phegopteris, Lastrea (Lastraea), Cyclosorus or Dryopteris. The most comprehensive papers dealing with fossil ferns of this complex are those by Alex. Braun (Ueber Fossile Goniopteris-Arten. Zeitschr. Geol. Ges., 4: 553-556. 1852) and Ettinghausen (Die Farnkräuter der Jetztwelt, 160-203, illus. 1865). The species are mainly based on venation of fragments of pinnae. Many have proven to belong to other genera. However, there are some which have sporangia or/and indusia which prove their affinity to Thelypteris, for which reason they are transferred into Thelypteris here.

THELYPTERIS Schmidel

Thelypteris Schmidel, Icon. Pl., ed. J.C.Keller, 45, t. 11, 13. Oct. 1763; Schott, Gen. Gil., ad t. 10. 1834; emend. H. Itô, in Nakai et Honda, Nova Flora Japonica, Polypodiaceae, Dryopteroideae, I: 123. 1939; Morton, Amer. Fern Journ., 53(4): 153-154. 1963; Ching, Bull. Fan Mem. Inst. Biol. Bot., 6: 250. 1936; Holttum, Taxon, 17(3): 330. 1968, gen. conserv. propos.; non Thelypteris Adanson, Fam. des Plantes, 2: 20. July-Aug. 1763 = Pteris). Type: Polypodium thelypteris L. = Thelypteris palustris Schott.

Meniscium Schreber in L. Gen. Pl., ed. 8, II: 757. 1791. Type: Polypodium reticulatum L. = Thelypteris reticulata (L.) Proctor.

Lastrea Bory, Dict. Class. Hist. Nat., 6: 588. 1824. Type: Polypodium oreopteris Ehrh. = Thelypteris limbosperma (All.) Fuchs.

Stegnogramma Blume, Enum. Pl. Jav., 172. 1828. Type: Stegnogramma aspidioides Blume = Thelypteris aspidioides (Willd.) Tryon.

Cyclosorus Link, Hort. Berol., 2: 128. 1833. Type: Aspidium goggilodus Schkuhr = Thelypteris totta (Thunb.) Schelpe.

Goniopteris Presl, Tent. Pterid., 181. 1836. Type: Polypodium viviparum Raddi = Thelypteris vivipara (Raddi) Reed.

Sphaerostephanos J. Smith in Hook. et Bauer, Gen. Fil., 21. 1839. Type: Sphaerostephanos asplenioides J. Smith = Thelypteris polycarpa (Blume) K. Iwats.

Mesochlaena R. Brown ex J. Smith, Journ. Bot., 3: 18. 1840. Type: Sphaerostephanos asplenioides J. Smith = Thelypteris polycarpa (Blume) K. Iwats.

Leptogramma J. Smith, Journ. Bot., 4: 51. 1841. Type: Polypodium tottum Willd., non Thunb. = Thelypteris pozoi (Lagasca) Morton.

Amauropelta Kunze, Farnkr., 1: 86. 1843. Type: Amauropelta breutelii Kunze = Thelypteris limbata (Swartz) Proctor.

Abacopteris Fée, Congr. Sci. France, X, 1: 178. 1843. Type: Aspidium lineatum Blume = Thelypteris lineata (Blume) K.Iwats.

Ampelopteris Kunze, Bot. Zeit., 6: 114. 1848. Type: Ampelopteris elegans Kunze = Thelypteris prolifera (Retz) Reed.

Glaphyropteris Presl, Abh. Bohm. Ges. Wiss., V, 5: 344. 1848. Type: Polypodium decussatum L. = Thelypteris decussata (L.) Proctor.

Haplodictyum Presl, Epim. Bot., 50. 1849. Type: Haplodictyum heterophyllum Presl = Thelypteris heterophylla (Presl) K.Iwats.

Pronephrium Presl, Epim. Bot., 258. 1849. Type: Aspidium lineatum Blume = Thelypteris lineata (Blume) K.Iwats.

Phegopteris (Presl) Fée, Gen. Fil., 242. 1852. Type: Phegopteris polypodioides Fée = Thelypteris phegopteris (L.) Slossen ex Rydb.

Oochlamys Fée, Gen. Fil., 297. 1852. Type: Oochlamys revoirei Fée = Thelypteris opposita (Vahl) Ching.

Hemestheum Newman, Phytologist, 4: app. XXII. 1851. Type: Polypodium thelypteris L. = Thelypteris palustris Schott.

Dictyocline Moore, Gard. Chron., 1855: 854. 1855. Type: Dictyocline griffithii Moore = Thelypteris griffithii (Moore) Reed.

Pneumatopteris Nakai, Bot. Mag. Tokyo, 47: 179. 1933. Type: Aspidium callosum Blume = Thelypteris callosa (Blume) K.Iwats.

Steiropteris (C.Chr.) C.Chr. in Verdoorn, Man. Pterid., 544. 1938. Type: Polypodium deltoideum Swartz = Thelypteris deltoidea (Swartz) Proctor.

Cyclogramma Tagawa, Acta Phytotax. Geobot., 7: 53. 1938. Type: Thelypteris simulans Ching = Thelypteris auriculata (J.Smith) K. Iwats.

Menisorus Alston, Bol. Soc. Brot., 30: 20. 1956. Type: Meniscium pauciflorum Hook. = Thelypteris pauciflora (Hook.) Reed.

Dimorphopteris Tagawa et K. Iwats. ex K. Iwats., Acta Phytotax. Geobot., 19: 8. 1961. Type: Dimorphopteris moniliformis Tagawa et K. Iwats. = Thelypteris moniliformis (Tagawa et K. Iwats.) K. Iwats.

Parathelypteris (H.Ito) Ching, Acta Phytotax. Sinica, 8: 300. 1963. Type: Aspidium glanduligerum Kunze = Thelypteris glanduligera (Kunze) Ching.

Metathelypteris (H.Itô) Ching, Acta Phytotax. Sinica, 8: 305. 1963. Type: Aspidium gracilescens Blume = Thelypteris gracilescens (Blume) Ching.

Macrothelypteris (H.Itô) Ching, Acta Phytotax. Sinica, 8: 308. 1963. Type: Nephrodium oligophlebium Baker = Thelypteris torresiana (Gaudich.) Alston.

Pseudophegopteris Ching, Acta Phytotax. Sinica, 8: 313. 1963. Type: Polypodium pyrrhorhachis Kunze = Thelypteris paludosa (Blume) K.Iwats.

Glaphyropteridopsis Ching, Acta Phytotax. Sinica, 8: 320. 1963. Type: Polypodium erubescens Wall. ex Hook. = Thelypteris erubescens (Wall. ex Hook.) Ching.

Pseudocyclosorus Ching, Acta Phytotax. Sinica, 8: 322. 1963. Type: Aspidium xylodes Kunze = Thelypteris xylodes (Kunze) Ching.

Mesoneuron Ching, Acta Phytotax. Sinica, 8: 325. 1963. Type: Aspidium crassifolium Blume = Thelypteris crassifolia (Blume) Ching.

Anisocampium Presl, Epim. Bot., 58. 1849. Type: Anisocampium cumingianum Presl = Thelypteris aristata (Fee) Reed.

Thelypteris abbiattii Reed, nom. nov. Basionym: Goniopteris burkartii Abbiatti, Darwiniana, 13(2-4): 556, f. 6, pl. 4. 1964. Argentina.

Th. abbottiana (Maxon) Ching, Fan Mem. Inst. Biol. Bull.,10: 250. 1941. Basionym: Dryopteris abbottiana Maxon, Journ. Wash. Acad. Sci., 14: 89. 1924. Hispaniola.

Th. abortiva (Blume) Reed, comb. nov. Basionym: Aspidium abortivum Blume, Enum. Pl. Jav., 154. 1828. Malesia.

Th. abrupta (Desv.) Proctor, Rhodora, 61: 305. (1959) 1960. Basionym: Polypodium abruptum Desv., Prodr., 239. 1827. West Indies-Brazil.

Th. acanthocarpa (Copel.) Reed, comb. nov. Basionym: Dryopteris acanthocarpa Copel., Philip. Journ. Sci., Bot. 6: 136, t. 17. 1911. Borneo.

Th. achalensis (Hieron.) Abbiatti, Darwiniana, 13(2-4): 566. 1964. Basionym: Aspidium achalense Hieron., Engl. Bot. Jahrb., 22: 371. 1896 (1897); Synonym: Aspidium conterminum var. oligosorum Griseb., Symb., 344, n. 2252, partim. 1879, non Aspidium oligosorum (Willd.) Kunth.

Th. acrostichoides (Michx.) Nieuwl., Amer. Midl. Nat., 2: 277. 1912. Basionym: Nephrodium acrostichoides Michx., Fl. Bor. Amer., 2: 267. 1803. = Polystichum.

Th. acuminata (Panz. in Christm. et Panz.) Morton, Amer. Fern Journ., 48: 139. (1958) 1959. Basionym: Polypodium acuminatum Panz. in Christm. et Panz., Nat. Hist., 14: 181, t. XCIX, f. 2. 1783; Synonym: Polypodium sophoroides Thunb., Trans. Linn. Soc., 2: 341. 1794; Aspidium oshimense Christ, Bull. Boiss., II, 1: 1018. 1901;

Dryopteris ogatana Koidz., Bot. Mag. Tokyo, 39: 10. 1925; Cyclosorus yamawakii H. Itô, Journ. Jap. Bot., 27: 340. 1952.

Thelypteris acuminata forma cristata (Tagawa) Reed, comb. nov. Basionym: Dryopteris acuminata forma cristata Tagawa, Acta Phytotax. Geobot., 1: 189. 1932. Japan (Honshu, Kyushu).

Th. acuminata var. kuliangensis (Ching) K.Iwats., Acta Phytotax. Geobot., 21: 40. 1964. Basionym: Cyclosorus acuminatus var. kuliangensis Ching, Bull. Fan Mem. Inst. Biol., 8: 192. 1932. China(Fukien), Japan (Shikoku, Kyushu), Taiwan.

Th. acuminata var. ogatana (Koidz.) K.Iwats., Acta Phytotax. Geobot., 21: 40. 1964. Basionym: Dryopteris ogatana Koidz., Bot. Mag. Tokyo, 39: 10. 1925. Japan (Honshu).

Th. acuminata forma pilosa (H.Itô) Reed, comb. nov. Basionym: Cyclosorus acuminatus forma pilosus H. Itô, Bot. Mag. Tokyo, 51: 712. 1937.

Th. adenophora (C.Chr.) Reed, comb. nov. Basionym: Dryopteris adenophora C.Chr., Ind. Fil., 251. 1905; Nephrodium hirsutum Presl, Epim. Bot., 48. 1849, non N. hirsutum Don, 1825, nec Bory, 1828. Luzon, Celebes.

Th. adenostegia (Copel.) Reed, comb. nov. Basionym: Dryopteris adenostegia Copel., Univ. Calif. Publ. Bot., 18: 220. 1942. New Guinea.

Th. adscendens Ching, Bull. Fan Mem. Inst. Biol., 6: 332. 1936. China (Kwangtung, Kwangsi).

Th. adnascens (Ching) Ching sensu Shimizu-H., Trans. Nat. Hist. Soc. Formosa, 28: 238, f. 1. 1938. Basionym: Dryopteris adnascens Ching sensu Suzuki-S. et Shimizu-H., Journ. Taihoku Soc. Agr. Forest., 2: 187. 1937. Taiwan. This name was published in this manner.

Th. aequatorialis (Copel.) Reed, comb. nov. Basionym: Dryopteris aequatorialis Copel., Univ. Calif. Publ. Bot., 19: 298. 1941. Ecuador.

Th. affinis (Presl ex Ett.) Morton, Contrib. U.S. Nat. Herb., 38(2): 50. 1967. Basionym: Meniscium affine Presl ex Ettingsh., Denkschr. Akad. Wiss. Math. Naturw. (Wien), 23: 94, t. 13, f. 3. 1864. Synonym: Dryopteris dispar Maxon et Morton, Bull. Torr. Bot. Club, 65: 364. 1938. Brazil.

Th. afra (Christ) Reed, comb. nov. Basionym: Dryopteris afra Christ, Bull. Soc. Bot. France, 55 (Mem. 8B): 107. 1908. Synonym: Dryopteris dewevrei Christ ex Bonap., Not. Pterid., 14: 207. 1924. West Trop. Africa (Guinea - Congo).

Th. afzelii (C.Chr.) Tard. in Humbert, Fl. Madagascar, Fam. 5, 1: 282. 1958. Basionym: Dryopteris afzelii C.Chr., Ark. f. Bot., 14(19): 2, t. 1, f. 3. 1916. Madagascar.

*Th. aizuensis (Suzuki) Reed, comb. nov. Basionym: Cyclosorus aizuensis Suzuki, Sci. Rept. Fac. Arts & Sci., Fukushima Univ., No. 10: 18, t. 1, f. 1-4. 1961. Miocene: Japan (Aizu Basin, Fukushima Pref.).

Th. alata (L.) Reed, comb. nov. Basionym: Polypodium alatum L., Sp. Pl., 2: 1086. 1753. West Indies.

Thelypteris alatella (Christ in K.Schum. et Laut.) Reed, comb. nov. Basionym: Nephrodium alatellum Christ in K. Schum. et Laut., Fl. Deut. Südsee, 112. 1901. New Guinea.

Th. albidipilosa (Bonap.) Reed, comb. nov. Basionym: Dryopteris albidipilosa Bonap., Not. Pterid., 15: 9. 1924. East trop. Africa (Oubangui, Congo).

Th. albociliata (Copel.) Reed, comb. nov. Basionym: Dryopteris albo-ciliata Copel., Journ. Arnold Arb., 10: 177. 1929. New Guinea.

Th. albosetosa (Copel.) Reed, comb. nov. Basionym: Dryopteris albosetosa Copel., Univ. Calif. Publ. Bot., 18: 221. 1942. New Guinea.

Th. alfredii (Rosenst.) Ching, Bull. Fan Mem. Inst. Biol. Bot., 10: 250. 1941. Basionym: Dryopteris alfredii Rosenst., Fedde Repert. 22: 10. 1925. Costa Rica.

*Th. alpina (Presl in Sternb.) Reed, comb. nov. Basionym: Pecopteris alpina Presl in Sternb., Flora der Vorwelt, 2: 147, t. 39, f. 5. 1838; Unger, Gen. et Sp. Pl. Foss., 185. 1850. Synonym: Aspidium sternbergii Ettingsh., Die Farnkr. der Jetztwelt, 197. 1865. Carboniferous: Alpine, Stangalpe, Styria. (Aff. Th. concinna et Th. noveboracensis).

Th. alta (Brause) Reed, comb. nov. Basionym: Dryopteris alta Brause, Engl. Bot. Jahrb., 56: 86. 1920. New Guinea.

Th. amboinensis (Willd.) Reed, comb. nov. Basionym: Aspidium amboinense Willd., Sp. Pl., 5: 228. 1810. Amboina.

Th. andina (Morton) Morton, Amer. Fern Journ., 51(1): 38. 1961. Basionym: Dryopteris andina Morton, Journ. Wash. Acad. Sci., 28: 528. 1938. Bolivia.

Th. andreana (Sodiro) Morton, Contrib. U.S. Nat. Herb., 38(2): 50. 1967. Basionym: Meniscium andreanum Sodiro, Recens., 71. 1883; Crypt. Vasc. Quit., 392. 1893. Ecuador, Santo Domingo.

Th. aneitensis (Fourn.) Reed, comb. nov. Basionym: Aspidium aneitense Fourn., Ann. Sci. Nat., V, 18: 297. 1874. Synonym: Dryopteris lenormandii C.Chr., Ind. Fil., 274. 1905. New Caledonia, New Hebrides.

Th. angulariloba Ching, Bull. Fan Mem. Inst. Biol., 6: 323. 1936. Synonym: Thelypteris simozawae Tagawa, Acta Phytotax. Geobot., 6: 157. 1937. China (Kwangtung, Hongkong), Japan (Kyushu, Honshu, Ryukyu).

Th. angusta (Copel.) Reed, comb. nov. Basionym: Dryopteris angusta Copel., Philip. Journ. Sci., Bot., 9: 3. 1914. New Guinea.

Th. angustifolia (Willd.) Proctor, Bull. Inst. Jamaica,Sci. Ser. No. 5: 57. 1953. Basionym: Meniscium angustifolium Willd., Sp. Pl., 5: 133. 1810. Tropical America, West Indies.

Th. angustifrons (Miq.) Ching, Bull. Fan Mem. Inst. Biol., Bot. 6: 318. 1936. Basionym: Aspidium angustifrons Miq., Ann. Mus. Lugd. Bot., 3: 178. 1867. Synonyms: Athyrium cystopteroides var. elatius Eaton, Proc. Amer. Acad., 4: 110. 1858; Dryopteris miyagii H. Itô, Bot. Mag. Tokyo, 49: 360. 1935; Dryopteris okinawaensis H. Itô, Bot. Mag. Tokyo, 49: 360. 1935; Dryopteris

glanduligera var. hyalostegia H. Itô, Bot. Mag. Tokyo, 49: 363. 1935; Lastrea miqueliana Tagawa, Acta Phytotax. Geobot., 15:14. 1953. Japan, Ryukyus, Okinawa Isl., Taiwan.

Thelypteris angustipes (Copel.) Reed, comb. nov. Basionym: Dryopteris angustipes Copel., Philip. Journ. Sci., Bot., 7: 60. 1912. Sarawak.

Th. angustipinnata (C.Chr. et Tard. ex Tard.) Reed, comb. nov. Basionym: Cyclosorus angustipinnatus C.Chr. et Tard ex Tard., Bull. Soc. Bot. France, 87: 369, t. 3. 1941. Tonkin.

Th. anjenabensis (Tard.) Reed, comb. nov. Basionym: Abacopteris anjenabensis Tard., Adansonia, 5(4): 494, t. 2, f. 5-7. 1965. Madagascar.

Th. anoptera (Kunze ex Kuhn) Reed, comb. nov. Basionym: Aspidium anopteron Kunze ex Kuhn, Linnaea, 36: 113. 1869. Brazil.

Th. antillana Proctor, Rhodora, 63: 33-34. 1961. West Indies (St. Kitts, Dominica).

Th. aoristisora (Harr.) Reed, comb. nov. Basionym: Polypodium aoristisorum Harr., Journ. Linn. Soc., 16: 30. 1877. Philippines.

Th. appendiculata (Blume) Reed, comb. nov. Basionym: Gymnogramma appendiculata Blume, Enum. addend., 1828; Fl. Javae Fil., 92, t. 39. 1828. Java.

Th. aquatilis (Copel.) Reed, comb. nov. Basionym: Dryopteris aquatilis Copel., Philip. Journ. Sci. Bot., 6: 75. 1911. New Guinea.

Th. aquatiloides (Copel.) Reed, comb. nov. Basionym: Dryopteris aquatiloides Copel., Philip. Journ. Sci. Bot., 7: 59. 1912. Sarawak.

Th. arborescens (Humb. et Bonpl. ex Willd. in L.) Morton, Contrib. U. S. Nat. Herb., 38(2): 50. 1967. Basionym: Meniscium arborescens Humb. et Bonpl. ex Willd. in L., Sp. Pl., ed. 4, 5: 133. 1810. Synonym: Thelypteris mollis (Mett.) Tryon, Rhodora, 69: 7. 1967. Colombia, Venezuela.

Th. arbuscula (Willd.) K.Iwats., Acta Phytotax. Geobot., 21(5-6): 170. 1965. Baionym: Aspidium arbusculum Willd. in L., Sp. Pl., ed. 4, 5: 233. 1810. India-Malesia-Polynesia, Mascarene Isls.

Th. arcana (Maxon & Morton) Morton, Contrib. U. S. Nat. Herb., 38(2): 42. 1967. Basionym: Dryopteris arcana Maxon et Morton, Bull. Torr. Bot. Club, 65: 352, t. 11. 1938. Ecuador.

Th. archboldiae (Copel.) Reed, comb. nov. Basionym: Lastrea archboldiae Copel., Journ. Arnold Arb., 30: 436. 1949. Fiji Isls.

Th. archboldii (C.Chr.) Reed, comb. nov. Basionym: Dryopteris archboldii C.Chr., Brittonia, 2: 297. 1937. New Guinea, Papua.

Th. arcuata (Poir. in Lam.) Reed, comb. nov. Basionym: Polypodium arcuatum Poir. in Lam., Encycl., 5: 528. 1804. West Indies.

Th. arfakiana (Bak. in Becc.) Reed, comb. nov. Basinym: Polypodium arfakianum Bak. in Becc., Malesia, 3: 45. 1886. New Guinea.

Th. argentina (Hieron.) Abbiatti, Rev. Mus. La Plata, Ser. 2, Bot., 9: 19. 1958. Basionym: Aspidium argentinum Hieron., Engl. Bot. Jahrb., 22: 367. 1896 (1897). Argentina - Bolivia.

Th. arguta (Kaulf.) Moxley, Bull. So. Calif. Acad., 19: 57. 1920. Basionym: Aspidium argutum Kaulf., Enum. Fil., 242. 1824. = Dryopteris.

Thelypteris arida (D.Don) Morton, Amer. Fern Journ., 49: 113. 1959. Basionym: Aspidium aridum D.Don, Prodr. Fl. Nepal., 4. 1825. Tropics of Asia: Singapore, Mariannas (Saipan), Taiwan, Bismarck Archipelago, Philippine Isls. (Palawan).

Th. aristata (Fee) Reed, comb. nov. Basionym: Goniopteris aristata Fee, Gen. Fil., 253. 1850-52. Synonym: Aspidium otarium Kunze ex Mett., Pheg. u. Asp., 34, n. 73. 1858; Anisocampium cumingianum Presl, Epim. Bot., 59. 1849, non Aspidium cumingianum Kunze, 1840. Assam, S. India, Ceylon.

Th. aspera (Presl) K.Iwats., Mem. Coll. Sci., Univ. Kyoto, Ser. B, 31(3): 192. 1965. Basionym: Goniopteris aspera Presl, Tent. Pterid., 183. 1836; Polypodium asperum Presl, Rel. Haenk., 1: 24. 1825, non L., 1753. Synonyms: Dryopteris presliana Ching in C.Chr., Ind. Fil. Suppl. III: 95. 1934; Abacopteris philippiarum Fée, Congr. Sci. France, 10 Sess., 178. 1843; Dryopteris gymnopteridifrons Hayata, Icon. Pl. Formos., 8: 148. 1919. Tropics of E. Asia, Taiwan.

Th. aspidioides (Willd.) Tryon, Rhodora, 69: 5. 1967. Basionym: Ceterach aspidioides Willd. in L., Sp. Pl., ed. 4, 5: 137. 1810. Trop. S. Amer.

Th. aspidioides var. subhastata (C.Chr.) Reed, comb. nov. Basionym: Dryopteris aspidioides var. subhastata C.Chr., Kgl. Dansk Vid. Selsk. Skr., 7: 287. 1907. Costa Rica, Columbia, Venezuela, Peru.

Th. asplenioides (Swartz) Proctor, Bull. Inst. Jamaica, Sci. Ser., No. 5: 57. 1953. Basionym: Polypodium asplenioides Swartz, in Schrad. Journ. Bot., 1800(2): 26. 1801. West Indies.

Th. assamica (Bedd.) Reed, comb. nov. Basionym: Nephrodium multilineatum var. assamicum Bedd., Journ. Bot., 31: 228. 1893. Assam.

Th. assurgens (Maxon) Tryon, Rhodora, 69: 5. 1967. Basionym: Dryopteris assurgens Maxon, Journ. Wash. Acad. Sci., 34: 24. 1944. Peru.

Th. asterothrix (Fee) Proctor, Bull. Inst. Jamaica, Sci. Ser., No. 5: 57. 1953. Basionym: Goniopteris asterothrix Fée, Gen. Fil., 253. 1850-1852. Synonym: Dryopteris malacothrix Maxon, Proc. Biol. Soc. Wash., 43: 87. 1930. Trop. Amer.

Th. asterothrix var. bibrachiata (Jenm.) Proctor, Bull. Inst. Jamaica, Sci. Ser., No. 5: 58. 1953. Basionym: Nephrodium bibrachiatum Jenm., Gard. Chron., III, 15: 230. 1894. West Indies.

Th. asymetrica (Fée) Reed, comb. nov. Basionym: Goniopteris asymetrica Fée, Gen. Fil., 253. 1850-1852. Philippine Isls.

Th. atasripii (Rosenst.) Reed, comb. nov. Basionym: Dryopteris atasripii Rosenst., Med. Rijks Herb., No. 31: 6. 1917. New Guinea.

Th. arthrothrix (Hook.) Reed, comb. nov. Basionym: Polypodium arthrothrix Hook., Sp. Fil., 5: 14. 1863. Madagascar, Mascarenes.

Th. atrospinosa (C.Chr. ex Kjellb.et C.Chr.) Reed, comb. nov. Basionym: Dryopteris atrospinosa C.Chr. ex Kjellb. et C.Chr., Engl. Bot. Jahrb., 66: 43. 1933. Celebes.

Th. atrovirens (C.Chr. in Christ) Reed, comb. nov. Basionym: Dryopteris atrovirens C.Chr. in Christ, Bull. Boiss., II, 7: 263.

1907; Vid. Selsk. Skrift., VII, 4: 316, f. 39. 1907. Synonym: Lastrea costaricensis Copel., Gen. Fil., 138. 1947. Central Amer.

Thelypteris attenuata (Kuntze) Morton, Contrib. U.S. Nat. Herb., 38(2): 35. 1967. Basionym: Dryopteris attenuata Kuntze, Rev. Gen. Pl., 2: 812. 1891; Aspidium attenuatum Kunze ex Mett., Pheg. u. Asp., 96, n. 233. 1858, non Swartz, 1801; Lastrea attenuata J.Smith, Journ. Bot., 3: 412. 1841 (nomen), non Brack., 1854; Nephrodium attenuatum Fée, Gen. Fil., 305. 1850-1852 (nomen). Synonym: Dryopteris stenobasis C.Chr., Ind. Fil., 294. 1905. Philippine Isls. (Samar), Celebes.

Th. augescens (Link) Munz et Johnston, Amer. Fern Journ., 12: 75. 1922. Basionym: Aspidium augescens Link, Fil. Sp., 103. 1841. Mexico-Costa Rica, Cuba, West Indies.

Th. augescens (var.) lindheimeri (A.Br. ex C.Chr.) R.P. St. John ex Small, Ferns Southeastern States, 241. 1938. Basionym: Aspidium lindheimeri A.Br. ex C.Chr., Danske Vid. Selsk. Skr., VII, 10: 182. 1913 (pro syn.). = Thelypteris X lindheimeri Wherry.

Th. aureo-viridis (Rosenst.) Reed, comb. nov. Basionym: Dryopteris aureo-viridis Rosenst., Fedde Repert., 13: 216. 1914. Taiwan.

Th. auriculata (J.Smith) K.Iwats., Acta Phytotax. Geobot., 19: 11. 1961. Basionym: Phegopteris auriculata J.Smith, Hist. Fil., 233. 1875; Polypodium auriculatum Wall. ex Hook., Sp. Fil., IV: 237. 1862, non L., 1753, nec Raddi, 1819, nec Presl, 1822. Synonyms: Polypodium appendiculatum var. squamaestipes Clarke, Trans. Linn. Soc. II. Bot., 1: 534, t. 79, f. 2. 1880; Dryopteris himalayensis C.Chr., Ind. Fil. Suppl. III: 88. 1934; Thelypteris simulans Ching, Bull. Fan Mem. Inst. Biol., Bot. 6: 280. 1936; Thelypteris subvillosa Ching, Bull. Fan Mem. Inst. Biol., Bot. 6: 270. 1936. Taiwan, Nepal, China (Yunnan), Sikkim-Himalaya, Java.

Th. auriculifera (v.A.v.R.) Ching, Bull. Fan Mem. Inst. Biol., Bot. 10: 250. 1941. Basionym: Dryopteris auriculifera v.A.v.R., Bull. Buit., III, 5: 197. 1922. Lingga Isl., Malesia.

Th. aurita (Hook.) Ching, Bull. Fan Mem. Inst. Biol., Bot. 6: 266. 1936. Basionym: Gymnogramma aurita Hook., Icon. Pl., t. 974. 1854. Sikkim-Tonkin.

Th. austera (Brause) Reed, comb. nov. Basionym: Dryopteris austera Brause, Engl. Bot. Jahrb., 56: 108. 1920. New Guinea.

Th. austro-philippina (Copel.) Reed, comb. nov. Basionym: Dryopteris austro-philippina Copel., Philip. Journ. Sci., 40: 300. 1929. Philippine Isls. (Mindanao).

Th. badia (v.A.v.R.) Ching, Bull. Fan Mem. Inst. Biol., Bot. 10: 250. 1941. Basionym: Dryopteris badia v.A.v.R., Bull. Jard. Bot. Buit., II, nr. XVI: 9. 1914. Synonym: Dryopteris linearis Copel., Philip. Journ. Sci., 12C: 56. 1917. Sumatra, Borneo.

Th. bakeri (Harr.) Reed, comb. nov. Basionym: Nephrodium bakeri Harr., Journ. Linn. Soc., 16: 29. 1877. Philippine Isls. (Panay).

Th. balansae (Ching) Reed, comb. nov. Basionym: Cyclosorus balansae Ching, Bull. Fan Mem. Inst. Biol., Bot. 8: 200. 1938. Tonkin.

Thelypteris balbisii (Spreng.) Ching, Bull. Fan Mem. Inst. Biol. Bot., 10: 250. 1941. Basionym: Polypodium balbisii Spreng., Nova Acta Caes. Leop. Carol., 10: 228. 1821. Synonyms: Aspidium sprengelii Kaulf., Flora, 1823(1): 365. 1823; Nephrodium sherringii Jenm., Journ. Bot., 17: 261. 1879. West Indies (Cuba, Jamaica, Haiti, Puerto Rico); Guatemala, Nicaragua, C.R., Venezuela.

Th. banaensis Tard. et C.Chr., Not. Syst. (Paris), 7: 66. 1938. Annam.

Th. bangii (C.Chr.) Tryon, Rhodora, 69: 5. 1967. Basionym: Dryopteris bangii C.Chr., Danske Vid. Selsk. Shrift., VII, 4: 333, f. 52 II. 1907; l.c., VII, 10: 190. 1913. S. Amer. (Bolivia, S. Brazil).

Th. baramensis (C.Chr. ex C.Chr. et Holtt.) Ching, Bull. Fan Mem. Inst. Biol. Bot., 6: 287. 1936. Basionym: Dryopteris baramensis C.Chr. ex C.Chr. et Holtt., Gardens Bull. Straits Settlements, 7: 246. 1934.

Th. bartlettii (Copel.) Reed, comb. nov. Basionym: Dryopteris bartlettii Copel., Univ. Calif. Publ. Bot., 14: 374, t. 58. 1929. Sumatra.

Th. batacorum (Rosenst.) Reed, comb. nov. Basionym: Dryopteris batacorum Rosenst., Fedde Repert., 13: 217. 1914. Sumatra.

Th. batjanensis (Rosenst.) Reed, comb. nov. Basionym: Dryopteris batjanensis Rosenst., Med. Rijks Herb., No. 31: 5. 1917. Batjan Isl.

Th. beccariana (Ces.) Reed, comb. nov. Basionym: Nephrodium beccarianum Ces., Atti Ac. Napoli, 7(8): 23. 1876. Borneo.

Th. beddomei (Bak. in Hook. et Bak.) Ching, Bull. Fan Mem. Inst. Biol. Bot., 6: 308. 1936. Basionym: Nephrodium beddomei Bak. in Hook. et Bak., Syn. Fil., 267. 1867. S. India, Ceylon, Malaysia, Taiwan, Philippine Isls., Java.

Th. belensis (Copel.) Reed, comb. nov. Basionym: Dryopteris belensis Copel., Univ. Calif. Publ. Bot., 18: 220. 1942. New Guinea.

Th. benguetensis (Copel.) Reed, comb. nov. Basionym: Cyclosorus benguetensis Copel., Philip. Journ. Sci., 81: 28. 1952. Philippine Isls. (Luzon).

Th. bergiana (Schlechtend.) Ching, Bull. Fan Mem. Inst. Biol. Bot., 10: 251. 1941. Basionym: Polypodium bergianum Schlechtend., Adumbr., 20, t. 9. 1825. Synonyms: Aspidium maranguense Hieron., Engl. Pfl.-fam. Ost. Afr., C: 85. 1895; Dryopteris palmii C.Chr., Ark. f. Bot., 14: 1, t. 2, f. 6. 1916; Nephrodium sewellii Bak., Journ. Linn. Soc., 15: 418. 1876; Nephrodium anateinophlebium Bak., Journ. Linn. Soc., 16: 202. 1877. S. Africa, Madagascar.

Th. berroi (C.Chr.) Reed, comb. nov. Basionym: Dryopteris berroi C.Chr., Kgl. Danske Vid. Selsk. Skr., VII, 10(2): 185, f. 24. 1912. Synonym: Cyclosorus berroi (C.Chr.) Abbiatti, Darwiniana, 13(2-4): 567. 1964. Uruguay, Paraguay, Argentina.

Th. biaurita (Bedd.) Reed, comb. nov. Basionym: Nephrodium biauritum Bedd., Handb. Suppl., 68. 1892. Assam.

Thelypteris bicolor (Bonap.) Reed, comb. nov. Basionym: Dryopteris bicolor Bonap., Notes Pterid., 14: 204. 1924. Gabon.

Th. biformata (Rosenst.) Tryon, Rhodora, 69: 5. 1967. Basionym: Dryopteris biformata Rosenst., Fedde Repert., 7: 300. 1909. Peru.

Th. biolleyi (Christ in Pittier) Proctor, Bull. Inst. Jamaica, Sci. Ser., No. 5: 58. 1953. Basionym: Aspidium biolleyi Christ in Pittier, Prim. Fl. Costaric., 3: 31. 1901. Costa Rica-Panama, Jamaica.

Th. bipinnata (Copel.) Reed, comb. nov. Basionym: Dryopteris bipinnata Copel., Philip. Journ. Sci. Bot., 9: 2. 1914. New Guinea.

Th. blanda (Fée) Reed, comb. nov. Basionym: Phegopteris blanda Fée, 8e Mem., 91. 1857. Mexico- Costa Rica.

Th. blastophora (Alston) Reed, comb. nov. Basionym: Cyclosorus blastophorus Alston, Bol. Soc. Broter., Ser. II, 30: 12. 1956. S. Nigeria.

Th. boholensis (Copel.) Reed, comb. nov. Basionym: Cyclosorus boholensis Copel., Philip. Journ. Sci., 81: 31, t. 23. 1952. Philippine Isls. (Bohol).

Th. boliviensis (Morton) Morton, Amer. Fern Journ., 51: 38. 1961. Basionym: Dryopteris boliviensis Morton, Journ. Wash. Acad. Sci., 28: 527. 1938. Bolivia.

Th. bonapartii (Rosenst.) Alston, Journ. Wash. Acad. Sci., 48(7): 233. 1958. Basionym: Dryopteris bonapartii Rosenst., Fedde Repert., 7: 303. 1909. Ecuador, Colombia.

Th. boninensis (Kodama ex Koidz.) K.Iwats., Acta Phytotax. Geobot., 21: 41. 1964. Basionym: Dryopteris boninensis Kodama ex Koidz., Bot. Mag. Tokyo, 38: 109. 1924. Bonin Isls.

Th. boottii (Tuckerm.) Nieuwl., Amer. Midl. Nat., 1: 226. 1910. Basionym: Aspidium boottii Tuckerm., Hovey's Mag. Hort., 9: 145. 1843. = X Dryopteris boottii.

Th. boqueronensis (Hieron.) Tryon, Rhodora, 69: 5. 1967. Basionym: Dryopteris boqueronensis Hieron., Hedwigia, 46: 329. 1907. Colombia.

Th. bordenii (Christ) Reed, comb. nov. Basionym: Dryopteris bordenii Christ, Philip. Journ. Sci. Bot., 2: 204. 1917. Philippines.

Th. borneensis (Hook.) Reed, comb. nov. Basionym: Polypodium borneense Hook., Sp. Fil., 5: 11. 1863. Synonym: Dryopteris labuanensis C.Chr., Ind. Fil., 273. 1905. Borneo.

Th. boydiae (Eaton) K.Iwats., Mem. Coll. Sci. Univ. Kyoto, Ser. B, 31(1): 36. 1964. Basionym: Aspidium boydiae Eaton, Bull. Torr. Bot. Club, 6: 361. 1879. Hawaii.

Th. brachyodus (Kunze) Ching, Bull. Fan Mem. Inst. Biol. Bot., 6: 286 (err. "brachyodon"). 1936. Basionym: Polypodium brachyodus Kunze, Linnaea, 9: 48. 1834. West Indies, Costa Rica - Peru, Galapagos, Malesia.

Th. brachypoda (Bak. in Im Thurn) Morton, Fieldiana, Bot., 28: 10-11. 1951. Basionym: Nephrodium brachypodum Bak. in Im Thurn, Timehri, 5: 213. 1886; Bak., Trans. Linn. Soc. II. Bot., 2: 290. 1887. Venezuela, Mt. Roraima.

Thelypteris brackenridgei (Mett.) Reed, comb. nov. Basionym: Aspidium brackenridgei Mett., Ann. Sci. Nat., IV, 15: 75. 1861. Polynesia, Bismarck Archipelago - Tahiti.

Th. bradei (Christ) Reed, comb. nov. Basionym: Dryopteris bradei Christ, Bull. Soc. Bot. Geneve, II, 1: 225. 1909. Costa Rica.

Th. brasiliensis (C.Chr.) Morton, Amer. Fern Journ., 51: 38. 1961. Basionym: Dryopteris decussata var. brasiliensis C.Chr., Danske Vid. Selsk. Skr., VII, 10: 161. 1913. Brazil.

Th. brassii (C.Chr.) Reed, comb. nov. Basionym: Dryopteris brassii C.Chr., Brittonia, 2: 295. 1937. New Guinea (Papua).

Th. brausei (Hieron.) Alston, Journ. Wash. Acad. Sci., 48(7): 233. 1958. Basionym: Dryopteris brausei Hieron., Hedwigia, 46: 337, t. 6, f. 11. 1907. Ecuador, Colombia.

Th. brittonae (Slosson ex Maxon in Britt.) Reed, comb. nov. Basionym: Dryopteris brittonae Slosson ex Maxon in Britt., Pterid. Porto Rico, 475. 1926. Puerto Rico, Hispaniola.

*Th. brongniartii (Ett.) Reed, comb. nov. Basionym: Aspidium brongniartii Ett., Die Farnkr. der Jetztwelt, 200. 1865. Synonyms: Pecopteris unita Brongn., Hist. Veg. Foss., 1: 342, t. 116, f. 1-5. 1828; Cyatheites unitus Geinitz, Verstein. der Steinkohl. in Sachsen, 25, t. 29, f. 4-5. 1855. Upper Carboniferous: Germany (Saarbrück, Gaislauter, Wettenau, Oberhohndorf), France (Alias, St. Etienne) Aff. Th. unita.

Th. brooksii (Copel.) Reed, comb. nov. Basionym: Dryopteris brooksii Copel., Philip. Journ. Sci. Bot., 3: 345. 1909. Borneo.

Th. brunnea (Wall. ex C.Chr.) Ching, Bull. Fan Mem. Inst. Biol., 6: 269. 1936. Basionym: Dryopteris brunnea Wall. ex C.Chr., Ind. Fil., 255. 1905; Polypodium brunneum Wall., nomen nud.; Phegopteris brunnea J.Smith, Hist. Fil., 233 (brunea). 1875 (nomen). = Th. paludosa.

Th. brunnea var. glabrata (Clarke) Ching, Bull. Fan Mem. Inst. Biol., 6: 271. 1936. Basionym: Polypodium distans var. glabrata Clarke, Thans. Linn. Soc., II. Bot., 1: 544. 1880.

Th. brunnea var. hirtirachis (C.Chr.) Ching, Bull. Fan Mem. Inst. Biol., 6: 271. 1936. Basionym: Dryopteris hirtirachis C.Chr., Ind. Fil.,Suppl. II: 15. (1916) 1917. = Th. paludosa.

Th. brunnea var. pallida Ching, Bull. Fan Mem. Inst. Biol., Bot. 11: 62. 1941.

Th. brunnescens (C.Chr. ex Kjellb. et C.Chr.) Reed, comb. nov. Basionym: Dryopteris brunnescens C.Chr. ex Kjellb. et C.Chr., Engl. Bot. Jahrb., 66: 44. 1933. Celebes.

Th. bukoensis (Tagawa) Ching, Bull. Fan Mem. Inst. Biol., Bot. 6: 272. 1936. Basionym: Dryopteris bukoensis Tagawa, Acta Phytotax. Geobot., 1: 89. 1932. Japan (Honshu).

Th. bunnemeyeri Reed, nom. nov. Basionym: Leptogramma celebica Ching, Sinensia, 7: 99, t. 5. 1936. Celebes.

Th. burkartii Abbiatti, Darwiniana, 13(2-4): 550-551, f. 4, pl. 2. 1964. Argentina.

Th. burmanica (Ching) Reed, comb. nov. Basionym: Cyclosorus burmanicus Ching, Bull. Fan Mem. Inst. Biol., Bot. 8: 205. 1938. Burma.

Thelypteris cabrerae (Weatherby)Abbiatti, Rev. Mus. La Plata, Ser. II, Bot. 9: 19. 1958. Basionym: Dryopteris cabrerae Weatherby, Bol. Soc. Argent. Bot., 3: 31, f. 1-5. 1949. Argentina.

Th. calcarata (Blume) Ching, Bull. Fan Mem. Inst. Biol. Bot., 6: 288. 1936. Basionym: Aspidium calcaratum Blume, Enum. Pl. Jav., 159. 1828. Oriental tropics: S. China - India - Java - Malesia - Samoa.

Th. callensii (Alston) Reed, comb. nov. Basionym: Cyclosorus callensii Alston, Bol. Soc. Broter., Ser. II, 30: 13. 1956. Congo.

Th. callosa (Blume) K.Iwats., Mem. Coll. Sci., Univ. Kyoto, Ser.B, 31(1): 34. 1964. Basionym: Aspidium callosum Blume, Enum. Pl. Jav., 152. 1828. Java, Sumatra.

Th. calva (Copel.) Reed, comb. nov. Basionym: Dryopteris calva Copel., Leaflets Philip. Bot., 3: 808. 1910. Mindanao.

Th. calvata Ching, Bull. Fan Mem. Inst. Biol., Ser II, 1: 313. 1949. China (Kwangtung).

Th. calvescens (Ching) Reed, comb. nov. Basionym: Cyclosorus calvescens Ching, Bull. Fan Mem. Inst. Biol., Bot. 8: 225. 1938. China (Kweichow), Tonkin.

Th. cana (J.Smith) Ching, Bull. Fan Mem. Inst. Biol., Bot. 6: 291. 1936. Basionym: Lastrea cana J. Smith, Cat. Cult. Ferns, 57. 1857. Sikkim.

Th. canadasii (Sod.) Alston, Journ. Wash. Acad. Sci., 48(7): 234. 1958. Basionym: Nephrodium canadasii Sodiro, Rec., 48. 1883; Crypt. Vasc. Quit., 236. 1893. Ecuador.

Th. canescens (Blume) K.Iwats., Mem. Coll. Sci., Univ. Kyoto, Ser. B, 31(1): 34. 1964. Basionym: Polypodium canescens Blume, Enum. Pl. Jav., 133. 1828. Java, Celebes, Philippine Isls.,Fiji.

Th. canlaonensis (Copel.) Reed, comb. nov. Basionym: Dryopteris canlaonensis Copel., Philip. Journ. Sci., 40: 300. 1929. Philippine Isls. (Negros).

Th. caribaea (Jenm.) Morton, Amer. Fern Journ., 53: 65. 1963. Basionym: Nephrodium caribeum Jenm., Journ. Bot., Brit. & For., 24: 270. 1886. Jamaica.

Th. castanea (Tagawa) Ching, Bull. Fan Mem. Inst. Biol., 6: 315. 1936. Basionym: Dryopteris castanea Tagawa, Acta Phytotax. Geobot., 4: 132. 1935. N. Taiwan.

Th. cataractorum (Wagner & Grether) Reed, comb. nov. Basionym: Cyclosorus cataractorum Wagner & Grether, Univ. Calif. Publ. Bot., 23: 50, t. 16. 1948. Ins. Admiralty.

Th. caucaensis (Hieron.) Alston, Journ. Wash. Acad. Sci., 48(7): 233. 1958. Basionym: Nephrodium caucaense Hieron., Engl. Bot. Jahrb., 34: 444. 1904. Costa Rica - Colombia - Bolivia.

Th. caudata (Ching) Reed, comb. nov. Basionym: Leptogramma caudata Ching, Sinensia, 7: 98, t. 4. 1936. China (Fukien), Taiwan.

Th. caudiculata (Sieber in Kunze) Reed, comb. nov. Basionym: Aspidium caudiculatum Sieber in Kunze, Linnaea, 24: 28. 1850. Comores, Mauritius.

Th. caudipinna Ching, Bull. Fan Mem. Inst. Biol., 6: 288. 1936. China (Hainan).

Thelypteris cavatensis (Copel.) Reed, comb. nov. Basionym: Lastrea cavitensis Copel., Philip. Journ. Sci., 81: 26. 1952. Luzon.

Th. celebica (Baker) Reed, comb. nov. Basionym: Acrostichum celebicum Baker, Kew Bull., 1901: 145. 1901. Celebes.

Th. cesatiana (C.Chr.) Reed, comb. nov. Basionym: Dryopteris cesatiana C.Chr., Ind. Fil., 257. 1905. Synonym: Meniscium beccarianum Ces., Rend. Acad. Napoli, 16: 27, 30. 1877, non Nephrodium beccarianum Ces., 1876. New Guinea, Fiji.

Th. chaerophylloides (Poir. in Lam.) Proctor, Bull. Inst. Jamaica, Sci. Ser., No. 5: 58. 1953. Basionym: Polypodium chaerophylloides Poir. in Lam., Encycl., 5: 542. 1804. West Indies.

Th. chamaeotaria (Christ) Reed, comb. nov. Basionym: Dryopteris chamaeotaria Christ, Philip. Journ. Sci., Bot. 2: 203. 1907. Malesia - Polynesia.

Th. chaseana Schelpe, Journ. S. Afr. Bot., 31(4): 263, f. 1 e-f. Oct. 1965. Africa (Southwest, Rhodesia, Malawi, Zambia, Tanzania, Angola).

Th. cheilanthoides (Kunze) Proctor, Bull. Inst. Jamaica, Sci. Ser., No. 5: 58. 1953. Basionym: Aspidium cheilanthoides Kunze, Linnaea, 22: 578. 1849. Brazil, Trop. Amer.

Th. cheilanthoides var. resinofoetida (Hook.) Proctor, Bull. Inst. Jamaica, Sci. Ser., No. 5: 58. 1953. Basionym: Nephrodium resinofoetidum Hook., Sp. Fil., 4: 105. 1862. Jamaica.

Th. chinensis Ching, Bull. Fan Mem. Inst. Biol., 6: 311. 1936. China (Anwhei).

Th. chlamydophora (Rosenst.) Ching, Bull. Fan Mem. Inst. Biol., 6: 287. 1936. Basionym: Dryopteris chlamydophora Rosenst., Med. Rijks Herb. Leiden, 31: 5. 1917. Malaya, Borneo, prob. Sumatra.

Th. christensenii (Christ) Reed, comb. nov. Basionym: Dryopteris christensenii Christ, Bull. Boiss., II, 7: 263. 1907; C.Chr., Vid. Selsk. Skr., VII, 4: 322, f. 46. 1907. Costa Rica -Panama.

Th. christii (C.Chr.) Reed, comb. nov. Basionym: Dryopteris christii C.Chr., Ind. Fil., 257. 1905. Synonym: Meniscium opacum Bak., Journ. Bot., 1877: 166. 1877. Ecuador.

Th. chrysoloba (Kaulf. ex Link) Ching, Bull. Fan Mem. Inst. Biol., Bot. 10: 251. 1941. Basionym: Aspidium chrysolobum Kaulf. ex Link, Hort. Berol., 2: 117. 1833. Brazil, Colombia.

Th. chrysodioides (Fée) Morton, Contrib. U.S. Nat. Herb., 38(2): 51. 1967. Basionym: Meniscium chrysodioides Fée, Gen. Fil., 225. 1852. S. Amer.

Th. chrysodioides var. goyazensis (Maxon & Morton) Morton, Contrib. U. S. Nat. Herb., 38(2): 51. 1967. Basionym: Dryopteris chrysodioides var. goyazensis Maxon & Morton, Bull. Torr. Bot. Club, 65: 374. 1938. Brazil.

Th. chunii Ching, Bull. Fan Mem. Inst. Biol., Bot. 6: 284. 1936. China (Kwangtung, Kweichow).

Th. ciliata (Wall. ex Benth.) Ching, Bull. Fan Mem. Inst. Biol., Bot. 6: 289. 1936. Basionym: Aspidium ciliatum Wall. ex Benth.,

Fl. Hongkong, 455. 1861. Synonym: Dryopteris pseudocalcarata C.Chr., Ind. Fil. Suppl. III: 95. 1934. Hongkong, Nepal S to Malaya.

*Thelypteris claiborniana (Berry) Reed, comb. nov. Basionym: Goniopteris claiborniana Berry, Bull. Torr. Bot. Club, 44: 331, t. 22. 1917. Eocene: Louisiana, Mississippi.

Th. clarkei (Bedd.) Reed, comb. nov. Basionym: Pleocnemia clarkei Bedd., Ferns Brit. India, Suppl., 15, t. 368. 1876. Synonym: Nephrodium artinexum Clarke, Trans. Linn. Soc., II. Bot., 1: 536. 1880. Sikkim.

Th. clintoniana (D.C.Eaton) House, New York State Mus. Bull., 233-234: 69. 1922. Basionym: Aspidium cristatum var. clintonianum D.C.Eaton in A. Gray, Manual, 5th ed.: 665. 1867. = Dryopteris.

Th. clemensiae (Copel.) Reed, comb. nov. Basionym: Dryopteris clemensiae Copel., Philip. Journ. Sci., 46: 213. 1931. Luzon.

Th. clypeolutana (Desv.) Proctor, Rhodora, 61: 306. (1959) 1960. Basionym: Nephrodium clypeolutanum Desv., Mem. Soc. Linn. Paris, 6: 258. 1827. Endemic to Lesser Antilles.

Th. coalescens (Baker) Reed, comb. nov. Basionym: Polypodium coalescens Baker, Journ. Bot., 1877: 164. 1877. Ecuador.

Th. coarctata (Kunze) Tryon, Rhodora, 69: 5. 1967. Basionym: Aspidium coarctatum Kunze, Bot. Zeit., 1845: 287. 1845. Caracas, Colombia.

Th. columbiana (C.Chr.) Morton, Leaflets of Western Bot., 8(8): 194. 1957. Basionym: Dryopteris columbiana C.Chr., Vid. Selsk. Skr., VII, 4: 279, f. 8. 1907. Colombia, Panama, Galapagos Isl.

Th. comosa (Morton) Morton, Amer. Fern Journ., 51: 38. 1961. Basionym: Dryopteris comosa Morton, Journ. Wash. Acad. Sci., 28: 528. 1938. Peru.

Th. compacta (Copel.) Reed, comb. nov. Basionym: Dryopteris compacta Copel., Philip. Journ. Sci., Bot. 6: 137, f. 18, 1911. Borneo.

Th. concinna (Willd.) Ching, Bull. Fan Mem. Inst. Biol., Bot. 10: 251. 1941. (Proctor, Bull. Inst. Jamaica, Sci. Ser., No. 5: 58. 1953). Basionym: Polypodium concinnum Willd., Sp. Pl., 5: 201. 1810. Trop. Amer., Jamaica, Cuba, Mexico - Costa Rica - Ecuador.

Th. concinna var. elongata (Fourn.) Reed, comb. nov. Basionym: Phegopteris elongata Fourn., Pl. Mex., 1: 87. 1872. Mexico.

Th. conferta (Brause) Reed, comb. nov. Basionym: Dryopteris conferta Brause, Engl. Bot. Jahrb., 49: 22, f. 1F. 1912. New Guinea.

Th. confluens (Thunb.) Morton, Contrib. U.S. Nat. Herb., 38(2): 71. 1967. Basionym: Pteris confluens Thunb., Prodr. Pl. Cap., 1800. S. Africa, Cape of Good Hope.

Th. confusa (Copel.) Reed, comb. nov. Basionym: Dryopteris confusa Copel., Philip. Journ. Sci., 6C: 146. 1911. Luzon.

Th. connexa (Kuhn ex Baker) Reed, comb. nov. Basionym: Nephrodium connexum Kuhn ex Baker, in Martius Fl. Bras., 1(2): 489. 1870. Synonym: Dryopteris martini C.Chr., Ind. Fil., 276. 1905. Cayenne.

Th. consanguinea (Fée) Proctor, Rhodora, 61: 306. (1959) 1960. Basionym: Aspidium consanguineum Fée, 11e Mem. Foug., 76, t. 20, f.3. 1866. Guadeloupe, West Indies.

Thelypteris consanguinea var. aequalis (C.Chr.) Reed, comb. nov. Basionym: Dryopteris consanguinea var. aequalis C.Chr., Smiths. Misc. Coll., 52: 380. 1909. Jamaica, Grenada.

Th. consimilis (Fée ex Baker) Proctor. Rhodora, 68: 468. 1966. Basionym: Gymnogramma gracilis " G. consimilis" Fée ex Baker, in Hook. & Baker, Syn. Fil., 377. 1868 (invalid). Jamaica, Guadeloupe.

Th. consobrina (Maxon & Morton) Tryon, Rhodora, 69: 5. 1967. Basionym: Dryopteris consobrina Maxon & Morton, Bull. Torr. Bot. Club, 65: 356. 1938. Peru.

Th. conterminа (Willd. in L.) Reed, comb. nov. Basionym: Aspidium conterminum Willd. in L., Sp. Pl., ed. 4, 5: 249. 1810. Trop.Amer.

Th. conterminoides (C.Chr.) Reed, comb. nov. Basionym: Dryopteris conterminoides C.Chr., Ind. Fil., 258. 1905. Synonym: Nephrodium simulans Baker, Journ. Bot., 1890: 106. 1890. New Guinea.

Th. contigua (Rosenst.) Reed, comb. nov. Basionym: Dryopteris contigua Rosenst., Med. Rijks. Herb. Leiden, No. 31: 8. 1917. Borneo, Malaya.

Th. contingens Ching, in herb.; pro syn., in Ching, Acta Phytotax. Sinica, 8: 310. 1963. (Macrothelypteris contingens Ching, 1963).

Th. cooleyi Proctor, Rhodora, 68: 468-469. 1966. St. Vincent.

Th. copelandii Reed, nom. nov. Basionym: Cyclosorus dimorphus Copel., Philip. Journ. Sci., 83: 99, t. 5. 1954. Luzon.

Th. cordata (Fée) Proctor, Bull. Inst. Jamaica, Sci. Ser., No. 5: 59. 1953. Basionym: Phegopteris cordata Fée, Gen. Fil., 244. 1850-1852. Synonym: Polypodium cubanum Baker in Hook. & Bak., Syn. Fil., 304. 1867. West Indies (Cuba, Puerto Rico, Jamaica), Mexico.

Th. coriacea (Brause) Ching, Bull. Fan Mem. Inst. Biol., Bot. 10: 251. 1941. Basionym: Dryopteris coriacea Brause, Engl. Bot. Jahrb., 56: 83. 1920. New Guinea.

Th. cornuta (Maxon) Ching, Bull. Fan Mem. Inst. Biol., Bot. 10: 251. 1941. Basionym: Dryopteris cornuta Maxon, Journ. Wash. Acad. Sci., 19: 245, fig. 1924. Tahiti.

Th. costata (Brack.) Reed, comb. nov. Basionym: Goniopteris costata Brack., Expl. Exp., 16: 28. 1854. Society Isls. (Fiji).

Th. costulisora (Copel.) Reed, comb. nov. Basionym: Lastrea costulisora Copel., Gen. Fil., 138. 1947. Synonym: Dryopteris basisora Copel., Philip. Journ. Sci., 6: 73. 1911, non D. basisora Christ, 1909. New Guinea.

Th. crassa (Copel.) Reed, comb. nov. Basionym: Dryopteris crassa Copel., Univ. Calif. Publ. Bot., 18: 220. 1942. New Guinea.

Th. crassifolia (Blume) Ching, Bull. Fan Mem. Inst. Biol., Bot. 6: 285. 1936. Basionym: Aspidium crassifolium Blume, Enum. Pl. Jav. 158. 1828. W. Malaysia - Malaya - Burma, Philippine Isls.

Th. crassifolia var. motleyana (Hook.) Ching, Bull. Fan Mem. Inst. Biol., Bot. 6: 286. 1936. Basionym: Nephrodium motleyanum Hook., Syn. Fil., 266. 1867. Borneo, Malacca.

Th. crinipes (Hook.) Reed, comb. nov. Basionym: Nephrodium crinipes Hook., Sp. Fil., 4: 71. 1862. N. India, Malacca.

Thelypteris cristata (L.) Nieuwl., Amer. Midl. Nat., 1: 226. 1910. Basionym: Polypodium cristatum L., Sp. Pl., 1090. 1753. = Dryopteris.

Th. cristata var. clintoniana (D.C.Eaton) Weatherby, Rhodora, 21: 177. 1919. Basionym: Aspidium cristatum var. clintonianum D.C. Eaton, in A. Gray's Man., ed. 5: 665. 1867. = Dryopteris.

Th. cruciata (Willd.) Tard., Not. Syst., 15(1): 90-91. 1954. Basionym: Aspidium cruciatum Willd. in L., Sp. Pl., ed. 4, 5: 278. 1810. Synonyms: Phegopteris montbrisoniana Fée, Gen. Fil., 247. 1850-1852; Polypodium sessilifolium Hook., Sp. Fil., 4: 251. 1862; Polypodium bojeri Hook., Sp. Fil., 4: 20. 1862. Reunion, Seychelles, Maurice.

Th. crypta (Underw. et Maxon) Reed, comb. nov. Basionym: Polypodium cryptum Underw. et Maxon, Bull. Torr. Bot. Club, 29: 579, fig. 1902. Cuba.

Th. cumingiana (Kunze) Reed, comb. nov. Basionym: Aspidium cumingianum Kunze, 1: 17, t. 19, f. 2. 1840. Panama.

Th. cuneata (C.Chr.) Reed, comb. nov. Basionym: Dryopteris cuneata C.Chr., Vid. Selsk. Skr., VII, 10: 253, f. 42. 1913. Brazil.

Th. curta (Christ) Reed, comb. nov. Basionym: Dryopteris curta Christ, Bull. Boiss., II, 7: 263. 1907. Costa Rica.

Th. cuspidata (Blume) K.Iwats., Mem. Coll. Sci.,Univ.Kyoto, Ser. B, 31(3): 192. 1965. Basionym: Meniscium cuspidatum Blume, Enum. Pl. Jav., 114. 1828. Indochina (Tonkin, Annam), Himalayas, Malaccas, Philippine Isls.

Th. cyatheoides (Kaulf.) Fosberg, Occ. Papers Bishop Mus., 23(2): 30. 1962. Basionym: Aspidium cyatheoides Kaulf., Enum. Fil., 234. 1824. Hawaiian Isls., New Guinea, Sumatra.

Th. cyclolepis (C.Chr. et Tard.) Tagawa, Journ. Jap. Bot., 26: 20. 1951. Basionym: Athyrium cyclolepis C.Chr. et Tard., Bull. Mus. Paris, II, 6: 109, f. 3-4. 1934. Annam.

Th. cylindrothrix (Rosenst.) K.Iwats., Fl. Eastern Himalaya, 482. 1966. Basionym: Dryopteris cylindrothrix Rosenst., Fedde Repert., 12: 246. 1913. Sikkim.

Th. cyrtocaulos (v.A.v.R.) Reed, comb. nov. Basionym: Dryopteris cyrtocaulos v.A.v.R., Bull. Buit., III, 5: 201. 1922. Sumatra.

Th. cystopteroides (D.C.Eaton) Ching, Bull. Fan Mem. Inst. Biol., Bot. 6: 316. 1936. Basionym: Athyrium cystopteroides D.C.Eaton, Proc. Amer. Acad., 4: 110. 1858. Synonym: Dryopteris abbreviatipinna Makino et Ogata, Journ. Jap. Bot., 6: 10. 1929. Japan, Korea, Taiwan.

Th. debilis (Mett.) Reed, comb. nov. Basionym: Phegopteris debilis Mett., Ann. Ludg. Bat., 1: 223, t. 6, f. 1. 1864. Amboina.

Th. decadens (Baker) Reed, comb. nov. Basionym: Nephrodium decadens Baker, Journ. Bot., 1886: 183. 1886. Fiji.

Th. decipiens (Clarke) Ching, Bull. Fan Mem. Inst. Biol., Bot. 6: 335. 1936. Basionym: Nephrodium gracilescens var. decipiens Clarke, Trans. Linn. Soc., II. Bot. 1(8): 514, t. 65, f. 2. 1880. N. India.

Thelypteris decora (Domin) Reed, comb. nov. Basionym: Dryopteris decora Domin, Bibl. Bot., 85: 48. 1913. Australia (Queensland).

Th. decurrenti-alata (Hook.) Reed, comb. nov. Basionym: Gymnogramma decurrenti-alata Hook., Sp. Fil., 5: 142, t. 294. 1864. Japan.

Th. decursive-pinnata (van Hall) Ching, Bull. Fan Mem. Inst. Biol., Bot. 6: 275. 1936. Basionym: Polypodium decursive-pinnatum van Hall, Nieuwe Verhandl. Nederl. Inst., 5: 204, tab. 1836. China, Japan, Tonkin, Kashmir.

Th. decursive-pinnata forma simplex (H.Itô) Reed, comb. nov. Basionym: Phegopteris decursive-pinnata forma simplex H.Itô, Nova Flora Jap., 1: 154. 1939. Japan.

Th. decursive-pinnata forma truncata (H.Itô) Reed, comb. nov. Basionym: Phegopteris decursive-pinnata forma truncata H.Itô, Nova Flora Jap., 1: 154. 1939. Japan.

Th. decussata (L.) Proctor, Bull. Inst. Jamaica, Sci. Ser., No. 5: 59. 1953. Basionym: Polypodium decussatum L., Sp. Pl., 2: 1093. 1753. West Indies, Jamaica; Amer. trop.

Th. decussata forma velutina (Sodiro) Reed, comb. nov. Basionym: Polypodium velutinum Sodiro, Rec., 59. 1883; Crypt. Vasc. Quit., 292. 1893. Costa Rica - Fr. Guiana, Ecuador, Peru.

Th. deflexa (Presl) Tryon, Rhodora, 69: 5. 1967. Basionym: Nephrodium deflexum Presl, Rel. Haenk., 1: 36, t. 5, f. 2. 1825. Synonyms: Dryopteris lindigii C.Chr., Ind. Fil., 275. 1905; Thelypteris lindigii (C.Chr.) Alston, Journ. Wash. Acad. Sci., 48: 233. 1958. Colombia - Peru.

Th. degener (Christ) Reed, comb. nov. Basionym: Dryopteris canescens var. degener Christ, Philip. Journ. Sci., Bot. 2C: 199. 1907. Philippine Isls. (Luzon).

Th. degeneri (Copel.) Reed, comb. nov. Basionym: Cyclosorus degeneri Copel., Journ. Arnold Arb., 30: 438. 1949. Fiji.

Th. dejecta (Jenm.) Reed, comb. nov. Basionym: Nephrodium dejecta Jenm., Gard. Chron., III, 18: 640. 1895. Demerara, Brit. Guiana.

Th. delicatula (Fée) Proctor, Rhodora, 61: 306. (1959) 1960. Basionym: Phegopteris delicatula Fée, 11e Mem. Foug., 51, t. 20, f. 1. 1866. West Indies, Guadeloupe.

Th. deltiptera (Copel.) Reed, comb. nov. Basionym: Dryopteris deltiptera Copel., Univ. Calif. Publ. Bot., 18: 220. 1942. New Guinea.

Th. deltoidea (Swartz) Proctor, Bull. Inst. Jamaica, Sci. Ser., No. 5: 59. 1953; (K.Iwats., Mem. Coll. Sci., Univ. Kyoto, Ser. B, 31(1): 31. 1964). Basionym: Polypodium deltoideum Swartz, Prodr., 133. 1788. West Indies, Jamaica.

Th. demerarana (Baker) Reed, comb. nov. Basionym: Polypodium demeraranum Baker, Timehri, 5: 214. 1886. Brit. Guiana.

Th. densa (Maxon) Tryon, Rhodora, 69: 5. 1967. Basionym: Dryopteris densa Maxon, Journ. Wash. Acad. Sci., 34: 25. 1944. Peru.

Th. densisora (C.Chr.) Reed, comb. nov. (Murillo, Cat. Illus. Pl. de Cundinamarca, 2: 105. 1966 (nomen)). Basionym: Dryopteris densisora C.Chr., Ind. Fil., 261. 1905. Synonym: Aspidium costale Mett. ex Kuhn, Linnaea, 36: 111. 1869. Costa Rica -Colombia - Venezuela.

Thelypteris dentata (Forsk.) E.St. John, Amer. Fern Journ., 26: 44. 1936. (Allen, Fl. N. Zealand, 1: 52. 1961). Basionym: Polypodium dentatum Forsk., Fl. Aegypt.-Arab., 185. 1775. Synonyms: Polypodium molle Jacq., Collect., 3: 188. 1769; Icon. Pl. Rar., t. 640. 1793; Dryopteris mollis (Jacq.) Hieron., Hedwigia, 46: 348. 1907; Dryopteris oblancifolia Tagawa, Acta Phytotax. Geobot., 5: 190. 1936; Aspidium natalense Fée, Mem. 8: 102. 1857; Nephrodium hispidulum Peter, Fedde Repert., Beih., 40: descr. 10, t. 4, f. 1-2. 1929. Pantropical: Yemen, Arabia, Trop. Africa (Ivory Coast, Oubangui, Zambesia, Mocambique), India, China, Thailand, Taiwan, Tonga, Palau, Galapagos Isls., Colombia, Paraguay, Uruguay, Argentina, Antilles.

Th. dentata var. buchananii Schelpe, Journ. S. Afr. Bot., 31(4): 265, f. 1d. 1965. Mocambique, Natal, Rhodesia

Th. dentata var. violascens (Link) Reed, comb. nov. Basionym: Aspidium violascens Link, Hort. Bot. Berol., 2: 115. 1833. Synonym: Cyclosorus dentatus var. violascens (Link) Abbiatti, Darwiniana, 13(2-4): 540, 545. 1964. Argentina, Brazil.

Th. devolvens (Baker) Reed, comb. nov. Basionym: Nephrodium devolvens Baker, Journ. Bot., 1885: 217. 1885. Brazil.

Th. diaphana (Brause) Ching, Bull. Fan Mem. Inst. Biol., Bot. 10: 251. 1941. Basionym: Dryopteris diaphana Brause, Engl. Bot. Jahrb., 56: 80. 1920. New Guinea.

Th. dicarpa (Fée) Reed, comb. nov. Basionym: Nephrodium dicarpum Fée, Gen. Fil., 305. 1850-1852. Reunion.

Th. dichrotricha (Copel.) Reed, comb. nov. Basionym: Dryopteris dichrotricha Copel., Philip. Journ. Sci., 6C: 74. 1911. New Guinea.

Th. dichrotrichoides (v.A.v.R.) Reed, comb. nov. Basionym: Dryopteris dichrotrichoides v.A.v.R., Malayan Ferns Suppl. Corr., 48. 1917. Synonyms: Dryopteris dichrotricha Copel., Philip. Journ. Sci., 7C: 54. 1912; Dryopteris weberi Copel., Philip. Journ. Sci., 38: 135. 1929. Philippine Isls. (Mindanao).

Th. dicksonioides (Mett. ex Kuhn) Ching, Bull. Fan Mem. Inst. Biol., Bot. 10: 251. 1941. Basionym: Phegopteris dicksonioides Mett. ex Kuhn, Linnaea, 36: 118. 1869. Hawaiian Isls., Tahiti.

Th. dicranogramma (v.A.v.R.) Reed, comb. nov. Basionym: Dryopteris dicranogramma v.A.v.R., Bull. Buit., III, 5: 202. 1922. Sumatra, Malaya.

Th. didymochlaenoides (Clarke) Ching, Bull. Fan Mem. Inst. Biol., Bot. 6: 325. 1936. Basionym: Nephrodium gracilescens var. didymochlaenoides Clarke, Trans. Linn. Soc. Lond., II. Bot. 1(8): 514, t. 68, f. 2. 1880. N. India.

Th. didymosora (Parish in Bedd.) Reed, comb. nov. Basionym: Nephrodium didymosorum Parish in Bedd., Ferns Brit. India, t. 200. 1866. Tenasserim, Perak, Singapore.

Th. dilatata (Hoffm.) House, New York State Mus. Bull., 233-234: 69. 1922. Basionym: Polypodium dilatatum Hoffm., Deutsch. Fl., 2: 7. 1795. = Dryopteris.

Thelypteris dilatata var. americana (Fisch. ex Kunze) House, New York State Mus. Bull. 233-234: 69. 1922. Basionym: Aspidium spinulosum var. americanum Fisch. ex Kunze, Amer. Journ. Sci., II, 6: 84. 1848. = Dryopteris.

Th. diminuta (Copel.) Reed, comb. nov. Basionym: Dryopteris diminuta Copel., Philip. Journ. Sci., 40: 298. 1929. Mindanao.

Th. dimorpha (Brause) Reed, comb. nov. Basionym: Dryopteris dimorpha Brause, Engl. Bot. Jahrb., 56: 100. 1920. New Guinea.

Th. diplazioides (Moritz ex Mett.) Ching, Bull. Fan Mem. Inst. Biol., Bot. 10: 251. 1941. Basionym: Aspidium diplazioides Moritz ex Mett., Pheg. u. Asp., 83, no. 200. 1858 (Abh. Senskenb. Ges. Frankfurt, 2: 367. 1858). Colombia, Venezuela.

Th. diplazioides (Desv.) Proctor, Bull. Inst. Jamaica, Sci. Ser., No. 5: 59. 1953. Basionym: Gymnogramma diplazioides Desv., Mem. Soc. Linn. Paris, 6: 214 (diplazoides). 1827. = Th. linkiana.

Th. dissimulans (Maxon et C.Chr. ex C.Chr.) Reed, comb. nov. Basionym: Dryopteris dissimulans Maxon et C.Chr. ex C.Chr., Vid. Selsk. Skr., VII, 10: 215. 1913. Cuba.

Th. distans (Hock.) Reed, comb. nov. Basionym: Nephrodium distans Hook., Sp. Fil., 4: 76 (adnota). 1862. Madagascar, Comores.

Th. distincta (Copel.) Reed, comb. nov. Basionym: Dryopteris distincta Copel., Univ. Calif. Publ. Bot., 18: 220. 1942. New Guinea.

Th. divergens (Rosenst.) Reed, comb. nov. Basionym: Dryopteris divergens Rosenst., Fedde Repert., 13: 218. 1914. Sumatra.

Th. diversiloba (Presl) Reed, comb. nov. Basionym: Nephrodium diversilobum Presl, Epim. Bot., 47. 1849. Luzon, Mindanao.

Th. diversisora (Copel.) Reed, comb. nov. Basionym: Dryopteris diversisora Copel., Occ. Papers Bishop Mus., 14: 54, t. 6. 1938. Rapa Isl.

Th. diversivenosa (v.A.v.R.) Ching, Bull. Fan Mem. Inst. Biol., Bot. 10: 251. 1941. Basionym: Dryopteris diversivenosa v.A.v.R., Bull. Buit., II, No. 28: 23. 1918. Sumatra.

Th. doodioides (Copel.) Reed, comb. nov. Basionym: Dryopteris doodioides Copel., Philip. Journ. Sci., 60: 107, t. 11. 1936. Solomon Isls.

Th. dryopteris (L.) Slosson ex Rydb., Fl. Rocky Mts., 1044. 1917. Basionym: Polypodium dryopteris L., Sp. Pl., 1093. 1753. = Dryopteris linnaeana.

Th. dryopteroidea (Brause) Reed, comb. nov. Basionym: Alsophila dryopteroidea Brause, Engl. Bot. Jahrb., 56: 70. 1920. Synonyms: Cyathea atrispora Domin, Acta Bohem., 9: 95. 1930; Dryopteris atrispora (Domin) C.Chr., Brittonia, 2: 296. 1937. New Guinea.

Th. duclouxii (Christ) Ching, Bull. Fan Mem. Inst. Biol., Bot. 6: 303. 1936. Basionym: Dryopteris duclouxii Christ, Bull. Acad. Geogr. Bot. Mans, 139. 1907. China.

Th. dumetorum (Maxon) Tryon, Rhodora, 69: 5. 1967. Basionym: Dryopteris dumetorum Maxon, Journ. Wash. Acad. Sci., 34: 26. 1944. Peru.

Thelypteris duplosetosa (Copel.) Reed, comb. nov. Basionym: Cyclosorus duplosetosus Copel., Philip. Journ. Sci., 81: 31. 1952. Philippine Isls. (Palawan).

Th. dura (Copel.) Reed, comb. nov. Basionym: Dryopteris dura Copel., Leaflets Philip. Bot., 3: 805. 1910. Philippine Isls. (Mindanao).

Th. ecallosa (Holtt.) Reed, comb. nov. Basionym: Cyclosorus ecallosus Holtt., Gard. Bull. Singapore, 11: 269. 1947. Malay Penin. (Pahang).

Th. echinata (Mett.) Reed, comb. nov. Basionym: Aspidium echinatum Mett., Ann. Ludg. Bat., 1: 230. 1864. Malaya, New Guinea.

Th. echinospora (v.A.v.R.) Reed, comb. nov. Basionym: Dryopteris echinospora v.A.v.R., Bull. Buit., III, 2: 149. 1920. Sumatra.

Th. edanyoi (Copel.) Reed, comb. nov. Basionym: Cyclosorus edanyoi Copel., Philip. Journ. Sci., 81: 37. 1952. Philippine Isls. (Panay).

Th. eggersii (Hieron.) Reed, comb. nov. Basionym: Nephrodium eggersii Hieron., Engl. Bot. Jahrb., 34: 441. 1904. Colombia.

Th. elata (Mett. ex Kuhn) Schelpe, Journ. S. Afr. Bot., 31(4): 265. 1965. Basionym: Aspidium elatum Mett. ex Kuhn, Fil. Afr., 131. 1868. Synonym: Nephrodium venulosum Hook., Sp. Fil., 4: 71. 1862, non Desv., 1827. Mocambique, Guinea cum insulis, Fernando Po.

Th. elegantula (Sodiro) Alston, Journ. Wash. Acad. Sci., 48(7): 233. 1958. Basionym: Nephrodium elegantulum Sodiro, Crypt. Vasc. Quit., 243. 1893. Colombia, Ecuador.

Th. elliptica (Rosenst.) Reed, comb. nov. Basionym: Dryopteris elliptica Rosenst., Med. Rijks Herb., No. 31: 6. 1917. Philippine Isls.

Th. elmerorum (Copel.) Reed, comb. nov. Basionym: Dryopteris elmerorum Copel., Philip. Journ. Sci., 40: 295, t. 2. 1929. Philippine Isls. (Mindanao).

Th. elwesii (Bak. in Hook. et Bak.) Ching, Bull. Fan Mem. Inst. Biol., Bot. 6: 308. 1936. Basionym: Nephrodium elwesii Bak. in Hook. et Bak., Syn. Fil., 497. 1874. Sikkim.

Th. engelii (Hieron.) Morton, Fieldiana, Bot., 28: 11. 1951. Basionym: Dryopteris engelii Hieron., Hedwigia, 46: 339, t. 6, f. 12. 1907. Synonym: Dryopteris pittieri C.Chr., Smiths. Misc. Coll., 52: 393. 1909. Venezuela, Colombia.

Th. engleriana (Brause) Reed, comb. nov. Basionym: Dryopteris engleriana Brause, Engl. Bot. Jahrb., 49: 19. 1912. New Guinea.

Th. ensifer (Tagawa) K.Iwats., Acta Phytotax. Geobot., 21: 40. 1964. Basionym: Dryopteris ensifer Tagawa, Acta Phytotax. Geobot., 6: 89. 1937. Synonym: Dryopteris sophoroides forma ensipinna Hayata, Icon. Pl. Formos., 4: 180. 1914. Taiwan.

Th. ensiformis (C.Chr.) Tryon, Rhodora, 69: 6. 1967. Basionym: Dryopteris ensiformis C.Chr., Danske Vid. Selsk. Skr., VII, Naturv. Afd., 10(2): 269, f. 46. 1913. Costa Rica.

Th. ensipinna (Brause) Ching, Bull. Fan Mem. Inst. Biol., Bot. 10: 251. 1941. Basionym: Dryopteris ensipinna Brause, Engl. Bot. Jahrb., 56: 84. 1920. New Guinea.

Thelypteris epaleata (C.Chr.) Reed, comb. nov. Basionym: Dryopteris epaleata C.Chr., Ind. Fil. Suppl. III: 85. 1934. Synonym: Dryopteris francii Copel., Univ. Calif. Publ. Bot., 14: 357. 1929, non C.Chr., 1925. New Caledonia.

Th. equitans (Christ) Reed, comb. nov. Basionym: Nephrodium equitans Christ, Bull. Boiss., II, 6: 163. 1906. Costa Rica.

Th. erecta (Copel.) Reed, comb. nov. Basionym: Cyclosorus erecta Copel., Philip. Journ. Sci., 81: 30, t. 22. 1952. Philippine Isls. (Leyte).

Th. erubescens (Wall. ex Hook.) Ching, Bull. Fan Mem. Inst. Biol., Bot. 6: 293. 1936. Basionym: Polypodium erubescens Wall. ex Hook., Sp. Fil., 4: 236. 1862. Synonym: Dryopteris reflexa Ching, Bull. Fan Mem. Inst. Biol., Bot. 2: 193. 1931. N. India, SW China, Malaya, Laos, Tonkin, Taiwan.

*Th. escheri (Heer) Reed, comb. nov. Basionym: Aspidium escheri Heer, Tertiärfl. der Helvetiae (Schweiz), 1: 36, t. 10, f. 2. 1855; l.c., 3: 153, t. 144, f. 9. 1859; Ett., Die Farnkr. der Jetztwelt, 200. 1865. Synonym: Dryopteris escheri (Heer) LaMotte, Geol. Soc. Amer. Mem. 51: 151. 1952. Miocene: Switzerland (Upper Rhone). Aff. Th. invisa et Th. multilineata.

Th. esquirolii (Christ) Ching, Bull. Fan Mem. Inst. Biol., Bot. 6: 301. 1936. Basionym: Dryopteris esquirolii Christ, Bull. Acad. Geogr. Bot. Man, 144. 1907. S. China, N. India, Taiwan, S. Korea, Japan (Honshu, Shikoku, Kyushu), Ryukyus.

Th. esquirolii var. glabrata (Christ) K.Iwats., Mem. Coll. Sci., Univ. Kyoto, Ser. B, 31(3): 182. 1965. Basionym: Dryopteris eberhardtii var. glabrata Christ, Not. Syst., 1: 37. 1909. Synonym: Thelypteris subochthodes Ching, Bull. Fan Mem. Inst. Biol., Bot. 6: 305. 1936. S. Honshu, Shikoku, Kyushu, Korea (Isl. Quelpaert), China.

*Th. ettinghausenii Reed, nom. nov. Basionym: Goniopteris polypodioides Ett., Denkschr. K. Akad. Wiss., Math.-Naturw. Cl., 8: 26, t. 2, f. 1-4, t. 3, f. 5. 1854. Synonyms: Lastraea polypodioides (Ett.) Heer, Fl. Tert Helvetiae (Schweiz), 3: 151, t. 144, f. 1-3. 1859; Phegopteris polypodioides (Ett.) Ett., Die Farnkr. der Jetztwelt, 196. 1865. Eocene: Switzerland.

Th. euchlora (Sodiro) Reed, comb. nov. Basionym: Polypodium euchlorum Sodiro, Rec., 58. 1883; Crypt. Vasc. Quit., 290. 1893. Ecuador.

Th. euchlora var. inaequans (C.Chr.) Reed, comb. nov. Basionym: Dryopteris euchlora var. inaequans C.Chr., Kgl. Dansk. Vid. Selsk. Skr., 7: 150. 1913. Panama, Nicaragua.

Th. eugracilis (Copel.) Reed, comb. nov. Basionym: Lastrea eugracilis Copel., Gen. Fil., 138. 1947. Synonym: Dryopteris gracilis Copel., Philip. Journ. Sci., 40: 294. 1929. Mindanao.

Th. euphlebia (Ching) Reed, comb. nov. Basionym: Cyclosorus euphlebius Ching, Bull. Fan Mem. Inst. Biol., Bot. 8: 226. 1938. China (Kwangsi, Kweichow), Tonkin.

*Th. europaeae Reed, nom. nov. Basionym: Pecopteris delicatula Brongn., Hist. Veg. Foss., 1: 349, t. 116. 1828; Unger, Gen. et Sp. Pl. Foss., 181. 1850. Synonym: Aspidium delicatulum (Brongn.) Ett., Die Farnkr. der Jetztwelt, 198. 1865. Upper Carboniferous: France (Fresnes), Germany (Saarbrück); Switzerland. Aff. Th. conterminum et Th. calcarata.

Thelypteris eurostotricha (Baker) Reed, comb. nov. Basionym: Nephrodium eurostotrichum Baker, Journ. Bot., 1880: 329. 1880. Madagascar.

Th. euryphylla (Rosenst.) Reed, comb. nov. Basionym: Dryopteris euryphylla Rosenst., Med. Rijks Herb. No. 31: 7. 1917. Sumatra.

Th. evoluta (Bedd.) Reed, comb. nov. Basionym: Nephrodium evolutum Bedd., Handb. Suppl., 76. 1892. N. India.

Th. exigua (Kunze ex Mett.) Reed, comb. nov. Basionym: Aspidium exiguum Kunze ex Mett., Pheg. u. Asp., 76, no. 180. 1858; Haplodictyum exiguum Fee, Gen. Fil., 309. 1850-1852 (nom. confus.); Lastrea exigua J.Sm., Journ. Bot., 3: 412. 1841 (nomen). Synonym: Phegopteris nervosa Fée, Gen. Fil., 244. 1850-1852. Philippines.

Th. extensa (Blume) Morton, Amer. Fern Journ., 49: 113. 1959. Basionym: Aspidium extensum Blume, Enum. Pl. Jav., 156. 1828. Synonym: Nephrodium wakefieldii Baker, Ann. Bot., 5: 326. 1891. Trop. Asia, Melanesia, Micronesia, N. Australia, E. Africa (Kenya), S. India, Ceylon, Burma-Malesia, Tonga, Java, Philippine Isls.

Th. falcata (Liebm.) Tryon, Rhodora, 69: 6. 1967. Basionym: Meniscium falcatum Liebm., Dansk. Vid. Selsk. Skr., V, 1: 183. 1849. Synonym: Dryopteris jurgensenii Maxon et Morton, Bull. Torr. Bot. Club, 65: 360. 1938. Mexico.

Th. falcatipinnula (Copel.) Reed, comb. nov. Basionym: Dryopteris falcatipinnula Copel., Philip. Journ. Sci., 6: 74. 1911. New Guinea.

Th. falcatula (Christ) Reed, comb. nov. Basionym: Dryopteris parasitica var. falcatula Christ, Philip. Journ. Sci., 2C: 147. 1907. Philippine Isls. (Mindanao, Palawan).

Th. falciloba (Hook.) Ching, Bull. Fan Mem. Inst. Biol., Bot. 6: 298. 1936. Basionym: Lastrea falciloba Hook., Journ. Bot., 9: 337. 1856. Himalayas, Burma, Tonkin, China.

Th. farinosa (Brause) Reed, comb. nov. Basionym: Dryopteris farinosa Brause, Engl. Bot. Jahrb., 56: 111. 1920. New Guinea.

Th. fasciculata (Fourn.) Ching, Bull. Fan Mem. Inst. Biol., Bot. 10: 251. 1941. Basionym: Aspidium fasciculatum Fourn., Ann. Sci. Nat., V, 18: 295. 1873. New Caledonia.

Th. fatuhivensis (E.Brown in E. et F. Brown) Ching, Bull. Fan. Mem. Inst. Biol., Bot. 10: 251. 1941. Basionym: Dryopteris fatuhivensis E.Brown in E. et F. Brown, Bernice P. Bichop Mus. Bull., 89: 27, f. 8. 1931. Marquesas.

Th. feei Moxley, Bull. So. Calif. Acad. Sci., 20: 35. 1921. = Th. puberula.

Th. fendleri (D.C.Eaton) Reed, comb. nov. Basionym: Aspidium fendleri D.C.Eaton, Mem. Amer. Acad., n.s., 8: 210. 1860. Venezuela, Colombia.

Th. ferox (Blume) Reed, comb. nov. Basionym: Aspidium ferox Blume, Enum. Pl. Jav., 153. 1828. S. Thailand, Malesia - Philippine Isls., Perak, ?Kumoan.

Th. filix-mas (L.) Nieuwl., Amer. Midl. Nat., 1: 226. 1910. Basionym: Polypodium filix-mas L., Sp. Pl., 1090. 1753. = Dryopteris.

Thelypteris finisterrae (Brause) Reed, comb. nov. Basionym: Dryopteris finisterrae Brause, Engl. Bot. Jahrb., 49: 20. 1912. New Guinea.

Th. firma (Baker ex Jenm.) Proctor, Bull. Inst. Jamaica, Sci. Ser., No. 5: 60. 1953. Basionym: Nephrodium firmum Bak. ex Jenm., Journ. Bot., 1879: 260. 1879. Jamaica.

Th. firmula (Baker) K.Iwats., Acta Phytotax. Geobot., 21(5-6): 170. 1965. Basionym: Polypodium firmulum Baker, Kew Bull., 1893: 211. 1893. Borneo.

*Th. fischeri (Heer) Reed, comb. nov. Basionym: Lastrea (Goniopteris) fischeri Heer, Fl. Tert. Helv., 1: 34, t. 9, f. 3. 1855. Synonyms: Cyclosorus fischeri (Heer) Kolakovskii, Akad. Nauk Greezinskoi SSR, Sukhum Bot. Sad, Monografii 1(1964): 23, t. 1, f. 1. 1964; Lastrea knightiana Newberry, U.S. Nat. Mus. Proc., 5: 503. 1882 (1883); Aspidium goldianum Lesq., 7th Ann. Rept., U.S. Geol. Surv. Terr., 393. 1873 (1874); Dryopteris integra Knowlton, U.S. Geol. Surv., Prof. Paper 155: 17, t. 1, f. 5. 1930; Dryopteris lesquereuxii Knowlton, Bull. U.S. Geol. Surv., 696: 284. 1919 (1920); Dryopteris richardsoniana Knowlton, U.S. Geol. Surv., Prof. Paper 155: 20, t. 2, f. 3-5. 1930. Eocene: Oregon, Alberta, British Columbia, Colorado; Pliocene: Georgia in SSR; Cretaceous: Colorado.

Th. flaccida (Blume) Ching, Bull. Fan Mem. Inst. Biol., Bot. 6: 336. 1936. Basionym: Aspidium flaccidum Blume, Enum. Pl. Jav., 161. 1828. Malaya - India - China, Japan.

Th. flavovirens (Rosenst.) Reed, comb. nov. Basionym: Dryopteris flavovirens Rosenst., Fedde Repert., 10: 334. 1912. New Guinea.

Th. flexilis (Christ) Ching, Bull. Fan Mem. Inst. Biol., Bot. 6: 283. 1936. Basionym: Aspidium flexile Christ, Bull. Acad. Geogr. Bot. Mans, 1902: 252. 1902. China (Szechwan, Kweichow). Synonyms: Aspidium melanorhizum Christ, Bull. Soc. Bot. Ital., 1901: 295. 1901, non Desv., 1827; Dryopteris subthelypteris C.Chr., Ind. Fil., 296. 1905.

Th. forsteri Morton, Contrib. U.S. Nat. Herb., 38(2): 60. 1967. Basionym: Polypodium invisum G. Forst., Fl. Ins. Austr. Prodr., 1786. Tahiti, Polynesia.

Th. foxii (Christ) Reed, comb. nov. Basionym: Dryopteris foxii Christ, Philip. Journ. Sci., 2C: 208. 1907; (Nephrodium foxii Copel., mss.). Philippine Isls. (Luzon - Mindanao).

Th. fragilis (Baker) Alston, Bol. Soc. Broter., 2 ser., 30: 25. 1956. Basionym: Polypodium fragile Baker, Journ. Linn. Soc., 16: 203. 1877, non L. Synonym: Dryopteris fragilis (Bak.) C.Chr., Ind. Fil., 266. 1905; Phegopteris fragilis Kuhn, v. Deck. Reis, 3(3): Bot. 66. 1879. Madagascar. (Probably should be based on Kuhn).

Th. fragrans (L.) Nieuwl., Amer. Midl. Nat., 1: 226. 1910. Basionym: Polypodium fragrans L., Sp. Pl., 1089. 1753. = Dryopteris.

Th. fragrans var. hookeriana Fernald, Rhodora, 25: 3. 1923. = Dryopteris.

Thelypteris francoana (Fourn.) Reed, comb. nov. Basionym: Aspidium francoanum Fourn., Bull. Soc. Bot. France, 19: 255. 1872. Nicaragua, Costa Rica, Ecuador.

Th. friesii (Brause) Schelpe, Bol. Soc. Broteriana, Ser. 2A, 41: 216. 1967 (1968). Basionym: Dryopteris friesii Brause in Fries, Wiss. Ergebn. Schwed. Rhodesia-Congo Exped. 1911-12, Bot. 1: 1. 1914. Rhodesia.

Th. fukienensis (Ching) Reed, comb. nov. Basionym: Cyclosorus fukienensis Ching, Bull. Fan Mem. Inst. Biol., Bot. 8: 209. 1938. China (Fukien).

Th. fulgens (Brause) Ching, Bull. Fan Mem. Inst. Biol., Bot. 10: 251. 1941. Basionym: Dryopteris fulgens Brause, Engl. Bot. Jahrb., 56: 89. 1920. New Guinea.

Th. funckii (Mett. in Triana et Planch.) Alston, Journ. Wash. Acad. Sci., 48(7): 233. 1958. Basionym: Aspidium funckii Mett. in Triana et Planch., Ann. Sci. Nat., V, 2: 246. 1864. Colombia, Venezuela, Peru, Ecuador, Costa Rica.

Th. funestra (Kunze) Alston, Kew Bull. 1932: 309. 1932. Basionym: Aspidium funestrum Kunze, Linnaea, 9: 96. 1834. = Ctenitis protensa var. funestra.

Th. furva (Maxon) Tryon, Rhodora, 69: 6. 1967. Basionym: Dryopteris furva Maxon, Journ. Wash. Acad. Sci., 34: 24. 1944. Peru.

Th. galanderi (Hieron.) Abbiatti, Darwiniana, 13(2-4): 566. 1964. Basionym: Aspidium galanderi Hieron., Engl. Bot. Jahrb., 22: 369. 1896 (1897). Argentina.

Th. gardneriana (Baker) Reed, comb. nov. Basionym: Nephrodium gardnerianum Baker, Fl. Bras., 1(2): 474. 1870; (Aspidium gardnerianum Kunze, msc.). Synonym: Dryopteris densiloba C.Chr., Ind. Fil., 261. 1905. Brazil.

Th. germaniana (Fée) Proctor, Rhodora, 61: 306. (1959) 1960. Basionym: Phegopteris germaniana Fée, 11 Mem. Foug., 55, t. 13, f. 2. 1866. West Indies, Cuba, Guadeloupe.

Th. ghiesbreghtii (Hook.) Morton, Contrib. U.S. Nat. Herb., 38(2): 45. 1967. Basionym: Polypodium crenatum var. ghiesbreghtii Hook., Sp. Fil., 5: 3. 1864. Synonym: Goniopteris mollis Fée, Gen. Fil., 252. 1850-1852. Mexico - Panama,

Th. gigantea (Mett.) Tryon, Rhodora, 69: 6. 1967; Morton, Contrib. U.S. Nat. Herb., 38(2): 51. 1967. Basionym: Meniscium giganteum Mett., Fil. Lechl., 1: 19. 1856. Synonym: Dryopteris simplicifrons C.Chr., Ind. Fil., 486. 1906. Peru.

Th. glabra (Brack.) Ching, Bull. Fan Mem. Inst. Biol., Bot. 10: 251. 1941. Basionym: Lastrea glabra Brack., Exped. Exp., 16: 200. 1854. Hawaii, Tahiti.

Th. glabrata (Mett. ex Kuhn) Tard., Not. Syst., 14: 344. 1952; Mem. IFAN, 28: 120. 1953. Basionym: Aspidium glabratum Mett. ex Kuhn, Fil. Afr., 133. 1868. = Athyrium.

Th. glabrata var. hirsuta Tard., Not. Syst., 14: 344. 1952.

Th. glandulifera (Brack.) Reed, comb. nov. Basionym: Goniopteris glandulifera Brack., Expl. Exp., 16: 29. 1854. Samoan Isls. (Tutuila).

Thelypteris glanduligera (Kunze) Ching, Bull. Fan Mem. Inst. Biol., Bot. 6: 320. 1936. Basionym: Aspidium glanduligerum Kunze, Anal. Pterid., 44. 1837. Synonym: Dryopteris thelypteris var. koreana Nakai, Bot. Mag. Tokyo, 45: 97. 1931. Himalayas - Japan.

Th. glanduligera var. atripes Tard. in Lecomte's Flore Gen. de l'Indochine, 7(2). fasc. 8: 365. 1941. Annam.

Th. glanduligera var. elatior (D.C.Eaton) Kurata, in Namegata et Kurata, Enum. Jap. Pterid., 317, 343. 1961. Basionym: Athyrium cystopteroides var. elatius D.C.Eaton, Proc. Amer. Acad., 4: 110. 1858. Japan.

Th. glanduligera var. hyalostegia (H.Itô) H.Itô, Bot. Mag. Tokyo, 52: 589. 1938. Basionym: Dryopteris glanduligera var. hyalostegia H.Itô, Bot. Mag. Tokyo, 49: 363. 1935. = Th. angustifrons.

Th. glanduligera var. koreana (Nakai) H.Itô, Nova Flora Jap., 1: 130. 1939. Basionym: Dryopteris thelypteris var. koreana Nakai, Bot. Mag. Tokyo, 45: 97. 1931. Korea.

Th. glanduligera Ching, var. typica; H.Itô, Nova Flora Jap., 1: 130. 1939. Taiwan; Himalayas - Japan.

Th. glandulosa (Desv.) Proctor, Rhodora, 61: 306. (1959) 1960. Basionym: Polypodium glandulosum Desv., Berl. Mag., 5: 317. 1811. West Indies.

Th. glandulosolanosa (C.Chr.) Tryon, Rhodora, 69: 6. 1967. Basionym: Dryopteris glanduloso-lanosa C.Chr., Dansk Bot. Ark., 9(3): 61. 1937. Peru.

Th. glaucescens (Brause) Ching, Bull. Fan Mem. Inst. Biol., Bot. 10: 251. 1941. Basionym: Dryopteris glaucescens Brause, Engl. Bot. Jahrb., 56: 85. 1920. New Guinea.

Th. glaziovii (Christ) Reed, comb. nov. Basionym: Aspidium glaziovii Christ, Bull. Boiss., II, 2: 633. 1902. Brazil.

Th. globulifera (Brack.) Reed, comb. nov. Basionym: Lastrea globulifera Brack., Expl. Exp., 16: 194. 1854. Hawaii.

Th. glutinosa (C.Chr.) Morton, Amer. Fern Journ., 53: 66. 1963. Basionym: Dryopteris glutinosa C.Chr., Svensk Vet. Akad. Handl., III, 16(2): 18. 1937. Haiti.

Th. goedenii (Rosenst.) Reed, comb. nov. Basionym: Dryopteris goedenii Rosenst., Fedde Repert., 4: 292. 1907. S. Brazil.

*Th. goeppertii (Ett.) Reed, comb. nov. Basionym: Aspidium goepperti Ett., Die Farnkr. der Jetztwelt, 198. 1865. Synonym: Aspidites decussatus Goepp., Syst. Fil. Foss., 369, t. 26, f. 1-2. 1836; Pecopteris decussata Goepp., Ubersicht d. foss. Flora Schlesiens, 215. 1844. Upper Carboniferous: Silesia. Aff. Th. oligocarpa et Th. multilineata.

Th. goggilodus (Schkuhr) Small, Ferns S.E. States, 248 cum tab., 475. 1938. Basionym: Aspidium goggilodus Schkuhr, Krypt. Gew., 1: 193, t. 33C. 1809. = Th. totta.

Th. goldiana (Hook. ex Goldie) Nieuwl., Amer. Midl. Nat., 1: 226. 1910. Basionym: Aspidium goldianum Hook. ex Goldie, Edinb. Philos. Journ., 6: 333. 1822. = Dryopteris.

Th. gongylodes (Schkuhr) Small, Ferns S.E. States, 248, 475. 1938; Morton, Contrib. U.S. Nat. Herb., 38(2): 73. 1967; K.Iwats., Mem. Coll. Sci., Univ. Kyoto, Ser. B, 31(1): 31. 1964. Basio-

nym: Aspidium gongylodes (pro err. goggilodus) Schkuhr, Krypt. Gew., 1: 193. 1809. = Th. totta.

Thelypteris gracilescens (Blume) Ching, Bull. Fan Mem. Inst. Biol., Bot. 6: 327. 1936. Basionym: Aspidium gracilescens Blume, Enum. Pl. Jav., 155. 1828. Synonyms: Dryopteris sublaxa Hayata, Icon. Fl. Formosa, 4: 183, f. 121. 1914; Dryopteris arisanensis Rosenst., Hedwigia, 56: 340. 1915. S. India, Perak, Malesia, Taiwan, Philippine Isls. to Java and New Guinea, China (Yunnan), Japan (Kyushu).

Th. gracilis (Hew.) Proctor, Bull. Inst. Jamaica, Sci. Ser., No. 5: 60. 1953. Basionym: Gymnogramma gracilis Hew., Mag. Nat. Hist., II, 2: 457. 1838. West Indies.

Th. grammitoides (Christ) Ching, Bull. Fan Mem. Inst. Biol., Bot. 6: 317. 1936. Basionym: Aspidium grammitoides Christ, Bull. Herb. Boiss., 6: 193. 1898. Philippine Isls. (Luzon).

Th. grantii (Copel.) Ching, Bull. Fan Mem. Inst. Biol., Bot. 10: 251. 1941. Basionym: Dryopteris grantii Copel., Bernice P. Bishop Mus. Bull., 93: 8, t. 7C. 1932. Society Isls., Tahiti.

Th. granulosa (Presl) Reed, comb. nov. Basionym: Polypodium granulosum Presl, Rel. Haenk., 1: 24, t. 4, f. 2. 1825. Luzon, Timor.

Th. gregaria (Copel.) Reed, comb. nov. Basionym: Cyclosorus gregarius Copel., Journ. Arnold Arb., 24: 440. 1943. New Guinea.

Th. gretheri (Wagner) B.C.Stone, Micronesica, 2: 3. 1966. Basionym: Lastrea gretheri Wagner, Pacific Sci., 2(3): 214, f. 1. 1948. Mariana Isl. (Rota).

Th. griffithii (Moore) Reed, comb. nov. Basionym: Dictyocline griffithii Moore, Gard. Chron., 1855: 854. 1855; Ind. Fil., LIX. 1857. Synonyms: Aspidium griffithii (Moore) Diels, Nat. Pfl.-fam., 1(4): 186. 1899; Stegnogramma griffithii (Moore) K.Iwats., Mem. Coll. Sci., Univ. Kyoto, Ser. B, Biol. 31(1): 20. 1964. Himalayas to Japan, Taiwan, Tonkin, N. India.

Th. griffithii var. wilfordii (Hook.) Reed, comb. nov. Basionym: Hemionitis wilfordii Hook., Fil. Exot., t. 93. 1859. Synonyms: Dictyocline griffithii var. wilfordii (Hook.) Moore, Ind. Fil., 317. 1861; Dictyocline griffithii var. pinnatifida (Hook.) Bedd., Ferns Brit. Ind., t. 155. 1866; Dictyocline wilfordii J.Sm., Hist. Fil., 149. 1875. Japan.

Th. grisea (Baker in Hook. et Bak.) Ching, Bull. Fan Mem. Inst. Biol., Bot. 6: 331. 1936. Basionym: Nephrodium griseum Baker in Hook. et Bak., Syn. Fil., 271. 1867. S. India.

Th. grunowii (Bolle) Reed, comb. nov. Basionym: Aspidium grunowii Bolle, Bonplandia, 3: 123. 1855. Ins. Caboverdicae.

Th. guadalupensis (Wikstr.) Proctor, Bull. Inst. Jamaica, Sci. Ser., No. 5: 60. 1953. Basionym: Polypodium guadalupense Wikstr., Vet. Akad. Handl., 1825: 435. 1826. Synonym: Polypodium scolopendrioides L., Sp. Pl., ed. 2, 1585. 1763, non L., 1753. Guadeloupe.

Th. gueintziana (Mett.) Schelpe, Journ. S. Afr. Bot., 31: 262. 1965. Basionym: Aspidium gueintzianum Mett., Pheg. u. Asp., 83, n. 201. 1858. Trop. and S. Africa, Natal, Reunion.

Thelypteris guentheri (Rosenst.) Ching, Bull. Fan Mem. Inst. Biol., Bot. 10: 251. 1941. Basionym: Dryopteris guentheri Rosenst., Fedde Repert., 25: 59. 1928. Bolivia.

Th. guineensis (Christ in A. Cheval.) Alston, Bull. Brit. Mus. (Nat. Hist.), Bot. 1: 48. 1952. Basionym: Dryopteris guineensis Christ in A. Cheval., Journ. de Bot., 22: 22. 1909. Fr. Guinea.

Th. gustavii (Bedd.) Reed, comb. nov. Basionym: Nephrodium gustavi Bedd., Journ. Bot., 1893: 227. 1893. India.

Th. gymnocarpa (Copel.) Morton, Amer. Fern Journ., 56(4): 179. 1966. Basionym: Dryopteris gymnocarpon Copel. in Elmer, Leaflets Philip. Bot., 3: 807. 1910. Philippine Isls. (Mindanao).

Th. gymnocarpa subsp. amabilis (Tagawa) Morton, Amer. Fern Journ., 56(4): 179. 1966. Basionym: Leptogramma amabilis Tagawa, Acta Phytotax. Geobot., 7: 76. 1938. Ryuksu Isls., Okinawa.

Th. gymnopoda (Baker) Reed, comb. nov. Basionym: Nephrodium gymnopoda Baker, Trans. Linn. Soc., II. Bot., 4: 252. 1894. Synonym: Dryopteris athyriocarpa Copel., Philip. Journ. Sci. Bot., 3: 344. 1909. Borneo.

Th. haenkeana (Presl) Reed, comb. nov. Basionym: Nephrodium haenkeanum Presl, Epim. Bot., 46. 1849. Synonym: Nephrodium serratum Presl, 1825, non Aspidium serratum Swartz, 1806, nec Meniscium serratum Cav., 1803. Malesia - Polynesia.

Th. halconensis (Copel.) Reed, comb. nov. Basionym: Cyclosorus halconensis Copel., Philip. Journ. Sci., 81: 29. 1952. Philippine Isls. (Mindoro).

Th. hallieri (Christ) Reed, comb. nov. Basionym: Aspidium hallieri Christ, Ann. Jard. Buit., II, 5: 106. 1905. Borneo.

Th. hamifera (v.A.v.R.) Reed, comb. nov. Basionym: Dryopteris hamifera v.A.v.R., Bull. Jard. Bot. Buit., II, No. XVI: 12. 1914. Sumatra.

Th. handroi (Brade) Reed, comb. nov. Basionym: Dryopteris handroi Brade, Arquiv. Jard. Bot. Rio de Janeiro, 18: 24. 1962-65. Brazil.

Th. harcourtii (Domin) Ching, Bull. Fan Mem. Inst. Biol., Bot. 10: 251. 1941. Basionym: Dryopteris harcourtii Domin, Kew Bull., 1929: 219. 1929; Mem. R. Czech. Soc. Sci., n.s., 2: 198, t. 34, f. 1. 1929. Dominica.

Th. harrisonii (Baker) Reed, comb. nov. Basionym: Nephrodium harrisonii Baker, Ann. Bot., 5: 326 (harrisoni). 1891. Synonym: Nephrodium stenophyllum Baker, Journ. Bot., 1884: 363. 1884, non Sod. 1883. Costa Rica.

Th. harveyi (Mett. ex Kuhn) Proctor ex Iwats., Amer. Fern Journ., 53: 133. 1963. Basionym: Aspidium harveyi Mett. ex Kuhn, Linnaea, 36: 115. 1869. Synonym: Dryopteris euaensis Copel., Univ. Calif. Publ. Bot., 12: 391. 1931. Polynesia, Tonga Isl.

Th. hastata (Fée) Proctor, Bull. Inst. Jamaica, Sci. Ser., No. 5: 60. 1953. Basionym: Goniopteris hastata Fée, 11 Mem., 65, t. 18, f. 1 (p.p.). 1866. West Indies, Jamaica.

Th. hastato-pinnata (Brause) Reed, comb. nov. Basionym: Dryopteris hastato-pinnata Brause, Engl. Bot. Jahrb., 56: 112. 1920. New Guinea.

Thelypteris hattorii (H.Itô) Tagawa, Acta Phytotax. Geobot., 5: 195. 1936. Basionym: Dryopteris hattorii H.Itô, Bot. Mag. Tokyo, 49: 359. 1935. Japan (Kyusyu, Sikoku, Honsyu), China (Szechuan).

Th. hattorii var. nemoralis (Ching) Kurata in Namegata et Kurata, Enum. Jap. Pterid., 317, 343. 1961. Basionym: Thelypteris nemoralis Ching, Bull. Fan Mem. Inst. Biol., Bot. 6: 338. 1936. Japan, Cent. China.

Th. hawaiiensis Reed, nom. nov. Basionym: Stegnogramma sandwicensis Brack., Expl. Exp., 16: 26, t. 4, f. 2. 1854. Hawaii.

Th. heineri (C.Chr.) Reed, comb. nov. Basionym: Dryopteris heimeri C.Chr., Fedde Repert., 6: 380–381. 1909. Brazil.

Th. henriquesii (Baker in Henriq.) Tard., Not. Syst., 14: 344. 1952. Basionym: Polypodium henriquesii Baker in Henriq., Bol. Soc. Brot., 4: 154, t. 1. (1886) 1887. Guinea, S. Thome.

Th. herbacea Holtt., Gard. Bull. Singapore, 11: 268. 1947. Malay Peninsula.

Th. herzogii (Rosenst.) Tryon, Rhodora, 69: 6. 1967. Basionym: Dryopteris herzogii Rosenst., Meded. Rijks Herb. Leiden, Nr. 19: 15. 1913. Bolivia.

Th. heterocarpa (Blume) Morton, Amer. Fern Journ., 49: 113. 1959. Basionym: Aspidium heterocarpon Blume, Enum. Pl. Jav., 155. 1828. Micronesia (Kusaie, Palau, Ponape), Malesia, Hongkong, Malaysia to New Guinea, Bismarck Archipelago.

Th. heterocarpa var. glaucostipes (Bedd.) Reed, comb. nov. Basionym: Nephrodium glaucostipes Bedd., Handb. Suppl., 80. 1892. Perak, Malaya, Borneo, Sumatra, Mentawi Isls.

Th. heteroclita (Desv.) Ching, Bull. Fan Mem. Inst. Biol., Bot. 10: 252. 1941. Basionym: Polypodium heteroclitum Desv., Berl. Mag., 5: 318. 1811. West Indies, Jamaica. (Proctor, Bull. Inst. Jamaica, Sci. Ser., No. 5: 60. 1953).

Th. heterophlebia (Baker) Reed, comb. nov. Basionym: Polypodium heterophlebium Baker, Journ. Bot., 1884: 363. 1884. Costa Rica.

Th. heterophylla (Presl) K.Iwats., Mem. Coll. Sci., Univ. Kyoto, Ser. B, 31(1): 32. 1964. Basionym: Haplodictyum heterophyllum Presl, Epim. Bot., 51. 1849. Philippine Isls.

Th. heteroptera (Desv.) Tard. in Humbert, Fl. Madagas., Fam. 5: 276, f. 38 (6–10). 1958. Basionym: Nephrodium heteropterum Desv., Prodr., 256. 1827. Reunion, Madagascar.

Th. hewittii (Copel.) Reed, comb. nov. Basionym: Dryopteris hewittii Copel., Philip. Journ. Sci., Bot. 3: 344. 1909. Borneo.

Th. hexagonoptera (Michx.) Weatherby, Rhodora, 21: 179. 1919. Basionym: Polypodium hexagonopterum Michx., Fl. Bor. Amer., 2: 271. 1803. Texas to N. Florida, N to Minnesota and Quebec.

Th. hexagonoptera forma furcata (Reed) Reed, comb. nov. Basionym: Dryopteris hexagonoptera forma furcata Reed, Amer. Fern Journ., 37: 83. 1947. Pennsylvania.

Th. hexagonoptera forma simonsii (Reed) Reed, comb. nov. Basionym: Dryopteris hexagonoptera forma simonsii Reed, Amer. Fern Journ., 35: 105. 1945. Maryland.

Thelypteris hickenii (Abbiatti) Reed, comb. nov. Basionym: Cyclosorus hickenii Abbiatti, Darwiniana, 13(2-4): 537-538, f. 1, pl. 1. 1964. Argentina.

Th. hieronymusii (C.Chr.) Reed, comb. nov. Basionym: Dryopteris hieronymusii C.Chr., Vid. Selsk. Skr., VII, 4: 307. 1907. Colombia.

Th. hillii (Baker) Reed, comb. nov. Basionym: Polypodium hillii Baker in Hook. et Bak., Syn. Fil., 505. 1874. Synonym: Goniopteris ghiesbrechtii Bail., Handb. Ferns Queensland, 40. 1874. Australia (Queensland).

Th. himalaica (Ching) Reed, comb. nov. Basionym: Leptogramma himalaica Ching, Sinensia, 7: 100, t. 6. 1936. N.W.India.

Th. hirsutipes (Clarke) Ching, Bull. Fan Mem. Inst. Biol., Bot. 6: 314. 1936. Basionym: Nephrodium gracilescens var. hirsutipes Clarke, Trans. Linn. Soc., II. Bot., 1(8): 514, t. 67, f. 1. 1880. N. India, China (Yunnan), Japan, Khasia.

Th. hirtirachis (C.Chr.) Ching, Bull. Fan Mem. Inst. Biol., Bot. 6: 271. 1936. Basionym: Dryopteris hirtirachis C.Chr., Ind. Fil. Suppl. II: 15. 1917. = Th. paludosa.

Th. hirtisora (C.Chr.) Reed, comb. nov. Basionym: Dryopteris hirtisora C.Chr., Contrib. U.S. Nat. Herb., 26: 277. 1926. China (Yunnan), N. Thailand.

Th. hirto-pilosa (Rosenst.) Reed, comb. nov. Basionym: Dryopteris hirto-pilosa Rosenst., Med. Rijks Herb., No. 31: 7. 1917. Philippine Isls.

Th. hispida (Brause) Reed, comb. nov. Basionym: Dryopteris hispida Brause, Engl. Bot. Jahrb., 56: 102. 1920. Synonym: Dryopteris hispiduliformis C.Chr., Ind. Fil. Suppl. III: 88. 1934. New Guinea.

Th. hispidifolia (v.A.v.R.) Reed, comb. nov. Basionym: Dryopteris hispidifolia v.A.v.R., Bull. Jard. Bot. Buit., II, No. XX: 15. 1915. Borneo.

Th. hispidula (Decne.) Reed, comb. nov. Basionym: Aspidium hispidulum Decne., Nouv. Ann. Mus., 3: 346. 1834. E. Malesia, Philippine Isls., New Guinea, Samoa.

Th. hokouensis (Ching) Reed, comb. nov. Basionym: Cyclosorus hokouensis Ching, Bull. Fan Mem. Inst. Biol., Ser. II, 1: 289. 1949. China (Yunnan).

Th. horridipes (v.A.v.R.) Reed, comb. nov. Basionym: Dryopteris horridipes v.A.v.R., Bull. Buit., II, No. 28: 23. 1918. Sumatra.

Th. hosei (Baker) K.Iwats., Acta Phytotax. Geobot., 21(5-6): 170. 1965. Basionym: Meniscium hosei Baker, Journ. Linn. Soc., 22: 230. 1886. Borneo.

Th. hostmannii (Klotzsch) Morton, Contrib. U.S. Nat. Herb., 38: 59. 1967. Basionym: Polypodium hostmannii Klotzsch, Linnaea, 20: 397. 1847. Surinam.

Th. houi (Ching) Reed, comb. nov. Basionym: Cyclosorus houi Ching, Bull. Fan Mem. Inst. Biol., Ser. II, 1: 290. 1949. China (Kweichow).

Thelypteris hudsoniana (Brack.) Reed, comb. nov. Basionym: Nephrodium hudsonianum Brack., Expl. Exp., 16: 188, t. 25. 1854. Sandwich Isls.

Th. hunsteiniana (Brause) Reed, comb. nov. Basionym: Dryopteris hunsteiniana Brause, Engl. Bot. Jahrb., 56: 79. 1920. New Guinea.

Th. hydrophila (Fee) Proctor, Rhodora, 61: 306. (1959) 1960. Basionym: Phegopteris hydrophila Fee, 11 Mem. Foug., 56, t. 13, f. 3. 1866. Guadeloupe.

Th. illicita (Christ) Reed, comb. nov. Basionym: Dryopteris illicita Christ, Bull. Soc. Bot. Geneve, II, 1: 225. 1909. Costa Rica.

Th. imbricata (Liebm.) Reed, comb. nov. Basionym: Polypodium imbricatum Liebm., Vid. Selsk. Skr., V, 1: 210. 1849. Synonym: Aspidium varians Mett. ex Kuhn, Linnaea, 36: 114. 1869. Mexico.

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Th. imponens (Ces.) Reed, comb. nov. Basionym: Polypodium imponens Ces., Rend. Ac. Napoli, 16: 27, 29. 1877. New Guinea.

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N. Australia, Polynesia, Trop. Africa (Oubangui).

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Th. laevis (Mett.) Reed, comb. nov. Basionym: Aspidium laeve Mett., Pheg. u. Asp., 104, n. 249. 1858. Philippine Isls. (Luzon).

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Th. laxa var. typica forma glabrescens H.Itô, Nova Flora Jap., 1: 140. 1939. Japan.

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Th. lepidula (Hieron.) Alston, Journ. Wash. Acad. Sci., 48(7): 233. 1958. Basionym: Dryopteris lepidula Hieron., Hedwigia, 46: 328, t. 4, f. 7. 1907. Colombia.

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Th. limbata (Swartz) Proctor, Rhodora, 61: 306. (1959) 1960. Basionym: Aspidium limbatum Swartz, Schrad. Journ. Bot., 1800(2): 35. 1801. Synonym: Amauropelta breutelii Kunze, Farnkr., 1: 86, 109. 1843. West Indies, St. Kitts, Guadeloupe.

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Th. lineata (Blume) K.Iwats., Mem. Coll. Sci., Ser. B, 31(1): 34. 1964. Basionym: Aspidium lineatum Blume, Enum. Pl. Jav., 144. 1828. Synonym: Dryopteris tenompokensis C.Chr., Gardens Bull. Straits Settlements, 7: 248. 1934. Java, Borneo, Malaya.

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Thelypteris linkiana (Presl) Tryon, Rhodora, 69: 6. 1967. Basionym: Grammitis linkiana Presl, Tent. Pterid., 209. 1836; Gymnogramma polypodioides Link, Hort. Berol., 2: 50. 1833. Synonym: Gymnogramma diplazioides Desv., Mem. Soc. Linn. Paris, 6: 214. 1827. West Indies, Hispaniola.

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Th. lithophylla (Copel.) Reed, comb. nov. Basionym: Dryopteris lithophylla Copel., Philip. Journ. Sci., 12C: 57. 1917. Borneo.

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Th. lobata (Copel.) Reed, comb. nov. Basionym: Cyclosorus lobatus Copel., Philip. Journ. Sci., 81: 33. 1952. Philippine Isls.

Th. loheriana (Christ) Reed, comb. nov. Basionym: Aspidium loherianum Christ, Bull. Boiss., 6: 191. 1898. Philippine Isls. (Luzon).

Th. lomatosora (Copel.) Reed, comb. nov. Basionym: Dryopteris lomatosora Copel., Univ. Calif. Publ. Bot., 19: 298. 1941. Peru.

Th. lonchodes (D.C.Eaton) Ching, Bull. Fan Mem. Inst. Biol., Bot. 10: 252. 1941. Basionym: Aspidium lonchodes D.C.Eaton, Mem. Amer. Acad., n.s., 8: 210. 1860. Cuba.

Th. longicaulis (Baker) Reed, comb. nov. Basionym: Nephrodium longicaule Baker, Journ. Bot., 1881: 204. 1881. New Grenada.

Th. longicuspis (Baker) Schelpe, Journ. S. Afr. Bot., 31(4): 262. 1965. Basionym: Nephrodium longicuspe Baker, Journ. Linn. Soc., 16: 202. 1877. Synonym: Nephrodium zambesiacum Baker, Ann. Bot., 5: 318. 1891. Madagascar, Nyasaland.

Th. longifolia (Desv.) Tryon, Rhodora, 69: 7. 1967. Basionym: Meniscium longifolium Desv., Mem. Soc. Linn. Paris, 6: 223. 1827. Synonyms: Dryopteris longifolia (Fée) Hieron., 1907, illegit.; Dryopteris desvauxii Maxon et Morton, Bull. Torr. Bot. Club, 65: 369. 1938. Brazil.

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Th. longipes (Blume) Reed, comb. nov. Basionym: Aspidium longipes Blume, Enum. Pl. Jav., 155. 1828. Java, Celebes.

Th. longipetiolata (K.Iwats.) K.Iwats., Mem. Coll. Sci., Univ. Kyoto, Ser. B, 31(3): 194. 1965. Basionym: Abacopteris longipetiolata K.Iwats., Acta Phytotax. Geobot., 18: 11. 1959. Taiwan.

Thelypteris longipilosa (Sodiro) Reed, comb. nov. Basionym: Nephrodium longipilosum Sodiro, Sert. Fl. Ecuad., II: 26. 1908. Ecuador.

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Th. lugubriformis (Rosenst.) Tryon, Rhodora, 69: 7. 1967. Basionym: Dryopteris lugubriformis Rosenst., Fedde Repert., 7: 299. 1909. Peru.

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Th. macbridei (Maxon) Tryon, Rhodora, 69: 7. 1967. Basionym: Dryopteris macbridei Maxon, Journ. Wash. Acad. Sci., 34: 25. 1944. Peru.

Th. macgregorii (Baker) Ching, Bull. Fan Mem. Inst. Biol., Bot. 10: 252. 1941. Basionym: Nephrodium macgregorii Baker, Ann. Bot., 5: 320. 1892. New Guinea.

Th. macilenta E.P.St. John, Amer. Fern Journ., 26: 50, 52, t. 5. 1936. (Florida). = Dryopteris.

Th. macradenia (Sodiro) Morton, Amer. Fern Journ., 51: 38. 1961. Basionym: Nephrodium macrodenium Sodiro, Rec. 47. 1883. Ecuador.

Th. macroptera (Copel.) Reed, comb. nov. Basionym: Dryopteris macroptera Copel., Univ. Calif. Publ. Bot., 12: 392. 1931. Tonga.

Th. macropus (Mett.) Reed, comb. nov. Basionym: Aspidium macropus Mett., Fil. Lechl., 2: 20. 1859. Brazil.

Th. macrorhizoma E.P.St. John, Amer. Fern Journ., 32: 146-147. (1942) 1943. Florida.

Th. macrotis (Hook.) Tryon, Rhodora, 69: 7. 1967. Basionym: Nephrodium macrotis Hook., Sp. Fil., 4: 86. 1862. Peru.

Th. madagascariensis (Fée) Schelpe, Journ. S. Afr. Bot., 31(4): 267. 1965. Basionym: Goniopteris madagascariensis Fée, Mem. Foug. 5e: 251. 1852. Synonym: Goniopteris patens Fée, Mem. Foug. 5e: 253. 1852; Gymnogramma unita Kunze, Linnaea, 18: 115. 1844; Goniopteris silvatica Pappe et Raws., Syn. Fil., Afr. Austr., 39. 1858 (nom. illegit.); Nephrodium costulare Baker, Journ. Linn. Soc. Lond., Bot. 16: 203. 1877; Dryopteris gladiata C.Chr., Ark. f. Bot., 14(19): 4, t. 1. 1916. Madagascar, S. Afr. (Natal).

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Th. magna (Copel.) Reed, comb. nov. Basionym: Cyclosorus magnus Copel., Philip. Journ. Sci., 81: 30. 1952. Philippine Isls. (Negros).

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Th. malodora (Copel.) Reed, comb. nov. Basionym: Dryopteris malodora Copel., Philip. Journ. Sci., 60: 108, t. 13. 1936. Solomon Isls.

Th. mapirensis (Rosenst.) Alston, Journ. Wash. Acad. Sci., 48(7): 234. 1958. Synonym: Dryopteris mapirensis Rosenst., Fedde Repert., 6: 313. 1909. Colombia, Bolivia.

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Th. marginalis (L.) Nieuwl., Amer. Midl. Nat., 1: 226. 1910. Basionym: Polypodium marginale L., Sp. Pl., 1091. 1753. = Dryopteris.

Th. marginalis forma davenportii (Floyd) L.B.Smith, Rhodora, 30: 17. 1928. Basionym: Nephrodium marginale forma davenportii Floyd, Rhodora, 4: 245. 1902. = Dryopteris.

Th. marginalis forma elegans (Robinson) Weatherby ex Hoffm., Proc. Bost. Soc. Nat. Hist., 36: 197. 1922. Basionym: Aspidium marginale var. elegans J.Robinson, Bull. Essex Inst. (Salem, Mass.), 8: No. 3, 151. 1875. = Dryopteris.

Th. mascarensis (Baker) Reed, comb. nov. Basionym: Polypodium mascarense Baker in Hook. et Baker, Syn. Fil., ed. 1, 455. 1868. Madagascar.

Th. matutumensis (Copel.) Reed, comb. nov. Basionym: Dryopteris matutumensis Copel., Philip. Journ. Sci., 40: 299, t. 3. 1929. Philippine Isls. (Mindanao).

Th. mauensis (C.Chr.) Reed, comb. nov. Basionym: Polypodium clarkei Baker, Ann. Bot., 5: 457. 1891; Dryopteris mauensis C.Chr., Ind. Fil., 277. 1905. Hawaiian Isls. (Maui).

Th. mauritiana (Fée) Reed, comb. nov. Basionym: Nephrodium mauritianum Fée, Gen. Fil., 308. 1850-1852. Madagascar, Mascarenes.

Th. meeboldii (Rosenst.) Reed, comb. nov. Basionym: Dryopteris meeboldii Rosenst., Fedde Repert., 12: 247. 1913. S India.

Thelypteris megacuspis (Baker) Reed, comb. nov. Basionym: Polypodium megacuspe Baker, Journ. Bot., 1890: 266. 1890. Tonkin.

Th. megalocarpa (v.A.v.R.) Ching, Bull. Fan Mem. Inst. Biol., Bot. 10: 252. 1941. Basionym: Dryopteris megalocarpa v.A.v.R., Bull. Buit., III, 5: 199. 1922. Sumatra.

Th. megalodus (Schkuhr) Proctor, Bull. Inst. Jamaica, Sci. Ser., No. 5: 61. 1953. Basionym: Polypodium megalodus Schkuhr, Krypt. Gew., 1: 24, t. 19B. 1806. = Th. pennata.

Th. megaphylla (Mett.) K.Iwats., Mem. Coll. Sci., Univ. Kyoto, 31(1): 34. 1964. Basionym: Aspidium megaphyllum Mett., Ann. Lugd. Bat., 1: 233. 1864. N. India, Ceylon, Malesia, Ins. Comorae, West Afr.

Th. megaphylloides (Rosenst.) Reed, comb. nov. Basionym: Dryopteris megaphylloides Rosenst., Fedde Repert., 12: 174. 1913. New Guinea.

Th. melanochlaena (C.Chr.) Reed, comb. nov. Basionym: Dryopteris melanochlaena C.Chr., Smiths. Musc. Coll., 52: 384. 1909. Guatemala.

Th. melanophlebia (Copel.) Reed, comb. nov. Basionym: Dryopteris melanophlebia Copel., Philip. Journ. Sci., Bot. 6: 147. 1911. Philippine Isls. (Negros).

Th. membranacea (Mett.) Tryon, Rhodora, 69: 7. 1967. Basionym: Phegopteris membranacea Mett., Fil. Lechl., 2: 22. 1859. Synonym: Nephrodium lechleri Hieron., Engl. Bot. Jahrb., 34: 448. 1904. Peru.

Th. membranifera (C.Chr. in Bonap.) Reed, comb. nov. Basionym: Dryopteris membranifera C.Chr. in Bonap., Notes Pterid., 16: 170, t. 2. 1925. Madagascar.

Th. menisciicarpa (Blume) K.Iwats., Acta Phytotax. Geobot., 21(5-6): 171. 1965. Basionym: Aspidium menisciicarpon Blume, Enum. Pl. Jav., 142. 1828. Synonyms: Cyclosorus menisciicarpus (Blume) Holtt., Dansk Bot. Ark., 25(2): 39. 1967; Phegopteris cordifolia v.A.v.R., Bull. Jard. Bot. Buit., Ser. II, 11: 19, t. 5. 1913; Dryopteris mirabilis Copel., Philip. Journ. Sci., 6C: 137, t. 19. 1911; Dryopteris verreculosa v.A.v.R., Bull. Jard. Bot. Buit., Ser. II, 11: 12. 1913; Polypodium holophyllum Baker, Journ. Bot., 1888: 325. 1888, non P. holophyllum Baker, 1879. Malaya, Sumatra, Borneo, Java, Philippine Isls. (Palawan).

Th. meniscioides (Liebm.) Reed, comb. nov. Basionym: Polypodium meniscioides Liebm., Vid. Selsk. Skr., V, 1: 211. 1849. Synonym: Goniopteris rostrata Fée, 11 Mem., 64, t. 17, f. 3. 1866. Mexico-Panama, Guadeloupe.

Th. mercurii (A.Braun ex Hieron.) Reed, comb. nov. Basionym: Dryopteris mercurii A.Braun ex Hieron., Hedwigia, 46: 335, t. 5, f. 9. 1907; Aspidium mercurii A.Br., mcs., Christ 1906, nomen. Mexico - Costa Rica - Ecuador.

Th. merrillii (Christ) Reed, comb. nov. Basionym: Dryopteris merrillii Christ, Philip. Journ. Sci., Bot. 2: 201. 1907. Philippines.

Th. mertensioides (C.Chr.) Reed, comb. nov. Basionym: Dryopteris mertensioides C.Chr., Vid. Selsk. Skr., VII, 4: 328, f. 50. 1907. Costa Rica.

Thelypteris metcalfei (Baker) Reed, comb. nov. Basionym: Polypodium metcalfei Baker, Ann. Bot., 5: 461. 1891. New Hebrides.

Th. mesocarpa (Copel.) Reed, comb. nov. Basionym: Dryopteris mesocarpa Copel., Bishop Mus. Bull., 93: 9, t. 7A. 1932. Society Isls.

Th. metteniana Ching, Bull. Fan Mem. Inst. Biol., Bot. 10: 252. 1941. Basionym: Nephrodium palustre Baker in Hook. et Bak., Syn. Fil., 270. 1827, non Thelypteris palustris Schott, 1834. Brazil.

Th. mettenii (Copel.) Abbiatti, Darwiniana, 13(2-4): 566. 1964. Basionym: Lastrea mettenii Copel., Gen. Fil., 139 (nom. nov.). 1947. Synonyms: Dryopteris palustris (Mett. ex Fée) Kuntze, Rev. Gen. Pl., 2: 813. 1891; Aspidium palustre Mett. ex Fée, Crypt. Vasc. Bresil, 2: 76. 1872-1873. Brazil.

Th. mexiae (C.Chr. ex Copel.) Ching, Bull. Fan Mem. Inst. Biol., Bot. 10: 252. 1941. Basionym: Dryopteris mexiae C.Chr. ex Copel., Univ. Calif. Publ. Bot., 17: 32, t. 6. 1932. Brazil.

*Th. meyeri (Heer) Reed, comb. nov. Basionym: Aspidium meyeri Heer, Tertiärfl. der Helv., 1: 36, t. 11, f. 2. 1855. Tertiary, Miocene: Switzerland, Oeningen, Lausanne. Aff. Th. mollis.

Th. micans (Brause) Reed, comb. nov. Basionym: Dryopteris micans Brause, Engl. Bot. Jahrb., 56: 98. 1920. New Guinea.

Th. microbasis (Bak. in Hook. et Bak.) Tard., Not. Syst., 14: 344. 1952 (1953); Mem. IFAN, 28: 117, t. 20, f. 1. 1953. Basionym: Nephrodium microbasis Bak. in Hook. et Bak., Syn. Fil., 496. 1874. Synonym: Dryopteris adenochlamys C.Chr., Fedde Repert., 9: 370. 1911. Africa (Senegal, Sudan, Guinea, Fr. Guinea, Dahomey, Ivory Coast, Ghana, Nigeria).

Th. microcarpa (v.A.v.R.) Ching, Bull. Fan Mem. Inst. Biol., Bot. 10: 252. 1941. Basionym: Dryopteris microcarpa v.A.v.R., Bull. Buit., III, 2: 146. 1920. Sumatra.

Th. microloncha (Christ) Reed, comb. nov. Basionym: Dryopteris microloncha Christ, Philip. Journ. Sci., 2: 202. 1907. Philippines.

Th. microsora Reed, nom. nov. Basionym: Dryopteris microsora Copel., Bishop Mus. Bull., 59: 12. 1929 (homonym), non Dryopteris microsora (Hook.) Kuntze, 1891. Fiji.

Th. millei (C.Chr.) Reed, comb. nov. Basionym: Dryopteris millei C.Chr., Vid. Selsk. Skr., VII, 10: 138. 1913. Ecuador.

Th. mindanaensis (Christ) Reed, comb. nov. Basionym: Dryopteris mindanaensis Christ, Philip. Journ. Sci., Bot. 2: 194. 1907. Philippine Isls (Mindanao).

Th. minensis Abbiatti, Darwiniana, 13(2-4): 563-564, f. 8, t. 6. 1964. Brazil.

Th. minuscula (Maxon) Morton, Contrib. U.S. Nat. Herb., 38(2): 43. 1967. Basionym: Dryopteris minuscula Maxon, Kew Bull. Misc. Inf., 1932: 135. 1932. Colombia.

Th. minutula Morton, Amer. Fern Journ., 43: 173-174. 1953. Ecuador.

Th. mixta (Rosenst.) Reed, comb. nov. Basionym: Dryopteris mixta Rosenst., Fedde Repert., 12: 172. 1913. New Guinea.

Th. mollicella (Maxon) Ching, Bull. Fan Mem. Inst. Biol., Bot. 10: 252. 1941. Basionym: Dryopteris mollicella Maxon, Proc. Biol. Soc. Wash., 36: 49. 1923. Dominica.

Thelypteris mollicula (Kunze ex Link) Ching, Bull. Fan Mem. Inst. Biol., Bot. 10: 252. 1941. Basionym: Polypodium molliculum Kunze ex Link, Fil. Sp., 130. 1841. Trop. Amer.

Th. mollis (Mett.) Tryon, Rhodora, 69: 7. 1967. Basionym: Phegopteris mollis Mett., Ann. Sci. Nat., V. Bot., 2: 242. 1864, non Dryopteris mollis (Jacq.) Hieron., 1907. Synonym: Dryopteris permollis Maxon et Morton, Bull. Torr. Bot. Club, 65: 372. 1938. = Th. arborescens (Humb. et Bonpl.) Morton.

Th. milliuscula (Kuhn) K.Iwats., Fl. Eastern Himalaya, 484. 1966. Basionym: Aspidium molliusculum Kuhn, Bot. Zeit., 26: 41. 1868. N. India.

Th. moniliformis (Tagawa et K.Iwats.) K.Iwats., Mem. Coll. Sci., Univ. Kyoto, Ser. B, 31(1): 36. 1964. Basionym: Dimorphopteris moniliformis Tagawa et K.Iwats. ex K.Iwats., Acta Phytotax. Geobot., 19: 8. 1961. Molucca Isls.

Th. morobensis (Copel.) Reed, comb. nov. Basionym: Dryopteris morobensis Copel., Univ. Calif. Publ. Bot., 18: 221. 1942. New Guinea.

Th. mosenii (C.Chr.) Reed, comb. nov. Basionym: Dryopteris mosenii C.Chr., Vid. Selsk. Skr., VII, 4: 300, f. 27. 1907. Brazil.

Th. motleyana (Christ) Holtt., Rev. Fl. Mal., 2: 247, f. 140. (1954) 1955. Basionym: Aspidium motleyanum Christ, Ann. Jard. Buit., II, 5: 105. 1905; Nephrodium motleyanum Hook. ex Baker in Hook. et Baker, Syn. Fil., 266. 1867 (nomen). (Mesoneuron). Malaya (Java, Sumatra).

Th. multiauriculata (Copel.) Reed, comb. nov. Basionym: Dryopteris multiauriculata Copel., Univ. Calif. Publ. Bot., 18: 221. 1942. New Guinea.

Th. multiformis (C.Chr.) Reed, comb. nov. Basionym: Dryopteris multiformis C.Chr., Vid. Selsk. Skr., VII, 10: 154, f. 17. 1913. (Th. multiformis (C.Chr.) Murillo, Cat. Illus. Plantas de Cundinamarca, 2: 107 (nom. illegit.). 1966).

Th. multifrons (C.Chr. in Bonap.) Ching, Bull. Fan Mem. Inst. Biol., Bot. 10: 252. 1941. Basionym: Dryopteris multifrons C.Chr. in Bonap., Notes Pterid., 16: 172, t. 2B. 1925. Madagascar.

Th. multijugis (Bak. in Hook. et Bak.) Reed, Comb. nov. Basionym: Nephrodium multijugum Bak. in Hook. et Bak., Syn. Fil., 291. 1867. Malay Peninsula.

Th. multilineata (Wall. ex Hook.) Morton, Amer. Fern Journ., 49: 113. 1959. Basionym: Polypodium multilineatum Wall. ex Hook., Sp. Fil., 5: 11.(1863) 1864. Synonyms: Abacopteris multilineata Ching, 1938; Nephrodium moulmeinense Bedd., Handl. 275. 1883; Dryopteris moulmeinensis (Bedd.) C.Chr., 1905. Malay Peninsul., Selangor, Ceylon, N. India - S. China, Sumatra, Philippines.

Th. multilineata var. malayensis Reed, nom. nov. (Abacopteris multilineata var. malayensis Holtt., Rev. Mal. Fl., 2: 297. 1954 (nom. illegit.)). Laminae tenuiores, pinnae latiores cum non densatis marginibus, vix dentatis. Malaysia

Th. multiseta (Bak.) Ching, Bull. Fan Mem. Inst. Biol., Bot. 6: 347 (err. multisectum). 1936. Basionym: Nephrodium multisetum Bak., Journ. Linn. Soc. , 22: 226-227. 1886. Borneo, Java.

Thelypteris multisora (C.Chr. ex C.Chr. et Holtt.) Reed, comb. nov. Basionym: Dryopteris multisora C.Chr. ex C.Chr. et Holtt., Gard. Bull. Straits Settlements, 7: 241. 1934. Borneo.

Th. munda (Rosenst.) Ching, Bull. Fan Mem. Inst. Biol., Bot. 10: 252. 1941. Basionym: Dryopteris munda Rosenst., Med. Rijks Herb., No. 31: 5. 1917. New Guinea.

Th. muricata (Brause) Reed, comb. nov. Basionym: Dryopteris muricata Brause, Engl. Bot. Jahrb., 56: 106. 1920. New Guinea.

Th. muscicola Proctor, Rhodora, 63: 33. 1961. West Indies, Nevis.

Th. mutabilis (Brause) Reed, comb. nov. Basionym: Dryopteris mutabilis Brause, Engl. Bot. Jahrb., 56: 97. 1920. New Guinea.

Th. muzensis (Hieron.) Alston, Journ. Wash. Acad. Sci., 48(7): 233. 1958. Basionym: Dryopteris muzensis Hieron., Hedwigia, 46: 331, t. 4, f. 6. 1907. Colombia, Ecuador.

Th. myriosora (Copel.) Reed, comb. nov. Basionym: Dryopteris myriosora Copel., Philip. Journ. Sci., 60: 108, t. 14. 1936. Solomon Isls.

Th. namburensis (Bedd.) Reed, comb. nov. Basionym: Nephrodium namburense Bedd., Handb. Suppl. 1892, p. 69. Assam.

Th. navarrensis (Christ) Proctor, Bull. Inst. Jamaica, Sci. Ser., No. 5: 61. 1953. Basionym: Aspidium navarrense Christ, Bull. Boiss., II. 7: 262. 1907. Trop. Amer., Costa Rica, Jamaica, Haiti.

Th. neglecta (Brade et Rosenst.) Ching, Bull. Fan Mem. Inst. Biol., Bot. 10: 253. 1941. Basionym: Dryopteris neglecta Brade et Rosenst., Bol. Mus. Nac. Rio Janeiro, 7: 142, t. 7. 1931. Brazil.

Th. nemoralis Ching, Bull. Fan Mem. Inst. Biol., Bot. 6: 338. 1936. (China: Kiangsi, Anwhei). = Th. hattorii var.

Th. nemoralis (Sodiro) Tryon, Rhodora, 69: 7. 1967. Basionym: Nephrodium nemorale Sod., Crypt. Vasc. Quit., 267. 1893. (Ecuador). = Th. sodiroi.

Th. neo-auriculata (Ching) Ching, Bull. Fan Mem. Inst. Biol., Bot. 6: 281. 1936. Basionym: Dryopteris neo-auriculata Ching, Bull. Fan Mem. Inst. Biol., Bot. 2: 196, t. 10. 1931. China (Yunnan).

Th. nephrodioides (Klotsch.) Proctor, Bull. Inst. Jamaica, Sci. Ser., No. 5: 61. 1953. Basionym: Aspidium nephrodioides Klotzsch., Linnaea, 20: 370. 1847. Synonym: Nephrodium guadalupense Fée, 11e Mém. Foug.: 89, t. 24, f. 3. 1866. Trop. Amer. (Colombia, Jamaica).

Th. nephrolepioides (C.Chr.) Reed, comb. nov. Basionym: Dryopteris nephrolepioides C.Chr., Brittonia, 2: 295, f. 1 c-d. 1937. New Guinea.

Th. nervosa (Klotzsch.) Tryon, Rhodora, 69: 7. 1967. Basionym: Polypodium nervosum Klotzsch., Linnaea, 20: 386. 1847, non Polypodium nervosum Boj., 1837, nom. nud. Guiana.

Th. nesiotica (Maxon et Morton) Morton, Contrib. U.S. Nat. Herb., 38(2): 43. 1967. Basionym: Dryopteris nesiotica Maxon et Morton, Bull. Torr. Bot. Club, 65: 362, t. 12. 1938. Trinidad.

Th. nevadensis (Baker) Clute, ex Morton, Amer. Fern Journ., 48: 139. 1958. Basionym: Nephrodium nevadense Baker, Ann. Bot., 5: 320. 1891, non Aspidium nevadense D.C.Eaton, Ferns N. Amer., 1: 73,

t. 10. 1878, non. illegit. Synonym: Dryopteris oregana C.Chr., C.Chr., Ind. Fil., 281. 1905. Western United States. (Calif., Oregon).

Thelypteris nicaraguensis (Fourn.) Morton, Contrib. U.S. Nat. Herb., 38(2): 55. 1967. Basionym: Phegopteris nicaraguensis Fourn., Bull. Soc. Bot. France, 19: 252. 1872. Centr. Amer., Nicaragua.

Th. nigrescentia (Jenm.) Reed, comb. nov. Basionym: Polypodium nigrescentium Jenm., Gard. Chron., III, 17: 100. 1895. Jamaica.

Th. nipponica (Franch. et Sav.) Ching, Bull. Fan Mem. Inst. Biol., Bot. 6: 309. 1936. Basionym: Aspidium nipponicum Franch. et Sav., Enum. Pl. Jap., 2: 242. 1867, p. 636. 1869. Cent. and W. China, Japan.

Th. nipponica var. borealis (Hara) Hiyama in Yaso, 3: 130. 1937. Basionym: Dryopteris nipponica var. borealis Hara, Bot. Mag. Tokyo, 48: 695. 1934. Japan (Hokkaido, Honshu, Yezo, Saghalien).

Th. nipponica var. typica; H.Itô, Nova Flora Jap., 1: 133. 1929.

Th. nitens (Desv.) Tryon, Rhodora, 69: 7. 1967. Basionym: Polypodium nitens Desv., Mem. Soc. Linn. Paris, 6: 240. 1827. Andes, Peru-Ecuador.

Th. nitidula (Presl) Reed, comb. nov. Basionym: Nephrodium nitidulum Presl, Epim. Bot., 46. 1849. Synonyms: Nephrodium philippinense Baker, Ann. Bot., 5: 327. 1891; Nephrodium basilare Presl, Epim. Bot., 258 (nomen). 1849; Dryopteris basilaris (Presl) C.Chr., Ind. Fil., 254. 1905 (nom. illegit.); Cyclosorus serratus Copel., Philip. Journ. Sci., 81: 36. 1952; Fern Fl. Philip., 2: 365-366. 1958. Philippine Isls. (Luzon, Bohol).

Th. nockiana (Jenm.) Proctor, Bull. Inst. Jamaica, Sci. Ser., No. 61. 1953. Basionym: Nephrodium nockianum Jenm., Journ. Bot., 1886: 270. 1886. Jamaica.

*Th. nodosa (Goepp.) Reed, comb. nov. Basionym: Aspidites nodosus Goepp., Syst. Fil. Foss., 372, t. 23, f. 1. 1836. Synonyms: Pecopteris nodosa Goepp., Übersicht d. Foss. Flora Schlesiens, 2: 215. 1844; Aspidites leptorrhachis Goepp., Syst. Fil. Foss., 373, t. 23, f. 2. 1836; Aspidium nodosum (Goepp.) Ett., Die Farnkr. der Jetztwelt., 198. 1865. Upper Carboniferous: Silesia (Waldenburg). Aff. Th. noveboracensis.

Th. normalis (C.Chr.) Moxley, Bull. So. Calif. Acad. Sci., 19: 57. 1920. Basionym: Dryopteris normalis C.Chr., Ark. f. Bot., 9(11): 31. 1910. = Th. kunthii.

Th. normalis var. harperi (C.Chr.) Wherry, Amer. Fern Journ., 54: 146. 1964. Basionym: Dryopteris normalis var. harperi C.Chr., Dansk. Vid. Selsk. Skr., VII, 10: 182. 1913. = Th. kunthii.

Th. notabilis (Brause) Ching, Bull. Fan Mem. Inst. Biol., Bot. 10: 253. 1941. Basionym: Dryopteris notabilis Brause, Engl. Bot. Jahrb., 56: 91. 1920. New Guinea.

Th. novae-hiberniae Holtt., Dansk Bot. Ark., 25(2): 50. 1967. New Ireland, New Hebrides.

Th. noveboracensis (L.) Nieuwl., Amer. Midl. Nat., 1: 225. 1910. Basionym: Polypodium noveboracense L., Sp. Pl., 1091. 1753. Newfoundland to Minnesota, south to Georgia and Arkansas.

Thelypteris noveboracensis forma excurrens Neidorf, Amer. Fern Journ., 39: 101. 1949. New York.

Th. noveboracensis forma fragrans (Peck) Reed, comb. nov. Basionym: Aspidium noveboracense var. fragrans Peck, New York State Mus. Rept., 28: 84. 1876. Synonym: Aspidium noveboracense forma suaveolens D.C.Eaton, Ferns N. Amer., 1: 50. 1878. New York.

Th. novoguineensis (Brause) Reed, comb. nov. Basionym: Dryopteris novoguineensis Brause, Engl. Bot. Jahrb., 49: 21. 1912. New Guinea.

Th. nuna (J.W.Moore) Ching, Bull. Fan Mem. Inst. Biol., Bot. 10: 253. 1941. Basionym: Dryopteris nuna J.W.Moore, Bernice P. Bishop Mus. Bull., 102: 7. 1933. Society Isls., Raiatea.

Th. nymphalis (G.Forst.) Reed, comb. nov. Basionym: Polypodium nymphale G.Forst., Prodr., 81. 1786. New Zealand, Polynesia.

Th. obliquata (Mett.) Ching, Bull. Fan Mem. Inst. Biol., Bot. 10: 253. 1941. Basionym: Aspidium obliquatum Mett., Ann. Sci. Nat., IV, 15: 75. 1861. New Caledonia.

Th. obliterata (Swartz) Proctor, Bull. Inst. Jamaica, Sci. Ser., No. 5: 62. 1953. Basionym: Polypodium obliteratum Swartz, Prodr., 132. 1788. West Indies, Jamaica, Mexico.

Th. oblonga (Brause) Reed, comb. nov. Basionym: Dryopteris oblonga Brause, Engl. Bot. Jahrb., 56: 109. 1920. New Guinea.

Th. obstructa (Copel.) Reed, comb. nov. Basionym: Dryopteris obstructa Copel., Univ. Calif. Publ. Bot., 12: 378. 1931. Rarotonga.

Th. obtusata (v.A.v.R.) Ching, Bull. Fan Mem. Inst. Biol., Bot. 10: 253. 1941. Basionym: Dryopteris obtusata v.A.v.R., Bull. Buit., II, No. 28: 22. 1918. Sumatra.

Th. obtusifolia (Rosenst.) Reed, comb. nov. Basionym: Dryopteris obtusifolia Rosenst., Fedde Repert., 10: 336. 1912. New Guinea.

Th. occulta (Hope) Reed, comb. nov. Basionym: Nephrodium occultum Hope, Journ. Bomb. Nat. Hist. Soc., 12: 627, t. 13. 1899. N.India.

Th. ochropteroides (Baker) Proctor, Bull. Inst. Jamaica, Sci. Ser., No. 5: 62. 1953. Basionym: Nephrodium ochropteroides Baker, Ann. Bot., 5: 325. 1891. Jamaica, Panama – Colombia.

Th. ochthodes (Kunze) Ching, Bull. Fan Mem. Inst. Biol., Bot. 6: 300. 1936. Basionym: Aspidium ochthodes Kunze, Linnaea, 24: 282. 1851. S. China (Yunnan), Tomkin, Japan, S. India.

Th. odontosora (Bonap.) Ching, Bull. Fan Mem. Inst. Biol., Bot. 10: 253. 1941; Alston, Bol. Soc. Broter., Ser. II, 30: 26. 1956. Basionym: Dryopteris odontosora Bonap., Notes Pterid., 4: 17. 1917. Guiana.

*Th. oeningensis (A.Braun) Reed, comb. nov. Basionym: Goniopteris oeningensis A.Braun in Bruckmann, Jahresb. Ver. Vaterl. Naturk. Württ., 6: 226. 1850. Synonyms: Lastrea oeningensis (A.Braun) Heer, Fl. Tert. Helv., 1: 32, t. 6, f. 3. 1855; Dikstra, Foss. Cat, 68: 3905. 1968; Phegopteris oeningensis (A.Braun) Ett., Die Farnkr. der Jetztwelt., 196. 1865. Upper Miocene: Rumania, Baden (Oeningen), Hungary.

Th. ogasawarensis (Nakai) H.Itô, ex Honda, Nom. Pl. Jap., 520. 1939. Basionym: Dryopteris ogasawarensis Nakai, Rigakkwai 26, Apr. 10, 1928 (nomen); Bot. Mag. Tokyo, 43: 2. 1929. Bonin Isl.

Thelypteris oligocarpa (Humb. et Bonpl. ex Willd.) Ching, Bull. Fan Mem. Inst. Biol., Bot. 10: 253. 1941. Basionym: Polypodium oligocarpum Humb. et Bonpl. ex Willd. in L., Sp. Pl., ed. 4, 5: 201. 1810. West Indies (St. Kitts, Haiti, Jamaica, Cuba), Mexico - Costa Rica, Trop. Amer.

Th. oligocarpa var. crassistipitata (Hieron.) Reed, comb. nov. Basionym: Aspidium oligocarpum var. crassistipitatum Hieron., Engl. Bot. Jahrb., 22: 367.(1896) 1897. Argentina (Tucuman).

Th. oligodictya (Baker) Reed, comb. nov. Basionym: Acrostichum oligodictyon Baker, Journ. Linn. Soc., 24: 261. 1887. Synonym: Syngramma angusta Copel., Philip. Journ. Sci., 3C: 348. 1909. (Holttum, Blumea, 11: 530. 1962). Sarawak, Brunei.

Th. oligolepia (v.A.v.R.) Ching, Bull. Fan Mem. Inst. Biol., Bot. 10: 253. 1941. Basionym: Dryopteris oligolepia v.A.v.R., Nova Guinea, 14: 17. 1924. New Guinea.

Th. oligophlebia (Baker) Ching, Bull Fan Mem. Inst. Biol., Bot. 6: 339. 1936. Basionym: Nephrodium oligophlebium Baker, Journ. Bot., 291. 1875. = Th. torresiana.

Th. oligophlebia var. elegans (Koidz.) Ching, Bull. Fan Mem. Inst. Biol., Bot. 6: 339, 341. 1936. Basionym: Dryopteris elegans Koidz., Bot. Mag. Tokyo, 38: 108. 1924. = Th. torresiana.

Th. oligophlebia var. elegans forma lophaea (Ogata) Namegata et Kurata, Enum. Jap. Pterid., 344. 1961. Basionym: Dryopteris oligophlebia var. lophaea Ogata, Icon. Fil. Jap., 5: t. 227. 1933. (Japan).

Th. oligophlebia var. lasiocarpa (Hayata) H.Itô, Bot. Mag. Tokyo, 52: 589. 1938; Nakai et Honda, Nova Flora Jap., 1: 144. 1939. Basionym: Dryopteris lasiocarpa Hayata, Journ. Coll. Sci., Univ. Tokyo, 30: 417. 1911. = Th. torresiana.

Th. oligophlebia var. subtripinnata (Tagawa) H.Itô, Nova Flora Jap., 1: 144. 1939. Basionym: Dryopteris elegans var. subtripinnata Tagawa, Acta Phytotax. Geobot., 2: 193. 1933. = Th. viridifrons.

Th. oligophylla (Maxon) Proctor, Bull. Inst. Jamaica, Sci. Ser., No. 5: 62. 1953. Basionym: Dryopteris oligophylla Maxon, Contrib. U. S. Nat. Herb., 10: 489. 1908. = Th. invisa.

Th. omeigensis (Ching) Reed, comb. nov. Basionym: Cyclosorus omeigensis Ching, Bull. Fan Mem. Inst. Biol., Bot. Ser. II, 1: 289. 1949. China (Szechuan).

Th. omeiensis (Baker) Ching, Bull. Fan Mem. Inst. Biol., Bot. 6: 282. 1936. Basionym: Polypodium omeiense Baker, Journ. Bot., 1888: 229. 1888. Synonyms: Dryopteris izuensis Kodama in Matsum., Icon. Pl. Koisikav., II: 7, t. 88. 1914; Dryopteris pseudo-africana Makino et Ogata, Journ. Jap. Bot., 4: 140. 1927; Dryopteris leveillei Christ, Bull. Geogr. Bot. Mus., 1909: Mem. XX, 176. 1909. China (Szechuan, Kweichow), Taiwan, Japan (Kyushu, Honshu).

Th. oosora (Baker) Reed, comb. nov. Basionym: Nephrodium oosorum Baker, Kew Bull., 1896: 41. 1896. Borneo.

Th. ophiura (Copel.) Reed, comb. nov., Univ. Calif. Publ. Bot., 18: 220. 1942. New Guinea.

Thelypteris opaca (Don) Reed, comb. nov. Basionym: Hemionitis opaca Don, Prodr. Fl. Nepal., 13. 1825. Synonym: Gymnogramma obtusata Blume, Enum. Pl. Jav., 113. 1828. N. India, Java.

Th. opposita (Vahl) Ching, Bull. Fan Mem. Inst. Biol., Bot. 10: 253. 1941. Basionym: Polypodium oppositum Vahl, Eclogae Amer., 3: 53. 1807. Synonym: Cochlamys revoirei Fée, Gen. Fil., 297. 1852. Trop. Amer., Colombia, West Indies.

Th. oppositifolia (Hook.) Reed, comb. nov. Basionym: Polypodium oppositifolium Hook., Sp. Fil., 5: 8. 1863. Guinea, S. Thome.

Th. oppositiformis (C.Chr. in Bonap.) Ching, Bull. Fan Mem. Inst. Biol., Bot. 10: 253. 1941. Basionym: Dryopteris oppositiformis C.Chr. in Bonap., Notes Pterid., 16: 173, t. 2. 1925. Madagascar.

Th. oppositipinna (v.A.v.R.) Ching, Bull. Fan Mem. Inst. Biol., Bot. 6: 268. 1936. Basionym: Phegopteris oppositipinna v.A.v.R., Bull. Jard. Bot. Buit., Ser. II, 16: 24. 1914. E. Himalayas to Malaya and Sumatra.

Th. orbicularis (C.Chr.) Reed, comb. nov. Basionym: Dryopteris orbicularis C.Chr., Ind. Fil., 281. 1905. Synonyms: Aspidium nephrodioides Hook., Sp. Fil., 4: 42, t. 235. 1862, non Klotzsch., 1847; Aspidium hookeri Baker, Syn. Fil., 257. 1867, non Wall. 1829 nec Klotsch. 1847. Malesia.

Th. oregana (C.Chr.) H. St. John, Proc. Biol. Soc. Wash., 41: 192. 1928. Basionym: Dryopteris oregana C.Chr., Ind. Fil., 286. 1905. = Th. nevadensis.

Th. oreopteris (Ehrh. in Willd.) Slosson ex Rydb., Flora Rocky Mts., 1043. 1917. Basionym: Polypodium oreopteris Ehrh. (in Willd., Prodr., 292. 1787) Beitr. Naturk. Verw. Wiss., 4: 44 . 1789. = Th. limbosperma.

Th. oreopteris (var.) hesperia Slosson ex Rydb., Flora Rocky Mts., 1044. 1917. = Th. limbosperma.

Th. organensis (Rosenst.) Ching, Bull. Fan Mem. Inst. Biol., Bot. 10: 253. 1941. Basionym: Dryopteris organensis Rosenst., Fedde Repert., 20: 91. 1924. Brazil.

Th. ornata (Wall. ex Bedd.) Ching, Bull. Fan Mem. Inst. Biol., Bot. 6: 346. 1936. Basionym: Polypodium ornatum Wall. ex Bedd., Ferns S. India, t. 171. 1864. (= Th. setigera ?). India, Burma, Taiwan.

Th. orthocaulis (K.Iwats.) Reed, comb. nov. Basionym: Cyclosorus orthocaulis K.Iwats., Amer. Fern Journ., 53: 135, t. 9. 1963. Tonga.

Th. ovata R.P.St.John in Small, Ferns S.E. States, 230, tab. 1938. Florida, Alabama, Georgia.

Th. ovata (var.) harperi (C.Chr.) R.P.St. John in Small, Ferns S.E. States, 233. 1938. Basionym: Dryopteris normalis var. harperi C.Chr., Dansk. Vid. Selsk. Skr., VII, 10: 182. 1913. = Th. kunthii.

Th. oxyoura (Copel.) Reed, comb. nov. Basionym: Dryopteris oxyoura Copel., Philip. Journ. Sci., 60: 107, t. 12. 1936. Solomon Isls.

Th. pachyrachis (Kunze ex Mett.) Ching, Bull. Fan Mem. Inst. Biol., Bot. 10: 253. 1941; Proctor, Bull. Inst. Jamaica, Sci. Ser., 5: 62. 1953. Basionym: Aspidium pachyrachis Kunze ex Mett., Pheg. u. Asp., 83, n. 199. 1858. Trop Amer., Colombia, Venezuela.

Thelypteris pachyrachis var. bogatensis (C.Chr.) Alston, Journ. Wash. Acad. Sci., 48(7): 233. 1958. Basionym: Dryopteris pachyrachis var. bogatensis C.Chr., Kgl. Dansk. Vid. Selsk. Skr., VII, 4: 306. 1907. Colombia.

Th. pachyrachis var. jenmani (Baker) Proctor, Bull. Inst. Jamaica, Sci. Ser., No. 5: 63. 1953. Basionym: Nephrodium jenmani Baker ex Jenm., Journ. Bot., 15: 263. 1877. Jamaica.

Th. pacifica Reed, nom. nov. Basionym: Polypodium clarkei Baker, Ann. Bot., 5: 457. 1891, non Pleocnemia clarkei Bedd., 1876. Hawaiian Isls.

Th. palauensis (Hosok.) Reed, comb. nov. Basionym: Meniscium palauense Hosok., Trans. Nat. Hist. Soc. Formosa, 28: 148. 1938. Palau Isl.

Th. palawanensis Reed, nom. nov. Basionym: Cyclosorus subdimorphus Copel., Philip. Journ. Sci., 81: 38. 1952. Philippine Isls. (Palawan).

Th. paleata (Copel.) Holtt., Rev. Fl. Mal., 2: 249, f. 141. (1954) 1955. Basionym: Dryopteris paleata Copel., Philip. Journ. Sci., 9C: 228. 1914. Sumatra, Borneo, Malaya.

*Th. paleoelegans Reed, nom. nov. Basionym: Pecopteris arguta Brongn., Hist. Veg. Foss., 1: 303, t. 108, f. 3. 1828, non Aspidium arguta Kaulf., 1824. Synonyms: Phegopteris arguta (Brongn.) Ett., Die Farnkr. der Jetztwelt, 195. 1865; Pecopteris elegans Germar, Petref., 39, t. 15. 1844, non Pecopteris elegans Sternb., 1821; Polypodites elegans (Germar) Goepp., Syst. Fil. Foss., 344, t. 15, f. 10. 1836; Unger, Gen. et Sp. Pl. Foss., 168. 1850. Carboniferous: France, Germany; Rhode Island. Aff. Th. decussata et Th. meniscioides.

Th. pallescens (Brause) Ching, Bull. Fan Mem. Inst. Biol., Bot. 10: 253. 1941. Basionym: Dryopteris pallescens Brause, Engl. Bot. Jahrb., 56: 88. 1920. New Guinea.

Th. paludosa (Blume) K.Iwats., Acta Phytotax. Geobot., 19: 11. 1961. Basionym: Aspidium paludosum Blume, Enum. Pl. Jav., 168. 1828. Synonyms: Polypodium pyrrhorhachis Kunze, Linnaea, 24: 257. 1851; Polypodium distans D.Don, Prodr. Fl. Nepal., 2. 1825, non Kaulf. 1824; Dryopteris brunnea Wall. ex C.Chr., Ind. Fil., 255. 1905; Dryopteris somai Hayata, Icon. Pl. Formos., 5: 287. 1915; Dryopteris christii Lév., Fl. Kouy-Tscheou, 491. 1915; Dryopteris hirtirachis C.Chr., Ind. Fil. Suppl., II: 15. 1917. Malaysia, N. India – Taiwan, S. China, Tonkin, Luzon, Polynesia.

Th. palustris Schott, Gen. Fil. in Obs. sub t. 10. 1834. Synonym: Acrostichum thelypteris L., Sp. Pl., 2: 1071. 1753; Polypodium palustre Salisb., Prodr., 403. 1796 (nom. illegit.). Semicosmopolitan (Europe, Algeria, Asia temp., Himalaya, Cent. China, S. India, Atl. N. Amer., Trop. Africa, New Zealand). (An Th. confluens (Thunb.) Morton, 1967).

Th. palustris forma afurcata Clute, Our Ferns, 151, 387. 1938. = Th. palustris var. pubescens.

Th. palustris forma glabra H.Itô in Nakai et Honda, Nova Flora Jap., 1: 127 (nota). 1939. Europe, Manchuria, Korea.

Thelypteris palustris var. haleana Fernald, Rhodora, 31: 34. 1929. Florida to Louisiana, N to Pennsylvania; Bermuda.

Th. palustris forma pubescens (Lawson) Clute, Our Ferns, 152, 387. 1938. Basionym: Lastrea thelypteris [pubescens Lawson, Edinb. New Phil. Journ., n.s., 19: 277. 1864. = Th. palustris var.

Th. palustris var. pubescens (Lawson) Fernald, Rhodora, 31: 34, t. 180. 1929. Basionym: Lastrea thelypteris [pubescens Lawson, Edinb. New Phil. Journ., n.s., 19: 277. 1864. Newfoundland to Manitoba, S to Georgia and Oklahoma; N.E.Asia (Kamtschatka).

Th. palustris var. pubescens forma linearis (Farwell) Reed, comb. nov. Basionym: Filix thelypteris var. linearis Farwell, Papers Mich. Acad. Sci., 2: 14. 1923. Michigan.

Th. palustris var. pubescens forma pufferae (A.A.Eaton) Reed, comb. nov. Basionym: Nephrodium thelypteris forma pufferae A.A.Eaton, Fern Bull., 10: 78. 1902. E. Massachusetts.

Th. palustris var. pubescens forma suaveolens (Clute) Reed, comb. nov. Basionym: Nephrodium thelypteris forma suaveolens Clute, Fern Bull., 18: 87. 1910. Nova Scotia, New Hampshire.

Th. palustris forma pufferae (A.A.Eaton) L.B.Smith, Rhodora, 30: 16. 1928. Basionym: Nephrodium thelypteris forma pufferae A.A.Eaton, Fern Bull., 10: 78. 1902. = Th. palustris var. pubescens forma.

Th. palustris var. squamigera (Schlecht.) Weatherby in Johnston, Contrib. Gray Herb., 73: 40. 1924; Tard., Mem. IFAN, 28: 119, t. 20, f. 7-8. 1953. Basionym: Aspidium thelypteris var. squamigerum Schlecht., Adumbr., 23, t. 11. 1825. = Th. confluens.

Th. palustris forma suaveolens (Clute) Fernald, Rhodora, 23: 165. 1921. Basionym: Nephrodium thelypteris forma suaveolens Clute, Fern Bull., 18: 87. 1910. = Th. palustris var. pubescens forma.

Th. palustris Schott, var. typica; Fernald, Rhodora, 31: 33. 1929.

Th. panamensis (Presl) E.P.St. John, Amer. Fern Journ., 26: 44. 1936. Basionym: Nephrodium panamense Presl, Rel. Haenk., 1: 35. 1825. (Mexico-Panama, Cuba, Jamaica). = Th. resinifera.

Th. papilio (Hope) K.Iwats., Mem. Coll. Sci., Univ. Kyoto, Ser. B, 31(3): 175. 1965. Basionym: Nephrodium papilio Hope, Journ. Bombay Nat. Hist. Soc., 12: 625, t. 12. 1899. Himalaya, Sikkim, N. India, Assam, Ceylon, Taiwan.

Th. papyracea (Bedd.) Reed, comb. nov. Basionym: Nephrodium papyraceum Bedd., Handb. Suppl., 69. 1892. N. India.

Th. paraphysata (Copel.) Reed, comb. nov. Basionym: Dryopteris paraphysata Copel., Philip. Journ. Sci., Bot. 6: 74. 1911. New Guinea.

Th. parasitica (L.) Tard. in Tard. et C.Chr., Not. Syst., Paris, 7: 75. 1938; Fosberg, Occ. Pap. Bish. Mus., 23(2): 30. 1962; K.Iwats., Journ. Jap. Bot., 38: 315. 1963. Basionym: Polypodium parasiticum L., Sp. Pl., 2: 1090. 1753. Synonym: Dryopteris mollis var. subglabra Hosok., Trans. Nat. Hist. Soc. Formos., 26: 78. 1936. Southeast Asia, China (Yunnan, Kwangtung), S. Japan, Taiwan, Caroline Isls., New Zealand, trop. and subtrop. Atl. Isls.

Thelypteris parasitica forma boninensis (H.Itô) Reed, comb. nov. Basionym: Cyclosorus parasiticus forma boninensis H.Itô, Bot. Mag. Tokyo, 51: 727. 1937. Bonin Isls.

Th. parasitica var. formosana (Ching) Reed, comb. nov. Basionym: Cyclosorus parasiticus var. formosanus Ching, Bull. Fan Mem. Inst. Biol., Bot. 8: 205. 1938. Taiwan.

Th. parasitica forma latiloba (H.Itô) Reed, comb. nov. Basionym: Cyclosorus parasiticus forma latilobus H.Itô, Bot. Mag. Tokyo, 51: 727. 1937. Bonin Isls.

Th. parasitica forma pilosissima (H.Itô) Reed, comb. nov. Basionym: Cyclosorus parasiticus forma pilosissimus H.Itô, Bot. Mag. Tokyo, 51: 727. 1937. Japan (Ryukyus).

Th. parasitica forma subglabra (Hosok.) Reed, comb. nov. Basionym: Dryopteris mollis var. subglabra Hosok., Trans. Nat. Hist. Soc. Formos., 26: 78. 1936. Japan (Sikoku, Kyushu, Ryukyus).

Th. parathelypteris (Christ) Ching, Bull. Fan Mem. Inst. Biol., Bot. 6: 314. 1936. Basionym: Aspidium parathelypteris Christ, Bull. Soc. Bot. France, 52 (Mem. 1): 36. 1905. China.

Th. paripinnata (Copel.) Reed, comb. nov. Basionym: Dryopteris paripinnata Copel., Univ. Calif. Publ. Bot., 18: 220. 1942. New Guinea.

Th. patens (Swartz) Small, Ferns S.E. States, 243, 475, tab. 1938. Basionym: Polypodium patens Swartz, Prodr., 133. 1788. West Indies, Mexico to Argentina and Paraguay, Galapagos Isls.

Th. patens var. dependens (C.Chr.) Proctor, Bull. Inst. Jamaica, Sci. Ser., No. 5: 63. 1953. Basionym: Dryopteris patens var. dependens C.Chr., Danek Vid. Selsk. Skr., VII, 10: 178. 1913. Jamaica.

Th. pauciflora (Hook.) Reed, comb. nov. Basionym: Meniscium pauciflorum Hook., Sp. Fil., 5: 164. 1964. (Menisorus Alston, 1956). Trop. West Africa.

Th. paucinervata (C.Chr.) Reed, comb. nov. Basionym: Dryopteris paucinervata C.Chr., Ind. Fil., 283. 1905. Synonym: Polypodium oligophlebium Baker in Hook. et Baker, Syn. Fil., 506. 1874, non P. oligophlebium Kunze, 1850. Peru.

Th. paucipinnata (Donn.Smith) Reed, comb. nov. Basionym: Nephrodium fendleri var. paucipinnatum Donn.Smith, Bot. Gaz., 12: 134. 1887. Guatemala. Synonym: Dryopteris donnell-smithii Maxon, Contrib. U.S. Nat. Herb., 13: 19. 1909.

Th. pavoniana (Klotzsch) Tryon, Rhodora, 69: 7. (Mar. 31). 1967; Crabbe, Brit. Fern Gaz., 9(8): 318. 1967. Basionym: Polypodium pavonianum Klotzsch, Linnaea, 20: 386. 1847. Peru.

Th. pectiniformis (C.Chr.) Ching, Bull. Fan Mem. Inst. Biol., Bot. 10: 253. 1941. Basionym: Dryopteris pectiniformis C.Chr., Gard. Bull. Straits Settlements, 4: 379. 1929. Malaya, Perak.

Th. pectiniformis var. eglandulosa Reed, nom. nov. Rachis et costae eglandulosae. Malaya. (Holtt., Rev. Fl. Mal., 2: 254. (1954) 1955, nom. illegit.).

Th. pectiniformis var. hirsuta Reed, nom. nov. Pinnae subtus hirsutae. Malaya, Padang. (Holtt., Rev. Fl. Mal., 2: 254. (1954) 1955, nom. illegit.).

Thelypteris peltata (v.A.v.R.) Reed, comb. nov. Basionym: Dryopteris peltata v.A.v.R., Bull. Jard. Bot. Buit., II, No. 16: 12. 1914. Sumatra.

Th. peltochlamys (C.Chr.) Reed, comb. nov. Basionym: Dryopteris peltochlamys C.Chr., Dansk Bot. Ark., 9: 65. 1937. Sumatra, Java, Malaya.

Th. penangiana (Hook.) Reed, comb. nov. Basionym: Polypodium penangianum Hook., Sp. Fil., 5: 13 (panangianum). 1863. China, N. India, Penang.

Th. pennata (Poir. in Lam.) Morton, Contrib. U.S. Nat. Herb., 38(2): 64. 1967. Basionym: Polypodium pennatum Poir. in Lam., Encycl. Meth., 5: 535. 1804. Synonyms: Polypodium megalodus Schkuhr, Kr. Gew., 1: 24, t. 19b. 1806; Thelypteris megalodus Proctor, 1953. Trop. Amer.

Th. pennigera (G.Forst.) Allan, Fl. N. Zeal., 51. 1961. Basionym: Polypodium pennigerum G.Forst. f., Prodr., 82. 1786. New Zealand, Polynesia, Philippine Isls.

Th. pentaphylla (Rosenst.) Reed, comb. nov. Basionym: Dryopteris pentaphylla Rosenst., Fedde Repert., 12: 529. 1913. New Guinea.

Th. perakensis (Bedd.) Reed, comb. nov. Basionym: Aspidium perakense Bedd., Journ. Bot., 1888: 4. 1888. Perak.

Th. perglandulifera (v.A.v.R.) Reed, comb. nov. Basionym: Dryopteris perglandulifera v.A.v.R., Bull. Buit., III, 2: 150. 1920. Sumatra.

Th. peripae (Sodiro) Reed, comb. nov. Basionym: Nephrodium peripae Sodiro, Rec., 52. 1883; Crypt. Vasc. Quit., 265. 1893. Ecuador.

Th. perpilifera (v.A.v.R.) Reed, comb. nov. Basionym: Dryopteris perpilifera v.A.v.R., Bull. Jard. Bot. Buit., II, No. 11: 12. 1913. New Guinea.

Th. perpubescens (Alston) Reed, comb. nov. Basionym: Dryopteris perpubescens Alston, Journ. Bot., 78: 227. 1940 (Oct.); Nova Guinea, Ser. 2, 4: 111, t. 8. 1940 (Dec.). New Guinea.

Th. perstrigosa (Maxon) Ching, Bull. Fan Mem. Inst. Biol., Bot. 10: 253. 1941. Basionym: Dryopteris perstrigosa Maxon, Kew Bull., 1932: 135. 1932. Colombia.

Th. peruviana (Rosenst.) Tryon, Rhodora, 69: 7. 1967. Basionym: Dryopteris peruviana Rosenst., Fedde Repert., 7: 298. 1909. Peru.

Th. petelotii Ching, Bull. Fan Mem. Inst. Biol., Bot. 6: 326. 1936. Tonkin.

Th. petrophila (Copel.) Reed, comb. nov. Basionym: Dryopteris petrophila Copel., Univ. Calif. Publ. Bot., 18: 220. 1942. New Guinea.

Th. phacelothrix (C.Chr. et Rosenst. ex Rosenst.) Tryon, Rhodora, 69: 7. 1967. Basionym: Dryopteris phacelothrix C.Chr. et Rosenst. ex Rosenst., Fedde Repert., 11: 56. 1912. Bolivia.

Th. phegopteris (L.) Slosson ex Rydb., Flora Rocky Mts., 1043. 1917. Basionym: Polypodium phegopteris L., Sp. Pl., 2: 1089. 1753. Synonym: Phegopteris polypodioides Fée, Gen. Fil., 243. 1850–1852. Newfoundland to Alaska, S to Pennsylvania, in mts. to W. N.C. and E. Tenn., west to Washington; Aleutians; Greenland; Iceland, Siberia; N and NW China; N. India; Asia Minor; northern Europe.

Thelypteris philippina (Presl) Ching, Bull. Fan Mem. Inst. Biol., Bot. 10: 253. 1941. Basionym: Physematium philippinum Presl, Epim. Bot., 34. 1849. Philippine Isls.

Th. physematioides (Kuhn et Christ ex Krug in Urban) Morton, Amer. Fern Journ., 43: 174. 1953. Basionym: Aspidium physematioides Kuhn et Christ ex Krug in Urban, Engl. Bot. Jahrb., 24: 115. 1897. Hispaniola.

Th. piedrensis (C.Chr.) Morton, Amer. Fern Journ., 53: 69. 1963. Basionym: Dryopteris piedrensis C.Chr., Smiths. Misc. Coll., 52: 372. 1909. Cuba, Puerto Rico.

Th. pilosa (Martens & Gal.) Crawford, Amer. Fern Journ., 41: 16, t. 3a. 1951. Basionym: Gymnogramma pilosa Martens et Gal., Mem. Acad. Brux., 15: 27, t. 4, f. 1. 1842. Mexico-Guatemala.

Th. pilosa var. alabamensis Crawford, Amer. Fern Journ., 41: 19-20, t. 3b. 1951. Alabama; Mexico.

Th. pilosa var. major (Fourn.) Crawford, Amer. Fern Journ., 41: 19, t. 4. 1951. Basionym: Gymnogramma pilosa var. major Fourn., Mex. Pl., 1:.73. 1872; Gymnogramma procurrens Fée, Mém. Foug. 8: 78. 1857; G. totta var. procurrens Baker in Hook. et Baker, 1874 (illegit.); Dryopteris pilosa var. procurrens C.Chr., 1913 (illegit.). Mexico-Guatemala.

Th. pilosissima Morton, Fieldiana, 28: 11-12. 1951. Venezuela.

Th. pilosiuscula (Zippel ex Racib.) Reed, comb. nov. Basionym: Nephrodium pilosiusculum Zippel ex Racib., Pterid. Buit., 189. 1898. Java.

Th. piloso-hispida (Hook.) Alston, Journ. Wash. Acad. Sci., 48(7): 233. 1958. Basionym: Nephrodium piloso-hispidum Hook., Sp. Fil., 4: 105. 1862. Mexico - Bolivia, Colombia.

Th. piloso-squamata (v.A.v.R.) Reed, comb. nov. Basionym: Dryopteris piloso-squamata v.A.v.R., Bull. Dept. Agric. Ind. Neerl., 21: 4. 1908. New Guinea.

Th. pilosula (Mett.) Tryon, Rhodora, 69: 7. 1967. Basionym: Aspidium pilosulum Mett., Fil. Hort. Bot. Lips., 130. 1856; Aspidium lasiesthes Mett., 1856, non Aspidium lasiethes Kunze, 1850 (nom. nud.); non Aspidium pilosulum Wall., 1829 (nom. nud.). Mexico-Peru.

Th. pinnata (Copel.) Ching, Bull. Fan Mem. Inst. Biol., Bot. 10: 253. 1941. Basionym: Dryopteris pinnata Copel., Univ. Calif. Publ. Bot., 14: 373. 1929. Sumatra.

Th. pittieri (C.Chr.) Reed, comb. nov. Basionym: Dryopteris pittieri C.Chr., Smiths. Misc. Coll., 52: 393. 1909. Colombia.

Th. pittsfordensis (Slosson) Victorin, Fil. Quebec, 2: 51. 1933. Basionym: Dryopteris pittsfordensis Slosson, Rhodora, 6: 75. 1904. (Vermont, Quebec). = Dryopteris.

Th. platensis Abbiatti, Darwiniana, 13(2-4): 553, f. 5, t. 3. 1964. Argentina.

Th. platyptera (Copel.) Reed, comb. nov. Basionym: Dryopteris platyptera Copel., Univ. Calif. Publ. Bot., 18: 219. 1942. New Guinea.

Thelypteris plumosa (C.Chr.) Reed, comb. nov. Basionym: Dryopteris plumosa C.Chr., Dansk. Bot. Ark., 9(3): 65-66. 1937. Borneo.

Th. plurifolia (v.A.v.R.) Reed, comb. nov. Basionym: Dryopteris plurifolia v.A.v.R., Bull. Buit., III, 5: 201. 1922. Sumatra.

Th. poecilophlebia (Hook.) Reed, comb. nov. Basionym: Polypodium poecilophlebium Hook., Sp. Fil., 5: 14. 1863. Australia.

Th. poiteana (Bory) Proctor, Bull. Inst. Jamaica, Sci. Ser., No. 5: 63. 1953. Basionym: Lastrea poiteana Bory, Dict. Class., 9: 233. 1826. Synonym: Polypodium crenatum Swartz, Prodr., 132. 1788, non Forsk., 1775. Trop. Amer., Jamaica, Galapagos Isls.

Th. polycarpa (Blume) K.Iwats., Mem. Coll. Sci., Univ. Kyoto, Ser. B, 31(1): 32. 1964. Basionym: Aspidium polycarpon Blume, Enum. Pl. Jav., 156. 1828. Synonym: Sphaerostephanos asplenioides J.Sm., in Hook. et Bauer, Gen. Fil., 21. 1839. Malaysia, Thailand Pen.

Th. polyotis (C.Chr. ex Kjellb. et C.Chr.) Reed, comb. nov. Basionym: Dryopteris polyotis C.Chr. ex Kjellb. et C.Chr., Engl. Bot. Jahrb., 66: 46. 1933. Celebes.

Th. polyphlebia (C.Chr.) Morton, Amer. Fern Journ., 51: 38. 1961. Basionym: Dryopteris polyphlebia C.Chr., Vid. Selsk. Skr., VII, 10: 161, f. 19. 1913. Costa Rica - Andes of Quito, Ecuador.

Th. polyphylla (Copel.) Reed, comb. nov. Basionym: Dryopteris polyphylla Copel., Univ. Calif. Publ. Bot., 19: 288, t. 37. 1941. Mexico.

Th. polypodioides (Raddi) Reed, comb. nov. Basionym: Ceterach polypodioides Raddi, Opusc. Sci. Bol., 3: 284. 1819; Fl. Bras., 1: 10, t. 22. 1825. Brazil.

Th. polyptera (Copel.) Reed, comb. nov. Basionym: Cyclosorus polypterus Copel., Philip. Journ. Sci., 84: 161. 1955. Philippine Isls (Negros).

Th. ponapeana (Hosak.) Reed, comb. nov. Basionym: Phegopteris ponapeana Hosak., Trans. Nat. Hist. Soc. Formosa, 26: 233. 1936. Caroline Isls (Ponape).

Th. porphyricola (Copel.) Ching, Bull. Fan Mem. Inst. Biol., Bot. 6: 287. 1936. Basionym: Dryopteris porphyricola Copel., Philip. Journ. Sci., 7C: 60. 1912. Borneo, Sarawak, Malaya.

Th. porphyrophlebia (Christ) Reed, comb. nov. Basionym: Aspidium porphyrophlebium Christ, Bull. Acad. Geogr. Bot. Mans, 1904: 117. 1904. China.

Th. pozoi (Lagasca) Morton, Bull. Soc. Bot. France, 106: 234. 1959. Basionym: Hemionitis pozoi Lagasca, Nov. Gen. et Sp., 33. 1816. Synonyms: Polypodium tottum Willd. in L., Sp. Pl., ed. IV, 5: 201. 1810, non Thunb., 1800; Acrostichum pilosiusculum Wikstr., Kgl. Vet. Acad. Handl., 1825: 439. 1826: Polypodium africanum Desv., Mem. Soc. Linn. Paris, 6: 239. 1826; Polypodium eliasii Sennen et Pau, Bull. Soc. Geogr. Bot. Mans, 1910: 94. 1910. Spain, Madeira, Azores, S. Africa, N. India-China, Korea, Japan, Malesia.

Th. pozoi subsp. himalaica (Ching) Morton, Amer. Fern Journ., 56(4): 179. 1966. Basionym: Leptogramma himalaica Ching, Sinensia, 7: 100. 1936. India, Himalaya.

Thelypteris pozoi subsp. mollissima (Kunze) Morton, Amer. Fern Journ., 56(4): 178. 1966. Basionym: Gymnogramma totta var. mollissima Kunze, Linnaea, 24: 249. 1851; G. mollissima Fischer ex Kunze, Linnaea, 23: 255, 310. 1850 (nom. nud.). N. India, Ceylon, S. China, S. Korea, Japan, Ryukyus.

Th. prenticei (Carr. in Seem.) Alston, Amer. Fern Journ., 45: 120. 1955. Basionym: Lastrea prenticei Carr. in Seem., Fl. Vit., 359. 1873. Fiji, Samoa.

Th. prismatica (Desv.) Schelpe, Bol. Soc. Broter., Ser. 2A, 41: 217. 1967 (1968). Basionym: Nephrodium prismaticum Desv., Mem. Soc. Linn. Paris, 6: 256. 1827. Mascarenes, Madagascar.

Th. procurrens (Mett.) Reed, comb. nov. Basionym: Aspidium procurrens Mett., Ann. Ludg. Bat., 1: 231. 1864. Java, Celebes, N. India.

Th. producta (Kaulf.) Reed, comb. nov. Basionym: Aspidium productum Kaulf., Enum., 237. 1824. Philippine Isls. (Luzon).

Th. prolifera (Retz.) Reed, comb. nov. Basionym: Hemionitis proliferum Retz., Obs., 6: 38. 1791. Synonyms: Meniscium proliferum (Retz.) Swartz, Syn. Fil., 19, 207. 1806; Ampelopteris elegans Kunze, Bot. Zeit., 6: 114. 1848; A. prolifera (Retz.) Copel., Gen. Fil., 144. 1947. S. China, N. India, Trop. Africa, Malesia, Polynesia, Mascarenes, Australia.

Th. prolixa (Willd. in L.) Ching, Bull. Fan Mem. Inst. Biol., Bot. 10: 254. 1941. Basionym: Aspidium prolixum Willd. in L. Sp. Pl., ed. 4, 5: 251. 1810. India, Trop. Africa, Mascarenes.

Th. prominula (Christ) Reed, comb. nov. Basionym: Aspidium prominulum Christ, Bull. Boiss., 4: 659. 1896. Costa Rica.

Th. protecta (Copel.) Reed, comb. nov. Basionym: Dryopteris protecta Copel., Univ. Calif. Publ. Bot., 18: 221. 1942. New Guinea.

Th. pseudarfakiana (Hosak.) Reed, comb. nov. Basionym: Phegopteris pseudarfakiana Hosak., Trans. Nat. Hist. Soc. Formos., 28: 147. 1938. Palau Isl.

Th. pseudogueintziana (R.Bonap.) Alston, Ferns W. Trop. Afr., 61. 1959. Basionym: Dryopteris pseudogueintziana R. Bonap., Bull. Jard. Bot. Brux., 4: 4. 1913. S. Africa, Cameroun, Madagascar.

Th. pseudohirsuta (Rosenst.) Reed, comb. nov. Basionym: Dryopteris pseudohirsuta Rosenst., Med. Rijks Herb. No. 31: 7. 1917. Philippine Isls.

Th. pseudoparasitica (v.A.v.R.) Reed, comb. nov. Basionym: Dryopteris pseudoparasitica v.A.v.R., Nova Guinea, 14: 19. 1924. New Guinea.

Th. pseudoreptans (C.Chr., Reed, comb. nov. Basionym: Dryopteris pseudoreptans C.Chr., Ind. Fil., 286. 1905. Synonym: Nephrodium debile Baker, Journ. Bot., 1880: 212. 1880. Sumatra.

Th. pseudosancta (C.Chr.) Reed, comb. nov. Basionym: Dryopteris pseudosancta C.Chr., Smiths. Misc. Coll., 52: 378. 1909. Costa Rica - Guatemala.

Th. pseudostenobasis (Copel.) Reed, comb. nov. Basionym: Dryopteris pseudostenobasis Copel., Journ. Arnold Arb., 10: 176. 1929. New Guinea.

Thelypteris ptarmica (Kunze ex Mett.) Reed, comb. nov. Basionym: Aspidium ptarmicum Kunze ex Mett., Pheg. u. Asp., 80, n. 191. 1858. S. Brazil.

Th. ptarmiciformis (C.Chr. et Rosenst. ex Rosenst.) Reed, comb. nov. Basionym: Dryopteris ptarmicifomris C.Chr. et Rosenst. ex Rosenst., Fedde Repert., 12: 472. 1913. Bolivia.

Th. pterifolia (Mett. ex Kuhn) Reed, comb. nov. Basionym: Aspidium pterifolium Mett. ex Kuhn, Linnaea, 36: 110. 1869. Synonym: Aspidium gleichenioides Christ, Bull. Herb. Boiss., II, 4: 960. 1904. Guatemala, Colombia, Bolivia.

Th. pteroidea (Klotzsch) Tryon, Rhodora, 69: 8. 1967. Basionym: Polypodium pteroideum Klotzsch, Linnaea, 20: 389. 1847. Colombia-Ecuador-Brazil.

Th. pterospora (v.A.v.R.) Reed, comb. nov. Basionym: Dryopteris pterospora v.A.v.R., Bull. Buit., III, 2: 148. 1920. Sumatra.

Th. puberula (Bak. in Hook. et Bak.) Morton, Amer. Fern Journ., 48: 138. (1958) 1959. Basionym: Nephrodium puberulum Bak. in Hook. et Bak., Syn. Fil., ed. 2, 495. 1874, non Aspidium puberulum Fée, Mém. Foug. 10: 40. 1865 (illegit. nom.), nec As. puberulum Gaud. in Freyc. Voy. Bot., 342. 1827. Centr. Amer., Mexico.

Th. pubescens (L.) Proctor, Bull. Inst. Jamaica, Sci. Ser., No. 5: 63. 1953. Basionym: Polypodium pubescens L., Syst. Nat., ed. 10, 2: 1327. 1759. West Indies, Jamaica.

Th. pubirachis (Bak.) Reed, comb. nov. Basionym: Nephrodium pubirachis Bak., Journ. Bot., 1876: 344. 1876. Fiji, Samoa.

Th. pusilla (Mett. in Triana et Planch.) Ching, Bull. Fan Mem. Inst. Biol., Bot. 10: 254. 1941. Basionym: Aspidium pusillum Mett. in Triana et Planch., Ann. Sci. Nat., V, 2: 245. 1864. Colombia.

Th. pustulosa (Copel.) Reed, comb. nov. Basionym: Cyclosorus pustulosus Copel., Philip. Journ. Sci., 81: 37. 1952. Philippine Isls. (Luzon, Mindoro).

Th. quadrangularis (Fée) Schelpe, Journ. S. Afr. Bot., 30(4): 196. 1964. Basionym: Nephrodium quadrangulare Fée, Gen. Fil., 308. 1850-52. Synonym: Dryopteris contigua Rosenst., Med. Rijks Herb., No. 31: 8. 1917. Pantropical: Borneo, Brit. Guiana, Africa (Mocambique, Zambesia, Ivory Coast, Oubangui).

Th. quadriaurita (Christ) Reed, comb. nov. Basionym: Dryopteris quadriaurita Christ, Philip. Journ. Sci., 2C: 209. 1907. New Guinea, Philippine Isls (Mindanao).

Th. quadriquetra (v.A.v.R.) Ching, Bull. Fan Mem. Inst. Biol., Bot. 10: 254. 1941. Basionym: Dryopteris quadriquetra v.A.v.R., Nova Guinea, 14: 16. 1924. New Guinea.

Th. quaylei (E.Brown in E. et F. Brown) Ching, Bull. Fan Mem. Inst. Biol., Bot. 10: 254. 1941. Basionym: Dryopteris quaylei E.Brown in E. et F. Brown, Bernice P. Bishop Mus. Bull., 89: 28, f. 9. 1931. Marquesas.

Th. quelpaertensis (Christ in Lev.) Ching, Bull. Fan Mem. Inst. Biol., Bot. 6: 328. 1936. Basionym: Dryopteris quelpaertensis Christ in Lev., Bull. Acad. Geogr. Bot. Mans, 7. 1910. Synonyms: Nephrodium montanum var. fauriei Christ, Bull. Herb. Boiss., 4: 671. 1896; Dryopteris christiana Kodama ex Koidz., Bot. Mag. Tokyo, 38: 107. 1924. Korea, Aleutian Isls., Kamtschatka.

Thelypteris quelpaertensis var. yakusmontana (Masam.) Tagawa, Acta Phytotax. Geobot., 5: 196. 1936. Basionym: Dryopteris yakusmontana Masam., Journ. Soc. Trop. Agr. Formos., 4: 76. 1932. Taiwan, Kyushu.

Th. rampans (Bak.) Reed, comb. nov. Basionym: Nephrodium rampans Bak., Journ. Bot., 1889: 177. 1889. Centr. China.

Th. randallii Maxon et Morton, in Morton, Amer. Fern Journ., 53: 69. 1963. Jamaica.

Th. recumbens (Rosenst.) Reed, comb. nov. Basionym: Dryopteris recumbens Rosenst., Hedwigia, 46: 123. 1906. S. Brazil.

Th. reducta Small, Ferns S.E. States, 254, illus. 1938. (Florida). = Dryopteris.

Th. reederi (Copel.) Reed, comb. nov. Basionym: Cyclosorus reederi Copel., Amer. Fern Journ., 43: 12. 1953. New Guinea.

Th. refracta (Fisch. et Mey. ex Kunze) Reed, comb. nov. Basionym: Polypodium refractum Fisch. et Mey. ex Kunze, Linnaea 23: 283, 321. 1850. Brazil, Paraguay, Argentina.

Th. regis (Copel.) Reed, comb. nov. Basionym: Dryopteris regis Copel., Univ. Calif. Publ. Bot., 18: 220. 1942. New Guinea.

*Th. reichiana (Presl in Sternb.) Reed, comb. nov. Basionym: Pecopteris reichiana Presl in Sternb., Flora der Vorwelt, 2: 155, t. 37, f. 2. 1838. Synonyms: Aspidium reichianum Ett., Die Farnkr. der Jetztwelt, 197. 1865; Pecopteris striata Sternb., Flora der Vorwelt, 2: 155, t. 37, f. 3-4. 1838. Upper Cretaceous (Senonian): Bavaria, Saxony. Aff. Th. ligulata.

Th. remotipinna (Bonap.) Reed, comb. nov. Basionym: Dryopteris remotpinnna Bonap., Notes Pterid., 5: 57. 1917. Madagascar.

Th. remotipinnata (Hayata) Alston in Koie et Reching., Biol. Skr. Danske Vid. Selsk., 10(3): 10. 1959. Basionym: Dryopteris remotipinnata Hayata, Gen. Ind. Fl. Formosa, 108. 1917. Sachalin-Manchuria-Mpngolia, N & E China.

Th. repandula (v.A.v.R.) Reed, comb. nov. Basionym: Dryopteris repandula v.A.v.R., Nova Guinea, 14: 20. 1924. New Guinea.

Th. repens (Hope) Ching, Bull. Fan Mem. Inst. Biol., Bot. 6: 304. 1936. Basionym: Nephrodium repens Hope, Journ. Bombay Nat. Hist. Soc., 21: 535. 1899. Himayala - Tonkin.

Th. reptans (J.F.Gmel.) Morton, Fieldiana, 28(1): 12. 1951; Amer. Fern Journ., 41: 87. 1951. Basionym: Polypodium reptans J.F. Gmel., Syst. Nat., 2(2): 1309. 1791. Florida - Brazil, Venezuela, Jamaica.

Th. reptans var. tenera (Fée) Proctor, Rhodora, 61: 306. (1959) 1960. Basionym: Goniopteris tenera Fée, 11 Mém. Foug., 60, t. 15, f. 3. 1866. Guadeloupe.

Th. resinifera (Desv.) Proctor, Bull. Inst. Jamaica, Sci. Ser., No. 5: 63. 1953. Basionym: Polypodium resiniferum Desv., Berl. Mag., 5: 317. 1811. Synonyms: Nephrodium panamense Presl, Rel. Haenk., 1: 35. 1825; Nephrodium caribaeum Jenm., Journ. Bot., 24: 270. 1886; Lastrea normalis Copel., Gen. Fil., 139. 1947. West Indies, Mexico - Panama.

Thelypteris resinifera var. promixa (C.Chr.) Reed, comb. nov. Basionym: Dryopteris panamensis var. proxima C.Chr., Smiths. Misc. Coll., 52: 377. 1909. Mexico.

Th. resinosofoetida (Hook.) Ching, Bull. Fan Mem. Inst. Biol., Bot. 10: 254. 1941. Basionym: Nephrodium resinosofoetidum Hook., Sp. Fil., 4: 105. 1862. Costa Rica - Bolivia.

Th. reticulata (L.) Proctor, Bull. Inst. Jamaica, Sci. Ser., No. 5: 63. 1953. Basionym: Polypodium reticulatum L., Syst. Nat., ed. 10, 2: 1325. 1759. Trop. Amer., Jamaica.

Th. retusa (Swartz) Reed, comb. nov. Basionym: Polypodium retusum Swartz, Vet. Akad. Handl., 1817: 61. 1817; Lindm., Ark. f. Bot., 1: 227, t. 10, f. 11. 1903. Brazil.

Th. rhombea (Christ) Reed, comb. nov. Basionym: Dryopteris diversiloba var. acrostichoides subvar. rhombea Christ, Philip. Journ. Sci., Bot. 2C: 200. 1907. Philippine Isls., Celebes.

Th. rigida (Ridl.) Reed, comb. nov. Basionym: Goniopteris rigida Ridl., Trans. Linn. Soc., II. Bot., 9: 258. 1916. Synonym: Phegopteris wollastonii v.A.v.R., Mal. Ferns Suppl., 515. 1917. New Guinea.

Th. rigidifolia (v.A.v.R.) Ching, Bull. Fan Mem. Inst. Biol., Bot. 10: 254. 1941. Basionym: Dryopteris rigidifolia v.A.v.R., Nova Guinea, 14: 18. 1924. New Guinea.

Th. rimbachii (Rosenst.) Reed, comb. nov. Basionym: Dryopteris rimbachii Rosenst., Fedde Repert., 7: 147. 1909. Ecuador.

Th. riograndensis (Lindm.) Reed, comb. nov. Basionym: Polypodium riograndense Lindm., Ark. f.Bot., 1: 230, t. 9, f. 6. 1903. S. Brazil, Paraguay, Uruguay.

Th. riopardensis (Rosenst.) Reed, comb. nov. Basionym: Dryopteris riopardensis Ros.,Hedw.,46: 121. 1906. S. Brazil.

Th. riparia (Copel.) Reed, comb. nov. Basionym: Dryopteris riparia Copel., Univ. Calif. Publ. Bot., 18: 221. 1942. New Guinea.

Th. rivulariformis (Rosenst.) Reed, comb. nov. Basionym: Dryopteris rivulariformis Rosenst., Fedde Repert., 6: 316. 1909. Synonym: Dryopteris stenophylla Rosenst., Fedde Repert., 5: 233. 1908. Bolivia.

Th. rivularioides (Fée) Abbiatti, Rev. Mus. LaPlata, Ser II. Bot., 9: 19. 1958. Basionym: Aspidium rivularioides Fée, Crypt. Vasc. Pl., 1: 148, t. 50, f. 1. 1869. S. Brazil, Paraguay, Uruguay, Argentina.

Th. rivularioides var. arechavaletae (Hieron.) Abbiatti, Darwiniana, 13(2-4): 566. 1964. Basionym: Aspidium arechavaletae Hieron., Engl. Bot. Jahrb., 22: 370. 1896 (1897). Uruguay.

Th. rivularioides var. pseudomontana (Hieron.) Abbiatti, Darwiniana, 13(2-4): 566. 1964. Basionym: Aspidium pseudomontaum Hieron., Engl. Bot. Jahrb., 22: 373. 1896 (1897). Argentina, S. Brazil.

Th. robertiana (Hoffm.) Slosson ex Rydb., Fl. Rocky Mts., 1044. 1917. Basionym: Polypodium robertianum Hoffm., Deutsch. Fl., 2: 20. 1795. = Gymnocarpium.

Thelypteris robinsonii (Ridl.) Ching, Bull. Fan Mem. Inst. Biol., Bot. 10: 254. 1941. Basionym: Lastrea robinsonii Ridl., Journ. Fed. Mal. States Mus., 10: (128-156). 1920; Journ. Mal. Br. Roy. Asiatic Soc., 4: 65. 1926. Malacca. (= Th. viscosa).

Th. rodigasiana (Moore) Reed, comb. nov. Basionym: Nephrodium rodigasianum Moore, L'Ill. Hort., 29: 27, t. 442. 1882. Samoa.

Th. roemeriana (Rosenst.) Reed, comb. nov. Basionym: Dryopteris roemeriana Rosenst., Nova Guinea, 8: 723. 1912. New Guinea.

Th. rolandii (C.Chr.) Tryon, Rhodora, 69: 8. 1967. Basionym: Dryopteris rolandii C.Chr., Dansk. Vid. Selsk. Skr., VII, 10: 258. 1913. Ecuador.

Th. roraimensis (Baker) Reed, comb. nov. Basionym: Polypodium roraimense Baker, Timehri, 5: 214. 1886. Brit. Guiana.

Th. rosei (Maxon) Tryon, Rhodora, 69: 8. 1967. Basionym: Dryopteris rosei Maxon, Smiths. Misc. Coll., 65(8): 10. 1915. Peru.

Th. rosenstockii (C.Chr.) Tryon, Rhodora, 69: 8. 1967. Basionym: Dryopteris rosenstockii C.Chr., Dansk. Vid. Selsk. Skr., VII, 4: 304. 1907. Ecuador.

Th. rotumaensis (St. John) Reed, comb. nov. Basionym: Cyclosorus rotumaensis St. John, Occ. Papers Bishop Mus., 21: 180, f. 3. 1954. Fiji Isls. (Rotuna).

Th. rubicunda (v.A.v.R.) K.Iwats., Mem. Coll. Sci., Univ. Kyoto, Ser. B, 31(3): 196. 1965. Basionym: Phegopteris rubicunda v.A.v.R., Bull. Jard. Bot. Buit., III, 2: 162. 1920. Malaya, Sumatra.

Th. rubida (J.Smith) K.Iwats., Mem. Coll. Sci., Univ. Kyoto, Ser. B, 31(3): 195. 1965. Basionym: Goniopteris rubida J.Smith, Journ. Bot., 3: 395. 1841. Philippine Isls.

Th. rubinervis (Mett. ex Kuhn) K.Iwats., Mem. Coll. Sci., Univ. Kyoto, Ser. B, 31(3): 195. 1965. Basionym: Phegopteris rubinervis Mett. ex Kuhn, Linnaea, 36: 116. 1869. Polynesia.

Th. rubra (Ching) K.Iwats., Journ. Jap. Bot., 38: 315. 1963. Basionym: Dryopteris rubra Ching, Bull. Fan Mem. Inst. Biol., Bot. 2: 198, t. 12. 1931. N. India - S. China.

Th. rudis (Kunze) Proctor, Bull. Inst. Jamaica, Sci. Ser., No. 5: 64. 1953. Basionym: Polypodium rude Kunze, Linnaea, 13: 133. 1839. Synonym: Polypodium ctenoides Jenm., Bull. Bot. Dept. Jamaica, II, 4: 129. 1897. Jamaica, Mexico - Bolivia, Peru.

Th. rufostraminea (Christ) Ching, Bull. Fan Mem. Inst. Biol., Bot. 6: 291. 1936. Basionym: Aspidium rufostramineum Christ, Bull. Soc. Bot. France, 52 (Mem. 1): 36. 1905. S. China.

Th. rupestris (Klotzsch) Reed, comb. nov. Basionym: Leptogramma rupestre Klotzsch, Linnaea, 20: 415. 1847. Colombia-Venezuela.

Th. rupicola (C.Chr.) Ching, Bull. Fan Mem. Inst. Biol., Bot. 10: 254. 1941. Basionym: Dryopteris rupicola C.Chr., Fedde Repert., 15: 24. 1917. Hispaniola.

Th. rurutensis (Copel.) Reed, comb. nov. Basionym: Dryopteris rurutensis Copel., Occ. Papers Bishop Mus., 14: 55, t. 7. 1938. S.E.Polynesia (Australian Isls.).

Thelypteris rusbyi (C.Chr.) Tryon, Rhodora, 69: 8. 1967. Basionym: Dryopteris rusbyi C.Chr., Smiths. Misc. Coll., 52: 390. 1909. Bolivia.

Th. rustica (Fée) Proctor, Rhodora, 61: 306. (1959) 1960. Basionym: Phegopteris rustica Fée, 11e Mém. Foug., 55, t. 13, f. 1. 1866. Synonym: Dryopteris dominicensis C.Chr., Smith. Misc. Coll., 52: 384. 1909. Guadeloupe, Dominica, St. Vincent, Costa Rica.

Th. sagittata (Swartz) Proctor, Bull. Inst. Jamaica, Sci. Ser., No. 5: 64. 1953. Basionym: Polypodium sagittatum Swartz, Prodr., 132. 1788. West Indies, Jamaica.

Th. sagittifolia (Blume) Reed, comb. nov. Basionym: Aspidium sagittaefolium Blume, Enum. Pl. Jav., 153. 1828. Java, Perak.

Th. sagittifolioides (Copel.) Reed, comb. nov. Basionym: Cyclosorus sagittifolioides Copel., Philip. Journ. Sci., 81: 29, t. 21. 1952. Philippine Isls. (Samar).

Th. sakayensis (Zeiller) Reed, comb. nov. Basionym: Nephrodium sakayense Zeiller, Bull. Soc. Bot. France, 32: 75. 1885. Perak.

Th. salicifolia (Wall. ex Hook.) Reed, comb. nov. Basionym: Meniscium salicifolium Wall. ex Hook., Icon. Pl., t. 990. 1854. Penang, Singapore, Malaya, Sumatra, Borneo.

Th. salzmannii (Fée) Morton, Los Angeles County Mus. Contrib. Sci., 35: 7. 1960. Basionym: Meniscium salzmannii Fée, Gen. Fil., 223 (salzmanni). 1850-52. Amer. trop.

Th. samarensis (Copel.) Reed, comb. nov. Basionym: Cyclosorus samarensis Copel., Philip. Journ. Sci., 81: 35. 1952. Philippine Isls. (Samar).

Th. sambiranensis (C.Chr.) Reed, comb. nov. Basionym: Dryopteris sambiranensis C.Chr., Cat. Pl. Madagas. Pterid., 26. 1932 (nom.); Dansk Bot. Ark., 7: 50, t. 12, f. 11. 1932. Madagascar.

Th. sampsoni (Bak.) K.Iwats., Mem. Coll. Sci., Univ. Kyoto, Ser. B, 31(3): 192. 1965. Basionym: Polypodium sampsoni Bak., Ann. Bot., 5: 471. 1891. Tonkin.

Th. sancta (L.) Ching, Bull. Fan Mem. Inst. Biol., Bot. 10: 254. 1941; Proctor, Bull. Inst. Jamaica, Sci. Ser., No. 5: 64. 1953. Basionym: Acrostichum sanctum L., Syst. Nat., ed. 10, 2: 1320. 1759. West Indies, Jamaica; Guatemala - Quito, Peru.

Th. sancta var. hirta (Jenm.) Reed, comb. nov. Basionym: Nephrodium sanctum var. hirtum Jenm., Bull. Bot. Dept. Jam., II, 3: 20. 1896. Jamaica.

Th. sancta var. jamaicensis (Bak. in Jenm.) Proctor, Bull. Inst. Jamaica, Sci. Ser., No. 5: 64. 1953. Basionym: Nephrodium jamaicense Bak. in Jenm., Journ. Bot., 15: 264. 1877. Jamaica.

Th. sancta var. magna (Jenm.) Proctor, Bull. Inst. Jamaica, Sci. Ser., No. 5: 64. 1953. Basionym: Nephrodium sanctum var. magnum Jenm., Bull. Bot. Dept. Jamaica, II, 3: 20. 1896. Jaimaica.

Th. sancta var. portoricensis (Kuhn) Morton, Amer. Fern Journ., 53: 64. 1963. Basionym: Aspidium sanctum var. portoricense Kuhn, Bot. Jahrb. Engl., 24: 115. 1897. Puerto Rico.

Thelypteris sancta var. strigosa (C.Chr.) Reed, comb. nov. Basionym: Dryopteris sancta var. strigosa C.Chr., Smiths. Misc. Coll., 52: 379. 1909. Cuba, Puerto Rico.

Th. sanctiformis (C.Chr.) Reed, comb. nov. Basionym: Dryopteris sanctiformis C.Chr., Vid. Selsk. Skr., VII, 10: 130, f. 12D. 1913. Panama - Ecuador.

Th. sandwicensis (Hook. et Arn.) Fosberg, Occ. Papers Bishop Mus., 23(2): 30. 1962; l.c., 23(8): 129. 1966. Basionym: Polypodium sandwicense Hook. et Arn., Bot. Beechey Voy., 105. 1832. = Ctenitis sandwicensis.

Th. savaiensis (Bak.) Reed, comb. nov. Basionym: Nephrodium savaiense Bak., Ann. Bot., 5: 318. 1891. Samoa.

Th. saxatilis R.P.St.John in Small, Ferns. S.E.States, 236, illus. 1938. = Dryopteris.

Th. saxicola (Swartz) Reed, comb. nov. Basionym: Polypodium saxicola Swartz, Vet. Akad. Handl., 1817: 59, t. 3, f. 5. 1817. Costa Rica - Peru.

Th. scaberula (Ching) Reed, comb. nov. Basionym: Cyclosorus scaberulus Ching, Bull. Fan Mem. Inst. Biol., Bot. 8: 223. 1938. China (Hainan).

Th. scalaris (Christ) Alston, Journ. Wash. Acad. Sci., 48(7): 234. 1958. Basionym: Aspidium scalare Christ, Bull. Boiss., II, 6: 159. 1906. Mexico to Guatemala and Costa Rica,and Colombia.

Th. scallanii (Christ in Baroni et Christ) Morton, Amer. Fern Journ., 56(4): 179. 1966. Basionym: Aspidium scallanii Christ in Baroni et Christ, Bull. Soc. Bot. Ital., 1901: 296. 1901. China (Szechuan).

Th. scalpturoides (Fée) Reed, comb. nov. Basionym: Phegopteris scalpturoides Fée, 11e Mém. Foug., 51. 1866. Cuba.

Th. scalpturoides var. jamaicensis (C.Chr.) Reed, comb. nov. Basionym: Dryopteris scalpturoides var. jamaicensis C.Chr., Kgl. Dansk Vid. Selsk. Skr., 7: 299. 1907. Jamaica.

Th. scariosa (Rosenst.) Reed, comb. nov. Basionym: Dryopteris scariosa Rosenst., Hedwigia, 46: 127. 1906. Brazil.

Th. schaffneri (Fée) Reed, comb. nov. Basionym: Nephrodium schaffneri Fée, 8 Mém. Foug., 108. 1857. Mexico.

Th. sclerophylla (Poepp. ex Spreng.) Morton, Amer. Fern Journ., 41: 87 (err. "Kunze"). 1951. Basionym: Aspidium sclerophyllum Poepp. ex Spreng. in L. Syst. Veg., ed. 16, 4: 99. 1827; Kunze, Linnaea, 9: 92. 1834. Florida, West Indies (Cuba, Jamaica, Puerto Rico, Hispaniola).

Th. scolopendrioides (L.) Proctor, Bull. Inst. Jamaica, Sci. Ser., No. 5: 64. 1953. Basionym: Polypodium scolopendrioides L., Sp. Pl., 2: 1085. 1753. Synonyms: Polypodium incisum Swartz, Prodr. Veg. Ind. Occ., 131. 1788; Goniopteris strigosa Fée, 11e Mém. Foug., 59, t. 15, f. 1. 1866. West Indies.

Th. semihastata (Kunze) Ching, Bull. Fan Mem. Inst. Biol., Bot. 10: 254. 1941. Basionym: Aspidium semihastatum Kunze, Linnaea, 9: 91. 1834. Peru.

Thelypteris seriacea (Scott in Bedd.) Reed, comb. nov. Basionym: Lastrea sericea Scott in Bedd., Ferns Brit. India, t. 308. 1869, non Dryopteris sericea C.Chr., Bot. Gaz., 56: 136. 1913. India, Burma, China (Yunnan).

Th. serra (Swartz) R.P.St. John in Small, Ferns S.E. States, 241, illus. 1938. Basionym: Polypodium serra Swartz, Prodr., 132. 1788. West Indies, Jamaica.

Th. serrata (Cav.) Alston, Kew Bull. 1932: 309. 1932. Basionym: Meniscium serratum Cav., Descr. Pl., 548. 1803. Florida, West Indies; Mexico - Bolivia, Brazil.

Th. serrulata (Swartz) Proctor, Bull. Inst. Jamaica, Sci. Ser., No. 5: 65. 1953. Basionym: Polypodium serrulatum Swartz, Schrad. Journ. Bot., 1800(2): 25. 1801. Jamaica.

Th. serrutula Ching, Bull. Fan Mem. Inst. Biol., Bot. 6: 319. 1936. China (Szechuan).

Th. sessilipinna (Copel.) Reed, comb. nov. Basionym: Dryopteris sessilipinna Copel., Philip. Journ. Sci., Bot. 6: 145. 1911. Philippine Isls.

Th. setigera (Blume) Ching, Bull. Fan Mem. Inst. Biol., Bot. 6: 345. 1936. Basionym: Cheilanthes setigera Blume, Enum. Pl. Jav., 138. 1828. Continental S. Asia, Malaysia, Philippines - Polynesia, Taiwan.

Th. setosula Reed, nom. nov. Synonym: Nephrodium angustifolium Presl, Epim. Bot., 48. 1849. Philippine Isls. (Luzon).

Th. sevillana Reed, nom. nov. Synonym: Cyclosorus glaber Copel., Philip. Journ. Sci., 81: 34. 1952. Philippine Isls (Bohol, Sevilla River).

Th. siambonensis (Hieron.) Abbiatti, Darwiniana, 13(2-4): 566. 1964. Basionym: Aspidium siambonense Hieron., Engl. Bot. Jahrb., 22: 372. (1896) 1897. Argentina (Tucuman).

Th. sikkimensis (Bak.) Reed, comb. nov. Basionym: Aspidium sikkimense Bak. in Hook. et Bak., Syn. Fil., 256. 1867. Sikkim.

Th. silvatica (Pappe et Rawson) Reed, comb. nov. Basionym: Goniopteris silvatica Pappe et Rawson, Syn. Fil. Afr. Austr., 30. 1858. Synonyms: Goniopteris patens Fée, Gen. Fil., 253. 1852, non Polypodium patens Swartz, 1788; Gymnogramma unita Kunze, Linnaea, 18: 115. 1844, non Polypodium unitum L., 1759. Ghana, Liberia, S. Africa.

Th. simillima (C.Chr.) K.Iwats., Acta Phytotax. Geobot., 21(5-6): 169. 1965. Basionym: Dryopteris simillima C.Chr., Ind. Fil., 292. 1905. Synonym: Nephrodium simulans Bak., Journ. Bot., 1888: 325. 1888, non Bak., 1874. Borneo.

Th. simozawae Tagawa, Acta Phytotax. Geobot., 6: 157. 1937. (Taiwan). = Th. angulariloba.

Th. simplex (Hook.) K.Iwats., Mem. Coll. Sci., Univ. Kyoto, 31(3): 189. 1965. Basionym: Meniscium simplex Hook., Lond. Journ. Bot., 1: 294, t. 11. 1842. S. China, Tonkin, Indochina, Taiwan, Ryukyus.

Th. simplex var. trifoliata (Ching) Reed, comb. nov. Basionym: Abacopteris simplex var. trifoliata Ching, Bull. Fan Mem. Inst. Biol., Bot. 10: 10. 1940. China (Fukien).

Thelypteris simplicifolia (J.Smith ex Hook.) Reed, comb. nov. Basionym: Aspidium simplicifolium J.Smith ex Hook., Icon. Pl., t. 919. 1854. Philippine Isls., Fiji.

Th. simulans Ching, Bull. Fan Mem. Inst. Biol., Bot. 6: 280. 1936. (Taiwan). = Th. auriculata.

Th. simulata (Davenp.) Nieuwl., Amer. Midl. Nat., 1: 226. 1910. Basionym: Aspidium simulatum Davenp., Bot. Gaz., 19: 495. 1894. Canada (P.E.I. to S. Quebec), south to N.E. Alabama, New York and West Virginia.

Th. singalanensis (Bak.) Ching, Bull. Fan Mem. Inst. Biol., Bot. 6: 334. 1936. Basionym: Nephrodium singalanense Bak., Journ. Bot., 1880: 212. 1880. Synonym: Nephrodium dayi Bedd., Journ. Bot., 1887: 323. 1887. Malaya, Sumatra, Borneo, Perak, Taiwan.

Th. sintenisii (Kuhn et Christ ex Krug in Urban) Reed, comb. nov. Basionym: Aspidium sintenisii Kuhn et Christ ex Krug in Urban, Engl. Bot. Jahrb., 24: 119. 1897; Urban, Symb. Ant., 4: 19. 1903. Puerto Rico.

Th. skinneri (Hook.) Reed, comb. nov. Basionym: Aspidium skinneri Hook., Icon. Pl., t. 924. 1854. Guatemala, Ecuador.

Th. sodiroi Reed, nom. nov. Synonym: Nephrodium nemorale Sodiro, Crypt. Vasc. Quit., 267. 1893; Thelypteris nemoralis (Sod.) Tryon, Rhodora, 69: 7. 1967, non Th. nemoralis Ching, 1936. Ecuador.

Th. sogerensis (Gepp) Reed, comb. nov. Basionym: Dryopteris sogerensis Gepp, Journ. Bot., 1923 (Suppl.): 61. 1923. New Guinea.

Th. spekei (Bak. in Hook. et Bak.) Ching, Bull. Fan Mem. Inst. Biol., Bot. 10: 254. 1941. Basionym: Nephrodium spekei Bak. in Hook. et Bak., Syn. Fil., 263. 1867. West Africa, Comores Isls.

Th. spenceri (Copel. ex Christ) Reed, comb. nov. Basionym: Dryopteris spenceri Copel. ex Christ, Philip. Journ. Sci., Bot. 2: 290. 1907. Philippine Isls.

Th. spinosa (Copel.) Reed, comb. nov. Basionym: Dryopteris spinosa Copel., Univ. Calif. Publ. Bot., 18: 219. 1942. Synonym: Lastrea armata Copel., Gen. Fil., 138. 1947. New Guinea.

Th. spinulosa (O.F.Muell.) Nieuwl., Amer. Midl. Nat., 1: 226. 1910. Basionym: Polypodium spinulosum O.F.Muell., Fl. Fridr., 113, f. 2. 1767. = Dryopteris.

Th. spinulosa var. americana (Fisch. ex Kunze) Weatherby, Rhodora, 21: 178. 1919. Basionym: Aspidium spinulosum (var.) americanum Fisch. ex Kunze, Amer. Journ. Sci., II, 6: 84. 1848. = Dryopteris.

Th. spinulosa var. concordiana (Davenp.) Weatherby, Rhodora, 21: 178. 1919. Basionym: Nephrodium spinulosum var. concordianum Davenp., Rhodora, 6: 33. 1904. = Dryopteris intermedia var.

Th. spinulosa var. dilatata (Hoffm.) St. John et Warren, Prelim. List Pl. Kaniksu Nat. For., 1: 1. 1925. Basionym: Polypodium dilatatum Hoffm., Deutsch. Fl., 2: 7. 1795. = Dryopteris.

Th. spinulosa var. fructuosa (Gilbert) Fernald, Rhodora, 28: 146. 1926. Basionym: Nephrodium spinulosum (var.) fructuosum Gilbert, List N. Amer. Pterid., 37. 1901. = Dryopteris intermedia.

Th. spinulosa var. intermedia (Muhl.) Nieuwl., Amer. Midl. Nat., 2: 278. 1912; Weatherby, Rhodora, 21: 178. 1919. Basionym:

Polypodium vel Aspidium intermedium Muhl. ex Willd. in L. Sp. Pl., ed. 4, 5: 262. 1810. = Dryopteris intermedia.

Th. sprengelii (Kaulf.) Proctor, Bull. Inst. Jamaica, Sci. Ser., No. 5: 65. 1953. Basionym: Aspidium sprengelii Kaulf., Flora, 1823(1): 365. 1823. = Th. balbisii.

Th. sprucei (Bak. in Hook. et Bak.) Ching, Bull. Fan Mem. Inst. Biol., Bot. 10: 254. 1941. Basionym: Nephrodium sprucei Bak. in Hook. et Bak., Syn. Fil., 269. 1867. Ecuador.

Th. squamaestipes (Clarke) Ching, Bull. Fan Mem. Inst. Biol., Bot. 6: 281. 1936. Basionym: Polypodium appendiculatum var. squamaestipes Clarke, Trans. Linn. Soc., II, Bot. 1: 543, t. 79, f. 2. 1880. Himalaya, Sikkim, N. India.

Th. squamigera (Schlecht.) Ching, Bull. Fan Mem. Inst. Biol., Bot. 6: 329. 1936 (pro err.,"squamulosa"). Basionym: Aspidium thelypteris var. squamigerum Schlecht., Adumbr., 23, t. 11. 1825. (Trop. et Austr. Africa, Madagascar, S. India, New Zealand) = Th. palustris var. vel Th. confluens.

Th. squamipes (Copel.) Reed, comb. nov. Basionym: Dryopteris squamipes Copel., Philip. Journ. Sci., 56: 99, t. 5. 1935. Philippine Isls. (Mindanao).

Th. squamulosa (Presl) Ching, Bull. Fan Mem. Inst. Biol., Bot. 6: 5, 329. 1936. Basionym: Lastrea squamulosa Presl, Tent. Pterid., 76 (nom. nud.). 1836; Nephrodium squamulosum ("Presl") Hook. f., Fl. New Zealand, 2: 39. 1855. = Th. confluens.

Th. standleyi (Maxon et Morton) Tryon, Rhodora, 69: 8. 1967. Basionym: Dryopteris standleyi Maxon et Morton, Bull. Torr. Bot. Club, 65: 368. 1938. Guatemala.

Th. stegnogrammoides (Bak.) Fosberg, Occ. Papers Bishop Mus., 23: 30. 1962. Basionym: Polypodium stegnogrammoides Bak., Syn. Fil., 317. 1867. Hawaiian Isls.

Th. stellato-pilosa (Brause) Reed, comb. nov. Basionym: Dryopteris stellato-pilosa Brause, Engl. Bot. Jahrb., 56: 96. 1920. New Guinea.

Th. stenobasis (C.Chr.) Ching, Bull. Fan Mem. Inst. Biol., Bot. 10: 254. 1941. Basionym: Dryopteris stenobasis C.Chr., Ind. Fil., 294. 1905. = Th. attenuata.

Th. stenodonta (Copel.) Reed, comb. nov. Basionym: Cyclosorus stenodontus Copel., Philip. Journ. Sci., 81: 28, t. 20. 1952. Philippine Isls. (Panay).

Th. stenolepis (Bak.) Reed, comb. nov. Basionym: Polypodium stenolepis Bak., Kew Bull., 1898: 231. 1898. Synonym: Aspidium yunnanense Christ, Bull. Boiss., 6: 965. 1898. S. China.

Th. stenophylla (Bak.) Reed, comb. nov. Basionym: Meniscium stenophyllum Bak., Journ. Bot., 1891: 108. 1891. Synonym: Dryopteris brevipinna C.Chr., Ind. Fil., 255. 1905. Borneo.

Th. stereophylla (v.A.v.R.) Ching, Bull. Fan Mem. Inst. Biol., Bot. 10: 254. 1941. Basionym: Dryopteris stereophylla v.A.v.R., Nova Guinea, 14: 17. 1924. New Guinea.

Thelypteris stierii (Rosenst.) Reed, comb. nov. Basionym: Gymnogramma stierii Rosenst., Festschr. Alb. v. Bamberg, 64. 1905. S. Brazil.

Th. stipellata (Blume) K.Iwats., Acta Phytotax. Geobot., 21(5-6): 168. 1965. Basionym: Aspidium stipellatum Blume, Enum. Pl. Jav., 152. 1828. W. Malaysia, Johore, Pahang, Trengganu, Perak, Ladrones Isls.

*Th. stiriaca (Unger) Reed, comb. nov. Basionym: Polypodites stiriacus Unger, Chlor. Prot., 212, t. 36, f. 1-6. 1849. Synonyms: Goniopteris stiriaca (Unger) A.Braun,(Ueber Foss. Goniopteris-Arten) Zeitschr. Geol. Ges., 4: 553, 556. 1852; Krausel, Palaobotanische Notizen, VIII. 1927; Lastrea stiriaca (Unger) Heer, Fl. Tert. Helv., 1: 31 (styriaca), t. 7-8. 1855; l.c., 3: 151. 1859; Dotzler, Palaeontographica, 83B: 4, t. 1, f. 1, t. 2, f. 1-2. 1938; Phegopteris stiriaca (Unger) Ett., Die Farnkr. der Jetztwelt, 195. 1865; Dryopteris stiriaca (Unger) Palibin, 1937; Cyclosorus stiriacus (Unger) Granbast, Ann. Paleont., 48: 106. 1962; Ching et Takht. in Takht., Paleobotanika, 4: 195, t. 2, f. 1-3. 1963; Lastrea helvetica Heer, Fl. Tert. Helv., 1: 33, t. 6, f. 2a-2c. 1855. Upper Tertiary (Oligocene-Miocene): Switzerland, France; (Neogene): Transcaucasia Goderdzi Pass, S.W.Georgia, SSR.

Th. stokesii (E.Brown in E. et F. Brown) Reed, comb. nov. Basionym: Dryopteris stokesii E.Brown in E. et F. Brown, Bishop Mus. Bull., 89: 20, f. 6. 1931. Polynesia (Rapa Isl.).

Th. straminea (Bak. in Hook. et Bak.) Reed, comb. nov. Basionym: Polypodium stramineum Bak. in Hook. et Bak., Syn. Fil., 316. 1867. Venezuela.

Th. striata (Schum.) Schelpe, Journ. S. Afr. Bot., 21(4): 268. 1965. Basionym: Aspidium striatum Schum., Kgl. Dansk Vid. Selsk., Afd. 4: 230. 1829. Synonyms: Polypodium pallidivenium Hook., Sp. Fil., 5: 8. 1863; Dryopteris hemitelioides Christ, Ann. Mus. Congo, 5: 26. 1909. Trop. Africa (Guinea, Camerouns, Congo, Senegal - Angola).

Th. striata var. molundensis (Brause) Reed, comb. nov. Basionym: Dryopteris molundensis Brause, Engl. Bot. Jahrb., 53: 378. 1915. Trop. Africa (Oubangui, Cameroun).

Th. strigosa (Willd.) Tard. in Humbert, Fl. Madagas. Fam. 5, 1: 274, f. 38(1-15). 1958. Basionym: Aspidium strigosum Willd. in L. Sp. Pl., ed. 4, 5: 249. 1810. Madagascar, Mauritius, Mascarenes, Reunion, S. Rhodesia.

Th. strigosissima (Copel.) Reed, comb. nov. Basionym: Dryopteris strigosissima Copel., Univ. Calif. Publ. Bot., 18: 221. 1942. New Guinea.

Th. struthiopteroides (C.Chr.) Reed, comb. nov. Basionym: Dryopteris struthiopteroides C.Chr., Smiths. Misc. Coll., 52: 388. 1909. Guatemala.

Th. stuebelii (Hieron.); Murillo, Cat. Illus. Plantes de Cundinamarca, 2: 110 (stübelii), nomen. 1966. (Colombia). = Th. thomsonii.

Thelypteris subalpina (v.A.v.R.) Reed, comb. nov. Basionym: Dryopteris subalpina v.A.v.R., Bull. Buit., III. 5: 200. 1922. Ternate.
Th. subandina (C.Chr. et Rosenst. ex Rosenst.) Tryon, Rhodora, 69: 8. 1967. Basionym: Dryopteris subandina C.Chr. et Rosenst. ex Rosenst., Fedde Repert., 12: 472. 1913. Bolivia.
Th. subappendiculata (Copel.) Reed, comb. nov. Basionym: Dryopteris subappendiculata Copel., Univ. Calif. Publ. Bot., 18: 220. 1942. New Guinea.
Th. subarida (Tatew. et Tagawa ex Tagawa) Reed, comb. nov. Basionym: Cyclosorus subaridus Tatew. et Tagawa ex Tagawa, Acta Phytotax. Geobot., 7: 77. 1938. Philippines, Taiwan, China (Kwangtung, Fukien, Chekiang, Kwangsi).
Th. subattenuata (Rosenst.) Reed, comb. nov. Basionym: Dryopteris subattenuata Rosenst., Fedde Repert., 10: 332. 1912. New Guinea.
Th. subaurita (Tagawa) Ching, Bull. Fan Mem. Inst. Biol., Bot. 6: 276. 1936. Basionym: Dryopteris subaurita Tagawa, Acta Phytotax. Geobot., 1: 157. 1932. Taiwan, Japan, Ryukyus.
Th. subcuneata (Bak.) Reed, comb. nov. Basionym: Nephrodium subcuneatum Bak., in Mart. Fl. Bras., 1(2): 487. 1870. Cayenne.
Th. subdimorpha (Copel.) Reed, comb. nov. Basionym: Dryopteris subdimorpha Copel., Univ. Calif. Publ. Bot., 18: 220. 1942. New Guinea.
Th. subelata (Bak.) Reed, comb. nov. Basionym: Nephrodium subelatum Bak., Kew Bull., 1906: 11. 1906. China (Yunnan).
Th. subfalcinella (v.A.v.R.) Reed, comb. nov. Basionym: Dryopteris subfacinella v.A.v.R., Bull. Buit., III, 2: 151. 1920. Sumatra.
Th. subglanduligera Ching, Bull. Fan Mem. Inst. Biol., Bot. 6: 323. 1936. Malay Penin. (Perak).
Th. subimmersa Ching, Bull. Fan Mem. Inst. Biol., Bot. 6: 306. 1936. China (Hainan). An Th. immersa (Blume) Ching, acc. Holtt., 1954.
Th. subintegra (Bak.) Reed, comb. nov. Basionym: Polypodium subintegrum Bak., Journ. Bot., 1877: 164. 1877. Ecuador.
Th. submarginalis (Langsd. et Fisch.) Small, Ferns S.E. States, 258, illus. 1938. Basionym: Polypodium submarginale Langsd. et Fisch., Icon. Fil., 12: t. 13. 1810. = Dryopteris.
Th. subnigra (Brause) Ching, Bull. Fan Mem. Inst. Biol., Bot. 10: 254. 1941. Basionym: Dryopteris subintegra Brause, Engl. Bot. Jahrb., 56: 82. 1920. New Guinea.
Th. subobliquata (Hook.) Ching, Bull. Fan Mem. Inst. Biol., Bot. 10: 254. 1941. Basionym: Polypodium subobliquatum Hook., Sp. Fil., 4: 240. 1862. Brazil, Guiana, Colombia.
Th. subochthodes Ching, Bull. Fan Mem. Inst. Biol., Bot. 6: 305. 1936. (China, Hongkong, Japan, Taiwan, Korea). = Th. esquirolii var. glabrata.
Th. subochthodes forma laciniata Kurata, Journ. Geobot., 11(2): 39. 1962. (Japan, Kyushu).
Th. subpectinata (Copel.) Reed, comb. nov. Basionym: Dryopteris subpectinata Copel., Bishop Mus. Bull., 93: 9, t. 7D. 1932. Tahiti.

Thelypteris subpennigera (C.Chr.) Reed, comb. nov. Basionym: Dryopteris subpennigera C.Chr., Cat. Pl. Madagas. Pterid., 26. 1932 (nomen); Dansk Bot. Ark., 7: 52, t. 12, f. 1-2. 1932. Madagascar.

Th. subpubescens (Blume) K.Iwats., Mem. Coll. Sci., Univ. Kyoto, Ser. B, 31(3): 173. 1965. Basionym: Aspidium subpubescens Blume, Enum. Pl. Jav., 149. 1828. Synonym: Aspidium jaculosum Christ, Bull. Boiss., II, 4: 615. 1904. Java to S. China, Taiwan, Luzon, Ceylon, Okinawa, LiuKiu, Queensland.

Th. subsimilis (Hook.) Reed, comb. nov. Basionym: Gymnogramma subsimilis Hook., Sp. Fil., 5: 142, t. 293. 1864. Fernando Po.

Th. subtetragona (Link) E.P.St.John, Amer. Fern Journ., 26: 44. 1936. Basionym: Polypodium subtetragonum Link, Hort. Berol., 2: 105. 1833. = Thelypteris tetragona.

Th. subulifolia (v.A.v.R.) Ching, Bull. Fan Mem. Inst. Biol., Bot. 10: 254. 1941. Basionym: Dryopteris subulifolia v.A.v.R., Bull. Buit., II, 28: 22. 1918. Sumatra.

Th. subvillosa Ching, Bull. Fan Mem. Inst. Biol., Bot. 6: 270. 1936 (err. "(Moore)"). Based on Polypodium auriculatum Wall. ex Hook., Sp. Fil., 4: 237. 1862; Polypodium subvillosum Moore, Ind. Fil., 308 (nomen). 1861. = Th. auriculata.

Th. sulfurea (E.Brown in E. et F. Brown) Reed, comb. nov. Basionym: Dryopteris sulfurea E.Brown in E. et F. Brown, Bishop Mus. Bull., 89: 23, t. 2. 1931. Marquesas.

Th. sumatrana (v.A.v.R.) Reed, comb. nov. Basionym: Dryopteris sumatrana v.A.v.R., Handb. Mal. Ferns, 227. (1908) 1909. Sumatra, Annam, New Guinea, Singapore, Malacca, Selanger, Penang.

Th. superba (Brause) Reed, comb. nov. Basionym: Dryopteris superba Brause, Engl. Bot. Jahrb., 56: 105. 1920. New Guinea.

Th. supernitens (Christ) Reed, comb. nov. Basionym: Dryopteris supernitens Christ, Fedde Repert., 8: 19. 1910. Costa Rica, Panama.

Th. supraspinigera (Rosenst.) Reed, comb. nov. Basionym: Dryopteris supraspinigera Rosenst., Hedwigia, 56: 353. 1915. New Guinea.

Th. suprastrigosa (Rosenst.) Reed, comb. nov. Basionym: Dryopteris suprastrigosa Rosenst., Fedde Repert., 10: 335. 1912. New Guinea.

Th. tablaziensis (C.Chr. ex Christ) Alston, Journ. Wash. Acad. Sci., 48(7): 234. 1958. Basionym: Dryopteris tablaziensis C.Chr. ex Christ, Bull. Boiss., II, 7: 262. 1907. Colombia, Panama, Costa Rica.

Th. taiwanensis (C.Chr.) K.Iwats., Mem. Coll. Sci., Univ. Kyoto, Ser. B, 31(3): 183. 1965. Basionym: Dryopteris taiwanensis C.Chr., Ind. Fil., 297. 1905. Synonyms: Aspidium lobulatum Christ, Bull. Herb. Boiss., II, 4: 614. 1904, non Blume, 1828; Dryopteris subhispidula Rosenst., Hedwigia, 56: 343. 1915. Taiwan, Ryukyus, S. China (Kwangtung), Micronesia (Palau).

*Th. takashimensis Reed, nom. nov. Based on Lastrea japonica Kryshtofovich, Journ. Geol. Soc. Tokyo, 25: 26, t. 15, f. 1-1a. 1918; Nagao, Proc. 3rd Pan-Pacif. Sci. Congr., 2(1926): 1552. 1928; Jongmans, Foss. Cat., 43: 1437. 1960; Takahasi, Jap.

Journ. Geol. & Geogr., 33: 194. 1962; Dijkstra, Foss. Cat., 68: 3905. 1968. Tertiary (Paleogene): Japan, Kyushu Isl., Takashima Coal Mine, Hizan.

Thelypteris tannensis (C.Chr.) Reed, comb. nov. Basionym: Dryopteris tannensis C.Chr., Ind. Fil., 297. 1905. Synonym: Polypodium excelsum Bak. in Hook. et Bak., Syn. Fil., 505. 1874, non Desv., 1827. New Hebrides.

Th. tatei (Maxon et Morton) Morton, Amer. Fern Journ., 51: 38. 1961. Basionym: Dryopteris tatei Maxon et Morton in Morton, Journ. Wash. Acad. Sci., 28: 529. 1938. Bolivia.

Th. tenebrica (Jenm.) Proctor, Bull. Inst. Jamaica, Sci. Ser., No. 5: 65. 1953. Basionym: Nephrodium tenebricum Jenm., Journ. Bot., 1882: 326. 1882. Jamaica. An hybrid Th. sagittata X Th. serrulata ?

Th. tenerifrons (Christ) Ching, Bull. Fan Mem. Inst. Biol., Bot. 10: 254. 1941. Basionym: Hypolepis tenerifrons Christ, Philip. Journ. Sci., Bot. 3: 274. 1908. Philippine Isls.

Th. tenerrima (Fée) Reed, comb. nov. Basionym: Aspidium tenerrimum Fée, Crypt. Vasc. Br., 1: 134, t. 43, f. 1. 1869. Brazil.

Th. tephrophylla (Copel.) Reed, comb. nov. Basionym: Dryopteris tephrophylla Copel., Philip. Journ. Sci., 40: 296. 1929. Philippine Isls. (Mindanao).

Th. terrestris (Copel.) Reed, comb. nov. Basionym: Dryopteris terrestris Copel., Univ. Calif. Publ. Bot., 18: 221. 1942. New Guinea.

Th. tetragona (Swartz) Small, Ferns S.E.States, 256, 476. 1938. Basionym: Polypodium tetragonum Swartz, Prodr., 132. 1788. Florida, Jamaica - Brazil, Peru, Galapagos Isls.

Th. tetragona subsp. aberrans Morton, Leaflets of Western Bot., 8(8): 194. 1957. Galapagos Isls.

Th. tetragona var. guadalupensis (Fée) Kramer, Acta Bot. Neerl., 9: 298. 1960. Basionym: Goniopteris guadalupensis Fée, 11e Mem. Foug., 64, t. 17, f. 2. 1866. Saba.

Th. teuscheri (v.A.v.R.) Reed, comb. nov. Basionym: Dryopteris teuscheri v.A.v.R., Bull. Dept. Agr. Ind. Neerl., 18: 6. 1908. Borneo.

Th. thelypteris (L.) Nieuwl., Amer. Midl. Nat., 1: 226. 1910. Basionym: Acrostichum thelypteris L., Sp. Pl., 2: 1071. 1753. = Th. palustris.

Th. thomsonii (Jenm.) Proctor, Bull. Inst. Jamaica, Sci. Ser., No. 5: 65. 1953. Basionym: Polypodium thomsonii Jenm., Journ. Bot., 1886: 272. 1886. Synonym: Dryopteris stuebelii Hieron., Hedwigia, 46: 340, t. 6, f. 13. 1907. Jamaica, Hispaniola, Colombia.

Th. thwaitesii (Hook.) Reed, comb. nov. Basionym: Meniscium thwaitesii Hook., Fil. Exot., t. 83. 1859. S. India, Ceylon.

Th. todayensis (Christ) Reed, comb. nov. Basionym: Dryopteris todayensis Christ, Philip. Journ. Sci., Bot. 2: 193. 1907. Philippine Isls.

Thelypteris tomentosa (Thouars) Ching, Bull. Fan Mem. Inst. Biol., Bot. 10: 255. 1941. Basionym: Polypodium tomentosum Thouars, Fl. Trist. d'Acunha, 32, t. 3. 1804. Bourbon, Tristan d'Acunha, Madagascar, Mascarenes.

Th. tonkinensis (C.Chr.) Ching, Bull. Fan Mem. Inst. Biol., Bot. 6: 292. 1936. Basionym: Dryopteris tonkinensis C.Chr., Bull. Mus. Paris, II, 6: 102. 1934. Tonkin, China (Kwangsi).

Th. toppingii (Copel.) K.Iwats., Acta Phytotax. Geobot., 21(5-6): 168. 1965. Basionym: Dryopteris toppingii Copel., Philip. Journ. Sci., 12C: 56. 1917. Synonym: Nephrodium indicum Ridley, Journ. Mal. Branch Roy. Asiat. Soc., 4: 73. 1926. Borneo, Malacca.

Th. torresiana (Gaudich.) Alston, Lilloa, 30: 11. 1960. Basionym: Polystichum torresianum Gaudich. in Freyc. Voy. Bot., 333. 1828. Synonyms: Aspidium uliginosum Kunze, Linnaea, 20: 6. 1847; Polypodium tenericaule Wall. ex Hook., Kew Journ. Bot., 9: 353. 1857; Nephrodium setigerum var. calvatum Bak., Journ. Bot., 1875: 201. 1875; Nephrodium oligophlebium Bak., Journ. Bot., 1875: 291. 1875; Dryopteris lasiocarpa Hayata, Mat. Fl. Formos., 417. 1911; Dryopteris elegans Koidz., Bot. Mag. Tokyo, 38: 108. 1924; Polypodium trichodes Reinw. ex J.Smith, Journ. Bot., 3: 394. 1841. Trop. Asia, Fiji, Bismarck Archipelago, India - Polynesia, Philippine Isls., Taiwan, Assam, China (Kiangsi), Japan (Kyushu); introd. in Trinidad, Brazil, Argentina.

Th. torresiana var. calvata (Bak.) K.Iwats., Mem. Coll. Sci., Univ. Kyoto, Ser. B, 31(3): 154. 1965. Basionym: Nephrodium setigerum var. calvatum Bak., Journ. Bot., 1875: 201. 1875. E. & Cent. China, Korea, Japan (Honshu, Shikoku, Kyushu).

Th. totta (Thunb.) Schelpe, Journ. S. Afr. Bot., 29: 91. 1963. Basionym: Polypodium tottum Thunb., Prodr. Pl. Cap., 172. 1800. Synonyms: Aspidium goggilodus Schkuhr, Krypt. Gew., 1: 193, t. 33c. 1809; Aspidium ecklonii Kunze, Linnaea, 10: 546. 1936; Nephrodium plantianum Pappe et Raws., Syn. Fil. Afr. Austr., 139. 1868. Trop. South Amer., West Indies, S. Africa, Taiwan, Japan, S.E.China, Australia, New Zealand, Hawaiian Isls.

Th. totta var. glabra (Mett. apud H.Itô) Reed, comb. nov. Basionym: Dryopteris gongylodes var. glabra Mett. apud H.Itô, Journ. Jap. Bot., 11: 786. 1935. Japan.

Th. totta var. glabra forma glaberrimus (H.Itô) Reed, comb. nov. Basionym: Cyclosorus goggilodus var. glaber forma glaberrimus H.Itô, Bot. Mag. Tokyo, 51: 714. 1937. Japan.

Th. totta var. glabra forma paucipilosa (H.Itô) Reed, comb. nov. Basionym: Cyclosorus goggilodus var. glaber forma paucipilosus H.Itô, Bot. Mag. Tokyo, 51: 714. 1937. Japan, Taiwan.

Th. totta var. hirsuta (Mett.) Morton, Contrib. U.S. Nat. Herb., 38(2): 73. 1967. Basionym: Aspidium unitum var. hirsutum Mett., Ann. Lugd. Bat., 1: 230. 1864. Synonym: Pteris polypodioides Poir. in Lam., Encycl. Meth., 5: 716. 1804. Brazil, Australia, New Zealand, Mexico, Hawaiian Isls.

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TWO NEW PINYON VARIETIES FROM ARIZONA

Elbert L. Little, Jr.

The pinyon (nut pine) of central Arizona with 1 slender leaf or needle in a fascicle, commonly referred to Pinus monophylla Torr. & Frém., is named here as a new variety of P. edulis Engelm. Another pinyon of the international border of southeastern Arizona, southwestern New Mexico, and adjacent northern Mexico, is distinguished as a new variety of its species, P. cembroides Zucc. (sens. strict.).

Many species of Pinus have broad geographic ranges distributed over widely varying climates, altitudes, and soils. Careful taxonomic examination of a widespread species often reveals the presence of geographic races and varieties. Like other pines, the pinyons exhibit similar geographic variations.

The 8 species of pinyons (nut pines) in southwestern United States and Mexico are grouped together as Pinus L. subsect. Cembroides Engelm. (St. Louis Acad. Sci. Trans. 4: 176, 178. 1880). Distribution maps have been published by William B. Critchfield and Little (U.S. Dept. Agr. Misc. Pub. 991, maps 15-18. 1966). Four species are native in the United States, though treated by some authors as varieties under the oldest name Pinus cembroides (sens. lat.). Morphological differences in seeds and other characters are sufficient not only for the retention of these 4 species, but also for the further recognition of additional geographical varieties and unnamed races.

From 1937 to 1941 I did research on Pinus edulis Engelm., the common species of pinyon, in Arizona and New Mexico as part of the research project of management of pinyon-juniper woodlands by the United States Forest Service (U.S. Dept. Agr., Agr. Handb. 271: 398-403, illus. 1965). The large edible seeds of that species are known as pinyon nuts (from Spanish piñon, plural piñones), pine nuts, and Indian nuts. They provide an annual harvest of about a million pounds or more. A taxonomic study of pinyons was begun and an abstract was published (Amer. Jour. Bot. 27 (10) sup. 24s. 1940). However, work on the project was discontinued during World War II.

One new variety from the Edwards Plateau in southwestern Texas was published, Texas pinyon, Pinus cembroides Zucc. var. remota Little (Wrightia 3: 183. 1966). Owing to delay in completing the taxonomic study, two additional varieties alluded to in that article are published here. A field trip to Arizona in May 1968 provided the opportunity for further study and collections of the two new varieties.

PINUS MONOPHYLLA Torr. & Frém. singleleaf pinyon
Pinus monophylla Torr. & Frém. in Frém., Rpt. Explor. Exped. Rocky Mts. 319, t. 4 1845; "monophyllus."

This is the pinyon of the Great Basin region, mountains from southern Idaho and northern and western Utah to Nevada, central and southern California, and northwestern Arizona, also northern Lower California, Mexico. Leaves 1 (rarely 2) in a fascicle, 2-6 cm. long, terete, 1.5-2 mm. wide, stout, rigid, sharp-pointed, dull light gray green, with 20-36 whitish lines or rows of stomata, and 3-9 (16) external resin-ducts. Cones ovoid, 5-7 cm. long; seeds narrowly ovoid, acuminate, 15-22 mm. long, very thin-walled (0.1-0.2 mm.), high in carbohydrate content and with mealy taste.

The type specimen was collected near Pine Nut Mts., SE. of Gardnerville, Douglas Co., Nevada, in 1844 by J. D. Frémont (267, NY). No varieties of Pinus monophylla are recognized here. However, a variation has leaves partly or mostly 2 in a fascicle.

PINUS EDULIS Engelm. pinyon
Pinus edulis Engelm. in Wisliz., Mem. Tour North. Mex. 88. 1848.

The commonest species of pinyon was named from a specimen collected in 1846 by A. Wislizenus (MO) near Santa Fe, New Mexico. It is widespread in foothills and mountains of Colorado, Utah, Arizona, and New Mexico and has outposts in adjacent states. The typical variety, P. edulis var. edulis, has 2 leaves in a fascicle, 2-5 cm. long, stout, rigid, green, with whitish lines of stomata on all surfaces, and 2 external dorsal resin-ducts. Cones ovoid or subglobose, 3-5 cm. long; seeds oblong, obtuse, 10-15 mm. long, thin-walled (0.3-0.4 mm.), high in fat content and with oily taste.

Variation in number of needles in a fascicle has long been observed among the pinyons. For example, the type specimen and plate of Pinus monophylla Torr. & Frém. both have rare 2-needle fascicles. P. fremontiana Endlicher (Syn. Conif. 183. 1847) was a renaming of P. monophylla, apparently because the needles were thought to be paired and cohering rather than single. P. edulis var. monophyllus Torr. (in Ives Rpt. Colo. R. pt. 4: 28. 1860; nom. nud.; Cebat Mts., J. S. Newberry in 1858, US) apparently was intended to unite both species, though under the later binomial. Among those giving additional reasons for combining the two were J. S. Newberry and Thomas Meehan (Torrey Bot. Club Bul. 12: 50, 81-82. 1885).

The legitimate trinomial Pinus monophylla var. edulis M. E. Jones (Zoe 2: 251. 1891) was made with the remark that both single and paired leaves were found frequently on the same individual tree. As no basionym was cited, the name was a new

variety, not a new combination.

Tidestrom (Fl. Utah Nev. 53. 1925) used number of resin-ducts in identification as follows: "Pinus monophylla is distinguished from Pinus edulis by the number of resin ducts in the leaves. In the former the number is normally eight (sometimes less), in the latter two in each leaf. Two-leaved forms of Pinus monophylla occur in western and southern Utah; these are recognized by three or four ducts in each leaf. Occasionally one-leaved forms of Pinus edulis are found, but these can readily be distinguished from Pinus monophylla by the number of ducts."

The 1-leaf or 1-needle variation of Pinus edulis described below was mentioned by me in five publications. Southwestern Trees (U.S. Dept. Agr., Agr. Handb. 9: 12. 1950) stated: "A form with the needles single as in singleleaf pinyon but relatively more slender and shorter occurs in central Arizona along the lower limit of the woodland zone north to Grand Canyon." The other references are: Key to southwestern trees (Southwest. Forest and Range Expt. Sta. Res. Rpt. 8: 4. 1951). Seminar and study tour of Latin-American conifers (Mex. Inst. Nac. Invest. Forest. English Ed. No. 1: 90. 1962). Pinyon (Pinus edulis Engelm.) (in Fowells, H. A., comp. Silvics of forest trees of the United States. U.S. Dept. Agr., Agr. Handb. 271: 402. 1965). Critchfield, William B., and Little, Geographic distribution of the pines of the world (U.S. Dept. Agr. Misc. Pub. 991: 8. 1966).

PINUS EDULIS Engelm. var. FALLAX Little, var. nov. pinyon

Pinus monophylla var. tenuis Tidestrom in Tidestrom & Kittell, Fl. Ariz. New Mex. 2. 1941; without Latin diagnosis.

A varietate typica differt foliis solitariis (1 in fasciculo, non 2), saepe etiam strobilis leviter maioribus 3.5-5.5 cm. longis seminibus paulo maioribus 14-17 mm. longis.

Arbor parva corona aperta rotunda extensa, ramulis tenuibus griseis glabris; gemmae cylindricae, acutae, leviter resinosae, squamis acutis fulvis; folia acerosa, 1 (raro 2) in fasciculo, brevia, plerumque 3-4 (2.5-5) cm. longa, 1.0-1.4 mm. lata, tereta, leviter curva, paulo flexilia, acuminata, integra, sordido-flavovirentia stomatibus 11-15 seriebus inconspicuis albidis; ductis resiniferis 2 (3) externalibus dorsalibus; vagina paulatim decidua; strobili subterminales, solitarii vel bini, fere sessiles, ovoidei, dehiscentes deciduique, parvi, 3.5-5.5 cm. longi, fulvi; squamae multae, apophysis rhomboidea, crassa umbone dorsali plano inermi; semina plura vel multa, gemina vel solitaria, obovoidea vel ellipsoidalia, magna, 14-17 mm. longa, 9-10 mm. lata, 7-8 mm. crassa, base obtuso, apice rotundo, aptera, testa tenue (0.3-0.4 mm.).

Small resinous tree 4-9 m. high, with trunk 15-30 cm. in diameter and open rounded spreading crown of nearly horizontal branches. Bark dark gray, rough, thick, furrowed into long scaly

plates. Twigs slender, light gray, smoothish, hairless. Buds cylindric, acute, slightly resinous; bud-scales acute, light brown. Leaves needlelike, 1 (rarely 2) in fascicle. Short, mostly 3-4 (2.5-5) cm. long, 1.0-1.4 mm. wide, terete, slightly curved, slightly flexible, acuminate, entire, dull light green with 11-15 inconspicuous whitish rows of stomata; resin-ducts 2 (-4) external dorsal; sheath of light brown membranous scales gradually deciduous.

Male strobili numerous, crowded, elliptic, 6-7 mm. long, light yellow. Year-old conelets on scaly stalk 4 mm. long, subglobose, about 1 cm. long, light brown, umbo rhomboidal with weak horizontal keel and short prickle.

Cones subterminal, single or paired, almost stalkless, ovoid, dehiscent and deciduous, small 3.5-5.5 cm. long, 3-4 cm. in diameter when closed and 4-6 cm. when open, yellow brown. Cone-scales many, apophysis rhomboidal, thick, keeled, the dorsal umbo flat, without prickle, apical and basal cone-scales reduced and sterile. Seeds several to many, paired or single, obovoid or ellipsoidal, large, 14-17 mm. long, 9-10 mm. wide, 7-8 mm. thick, dark brown, obtuse at base, rounded at apex, wingless, thin-walled (0.3-0.4 mm.), high in fat content and with oily taste.

TYPE COLLECTION, ARIZONA: Gila Co., Tonto National Forest, Sierra Ancha Expt. Forest, near Natural Drainage D, Sec. 14, T. 5 N., R. 13 E., alt. 4700 ft., July 4, 1961, E. L. Little, Jr. 18581 (holotype, US; isotypes, A, ARIZ, NY, OKL, TEX, UC, UNM, USFS).

Additional specimens distributed, ARIZONA: Coconino Co., Coconino National Forest, 9 mi. SE. of Sedona, Sec. 25, T. 16 N., R. 6 E., alt. 5200 ft., May 15, 1968, E. L. Little, Jr. 23002, 23003 (seedlings).

DISTRIBUTION: Mountains at 4500-5500 (6000) ft. altitude in central and eastern Arizona. Also local in Grand Canyon, Coconino Co., and in Florida Mts., Luna Co., New Mexico.

New Mexico: Luna Co., Florida Mts. J. S. Findley Jan. 31, 1960 (UNM).

Arizona: Mountains in central and eastern parts mostly along southern slopes of Mogollon Rim and adjacent mountains southward. From Oak Creek Canyon south and east to upper tributaries of Verde, Salt, and Gila Rivers. Coconino Co., Grand Canyon, Oak Creek Canyon, etc.; Yavapai Co., near Camp Verde, near Prescott, S. to Bradshaw Mts.; Gila Co., near Pine and Payson, Mazatzal Mts., Sierra Ancha, Pinal Mts., Apache Mts., etc.; Pinal Co., Superstition Mts. and Devils Canyon near Superior; Graham Co., Galiuro Mts., Pinaleño Mts. (Mt. Graham); Greenlee Co., mts. N. and E. of Clifton. Kaibab, Coconino, Prescott, Tonto, Coronado,

and Apache National Forests. San Carlos Indian Reservation.

This variety is found mostly southward and at lower altitudes than the typical variety. In the lower part of Oak Creek Canyon around Sedona it is common. However, it does not form extensive woodlands. It is scattered in the Pinyon-Juniper Type (SAF No. 239), associated with Juniperus osteosperma and J. monosperma, also in the chaparral type of evergreen shrubs such as Quercus turbinella.

In 1935 I first observed this 1-needle variation while in watershed management research at the Sierra Ancha Experimental Forest on the Tonto National Forest, about 30 miles north of Globe, Gila County, Arizona. The trees, referred to Pinus monophylla by local foresters, were scattered in the lower part of Parker Creek Canyon in the chaparral zone at an altitude of about 4700 ft. Three miles upstream in the same canyon in the oak woodland at 5800 ft. were a few trees of P. edulis, the typical 2-needle variation.

Soon after beginning work on the pinyon project about two years later, I concluded that this variation belonged with Pinus edulis. At that time, being reluctant to distinguish minor variations by name, I designated this one as "Pinus edulis Engelm. 1-leaf form." In 1939, I so annotated specimens in several eastern herbaria, using a rubber stamp. Likewise, in 1941, I checked specimens in California herbaria.

While in Washington, D.C., in 1939, I mentioned this variation of Pinus edulis to the late Ivar Tidestrom, then retired and working on his flora of Arizona and New Mexico. However, he changed from his earlier interpretation and named it Pinus monophylla var. tenuis Tidestrom (in Tidestrom and Kittell, Fl. Ariz. New Mex. 2. 1941; without Latin diagnosis). His brief English description was: "Distinguished from the type by its more slender leaves and the number of resinducts, the latter usually 2, marginal. West-central Arizona and westward." I cited this variety as a synonym of P. edulis in the Forest Service Check List (U.S. Dept. Agr., Agr. Handb. 41: 264. 1953).

Kearney and Peebles (Flowering Plants Ferns Ariz. 61. 1942; Ariz. Fl. 52. 1951) also were aware of this variation and remarked under Pinus monophylla: "As it occurs in Arizona, this pine scarcely differs from the ordinary pinyon (Pinus edulis) except in its solitary leaves, and may be only a variant of that species. Presumably typical P. monophylla, in California and Nevada, has thicker and more rigid leaves and larger cones than the Arizona form."

Trees and specimens of this new variety generally have been referred to Pinus monophylla on the basis of needle number. The varietal epithet fallax, deceptive, refers to this character.

However, herbarium specimens of the new variety are readily distinguished by the slender narrow green needles only 1.0-1.4 mm. wide. P. monophylla has relatively stout, rigid, sharp-pointed needles varying greatly in length, 2-6 cm. long, 1.5-2 mm. wide, straight or slightly curved, and a different color, gray green (grayer than in P. edulis) or sometimes pale olive green.

There are also slight differences in needle anatomy in cross section. Along with smaller diameter, the new variety has fewer (11-15) rows of stomata, usually thinner hypodermis, and fewer resin-ducts, usually 2 (-4), as observed by Tidestrom (Fl. Utah Nev. 53. 1925). Pinus monophylla has 20-26 rows of stomata, hypodermis of 1-3 layers of thick-walled cells, and 3-9 (16) resin-ducts. Of course, differences in needle anatomy are useful to the extent they are correlated with other morphological characters. For example, number of resin-ducts alone would not merit separation of populations into species.

Seeds of Pinus monophylla are easily distinguished from seeds of P. edulis (including the new variety) by their larger size, 15-22 mm. long, thinner shells or seed coats (0.1-0.2 mm.), and chemical composition and taste. The shape is slightly different, narrowly ovoid, relatively less broad and gradually tapering to base. The seeds are so thin-shelled that they can be crushed and cracked with the fingers, between thumb and forefinger, while seeds of P. edulis must be cracked with the teeth.

Pinyon nuts of Pinus edulis, including the new variety, have an oily flavor, while those of P. monophylla are mealy. These taste differences have been confirmed by chemical analyses, for example, by C. W. Botkin and L. B. Shires (The composition and value of pinon nuts. N. Mex. Agr. Expt. Sta. Bull. 344, 14 pp., illus. 1948). Seeds of P. edulis average more than 60 percent fat, less than 20 percent carbohydrate, and less than 15 percent protein. Seeds of P. monophylla average less than 25 percent fat, more than 50 percent carbohydrate, and less than 10 percent protein. Most persons prefer the oily flavor over mealy. Nearly all the pinyon nuts or Indian nuts sold commercially belong to P. edulis. However, nuts of P. monophylla are harvested and consumed locally. Botkin and Shires reported a chemical analysis of one sample of P. edulis 1-leaf variety from southeast of Kingman, Ariz., oily like the typical variety but with slightly higher fat content (65.66%).

The two varieties of Pinus edulis have separate natural ranges and altitudinal zones but meet in a few places. Plants of the new, 1-needle variety bear 2-needle fascicles rarely. Plants of the typical, 2-needle variety produce 3-needle fascicles rarely but not 1-needle fascicles.

Further field work in early autumn to collect specimens with filled seeds would be desirable in northwestern Arizona and

southwestern Utah. In those regions, trees with both 1- and 2-needle fascicles have been found. Pinus monophylla is known in Arizona only from the northwest corner, in Virgin Mts. and Hualapai Mts. and vicinity in Mohave County. Eastward, for example, near Peach Springs, this species meets and may intergrade with the typical 2-needle variety of Pinus edulis. Also, P. edulis var. fallax may extend northwest to Hualapai Mts.

Pinus edulis var. fallax has no outstanding characters of economic value. Its nuts are not of commercial importance because of poor seed crops. No bumper pinyon nut crops have been reported within its range. Trees at low altitudes seldom mature seeds in quantities, and many full-size seeds are empty (blighted or blasted). This variety is located in a warmer climate than the typical variety and sheds pollen up to a month earlier. Because of the longer growing season, it might grow less slowly. This variety is hardy in a semiarid warm temperate climate and is classed doubtfully in Zone 7, while the typical variety is hardy in Zone 4. Like the latter, the new variety may have possibilities for planting for shelterbelts, timber, pulpwood, erosion control, wildlife cover and food, and Christmas trees. In future tree breeding programs for pinyon nut production, this large-seed variety of a lower altitudinal zone should be tested.

Number of needles in a fascicle has been reduced to 1 independently in 3 species of pinyon, P. monophylla, P. edulis var. fallax, and P. nelsonii Shaw (Little in Seminar and study tour of Latin-American conifers. Mex. Inst. Nac. Invest. Forest. English Ed. No. 1: 90. 1962). In P. nelsonii of Mexico 3 very slender, weak needles cohere functionally as 1. Reduction of needle number in a fascicle occurs in semiarid regions with low rainfall and may be assumed to be an adaptation for reduced leaf surface with less transpiration. These illustrations with 1-needle fascicles are interesting examples of reversible evolution from alternate leaves to whorled and back to alternate. The spur shoot in Pinus with mostly 2-5 needles may have developed from an ancestral type like Cedrus or Larix with needles both alternate on leading twigs and whorled on spur shoots. The 1-needle pinyons approach the original, primitive type with alternate leaves as in several related genera such as Picea, Tsuga, and Abies.

PINUS CEMBROIDES Zucc. Mexican pinyon

Pinus cembroides Zucc., K. Bayer. Akad. Wiss. Munchen, Abhandl. Math.-Phys. 1: 392. 1832; Flora [Jena] 15 (2), Beibl. 93, 1832.

Mexican pinyon was named from a specimen collected by Wilhelm F. Karwinski in central Mexico, apparently near Zimapán, Hidalgo (Endlicher, Synops. Conif. 183. 1847). The typical variety of this species is widely distributed in mountains of northern and central Mexico and extends northward into the United States only in Trans-Pecos Texas. It has fascicles of 3 slender leaves

mostly 3.5-5 cm. long, with 2-5 lines of dorsal stomata, also thick-walled seeds (0.5-1.0 mm.)

In the restricted sense, Pinus cembroides has two additional varieties. P. cembroides var. remota Little (Wrightia 2: 142. 1959), Texas pinyon, rare and local in the Edwards Plateau and Trans-Pecos Texas, is characterized by leaves mostly 2 in a fascicle (with dorsal stomata) and by thin-walled seeds (0.1-0.4 mm.). That variety might be of hybrid origin between that species and P. edulis. The other variety is described below.

PINUS CEMBROIDES Zucc. var. BICOLOR Little, var. nov.

Mexican pinyon

A varietate typica differt foliis bicoloribus sine stomatibus dorsalibus, superficie dorsali atro-virenti et superficiebus ventralibus albis atque glaucis: etiam strobilis minoribus 2-3 cm. longis seminibus paucioribus minoribus (8) 10-13 mm. longis.

Arbor parva corona aperta extensa irregulari vel rotunda, ramulis tenuibus griseis glabris; gemmae cylindricae, acutae, leviter resinosae, squamis elongato-acuminatis, apice atro-rubro; folia acerosa, 3 (raro 2 vel 4) in fasciculo, brevia, plerumque 2.5-4 (2-5) cm. longa, 0.8-1.0 mm. lata, tenua, flexilia, acuminata, integra, bicoloria sine stomatibus dorsalibus, stomatibus ventralibus 2-3 seriebus, ductis resiniferis 2 externalibus dorsalibus; vagina paulatim decidua; strobili subterminales, solitarii vel bini, brevi-pedunculati, subglobosi, dehiscentes et decidui, perparvi, 2-3 cm. longi, fulvi; squamae plurae vel multae, apophysis rhomboidea, crassa umbone dorsali plano inermi: semina pauca, solitaria vel gemina, ellipsoidalia, parva, (8) 10-13 mm. longa, 7-10 mm. lata, 7-8 mm. crassa, base atque apice rotundo, aptera, testa crassa (0.7-1.0 mm.).

Differs from the typical variety in the two-colored leaves without dorsal stomata, dorsal surface dark green, and ventral surfaces white and glaucous; also in the smaller cones 2-3 cm. long with fewer, smaller seeds (8) 10-13 mm. long.

Small resinous tree 4-9 (15) m. high, with trunk 12-45 cm. in diameter and open irregular or rounded spreading crown of nearly horizontal branches. Bark blackish or dark gray, rough, thick, furrowed into long scaly ridges or plates, often exposing orange brown or reddish brown inner bark, on large branches gray and smooth. Twigs slender, light gray, smoothish, hairless. Buds cylindric, acute, slightly resinous; bud-scales long acuminate, light brown, dark red at apex. Leaves needlelike, 3 (rarely 2 or 4) in fascicle, short, mostly 2.5-4 (2-5) cm. long, 0.8-1.0 mm. wide, slightly spreading, slender, straight, flexible, acuminate, entire, dorsal surface dark green without dorsal stomata, ventral surfaces white and glaucous with 2-3 inconspicuous rows of stomata; resin-ducts 2 external dorsal; with sheath of light brown

membranous scales gradually deciduous.

Year-old conelets on scaly stalk 5-8 mm. long, subglobose, 8-10 mm. long, light brown, umbo rhomboidal with weak horizontal keel and no prickle.

Cones subterminal, single or paired, short-stalked, subglobose, dehiscent and deciduous, very small, 2-3 cm. long, 2-2.5 cm. in diameter when closed and 3-4 cm. when open, yellow brown, often slightly reddish tinged. Cone-scales several to many, the apophysis rhomboidal, thick, keeled, the dorsal umbo flat, without prickle, apical and basal cone-scales reduced and sterile. Seeds few (sometimes only 1), single or paired, ellipsoidal, small, (8) 10-13 mm. long, 7-10 mm. wide, 7-8 mm. thick, dark brown, rounded at base and apex, wingless, thick-walled (0.7-1.0 mm.), edible, high in fat content and with oily taste.

TYPE COLLECTION, ARIZONA: Santa Cruz Co., Coronado National Forest, Santa Rita Mts., Madera Canyon, Sec. 13, T. 20 S., R. 14 E., alt. 6500 ft., May 20, 1968, E. L. Little, Jr. 23011 (female plant, cones and seeds under several trees; holotype, US; isotypes, A, ARIZ, NY, OKL, TEX, UC, UTM, USFS), 23010 (male plant), 23012 (seedlings).

DISTRIBUTION: Mountains at 5000-7000 (8000) ft. altitude in southwestern New Mexico, southeastern Arizona, northeastern Sonora, and western Chihuahua. Also local in mountains of Coahuila, Nuevo León, Tamaulipas, San Luis Potosí, and Zacatecas.

New Mexico: Mountains of southwestern corner; Hidalgo Co., Peloncillo Mts. on Coronado National Forest, Animas Mts., Big Hatchet Mts.; Grant Co., mts. near Pinos Altos, Mule Creek, and Burro Mts. all on Gila National Forest.

Arizona: Mountains of southeastern part including nearly all divisions of Coronado National Forest; Greenlee Co., mts. N. and E. of Clifton on Apache National Forest; Graham Co., Pinaleño Mts. (Mt. Graham); Pima Co., Santa Catalina Mts. (Mt. Lemmon), Rincon Mts., Baboquivari Mts., Coyote Mts.; Santa Cruz Co., Santa Rita Mts., Ruby Mts. NW. of Nogales, Patagonia Mts.; Cochise Co., Huachuca Mts., Mule Mts., Whetstone Mts., Chiricahua Mts., Peloncillo Mts. Probably on other peaks reaching 7000 ft. altitude.

Sonora: Mountains in northeastern part and along international boundary west toward Nogales.

Chihuahua: San Luis Mts. in northwestern corner along international boundary. Apparently less common in Sierra Madre Occidental in western Chihuahua than typical variety; recorded from near El Vergel (Little 18919) in southwestern part, also an intermediate specimen with 2 rows of dorsal stomata on leaves collected 25 mi. W. of La Junta (Little 18907).

Specimens of Pinus cembroides without dorsal stomata were noted from other states of Mexico, as follows:

TAMAULIPAS: 3 mi. N. of Miquihuana, July 11, 1949, Stanford, Lauber, Taylor 2397 (UTC).

COAHUILA: Mt. Jimulco, 13 km. E. of Jimulco, alt. 3100 m., June 29, 1941, Stanford, Retherford, Northcraft 110 (CAL, UTC): Sierra de la Madera, Cañon del Agua, Mun. de Cuatro Ciénegas, Sept. 8, 1939, C. H. Muller 3229 (CAL).

SAN LUIS POTOSÍ: 13 mi. SW. of San Luis Potosí, alt. 7800-8000 ft., July 28, 1958, R. M. Straw & M. Forman 1438 (US).

ZACATECAS: Concepción del Oro, Sierra Madre Oriental, alt. 2500-2700 m., July 18-19, 1934, F. W. Pennell 17435 (US): Jaguey, Cedros, alt. 8000 ft., May 1908, F. E. Lloyd 84 (US, CAL).

NUEVO LEÓN: Sierra de la Cebolla, Mun. de Montemorelos y Rayones, Aug. 21, 1939, C. H. Muller 2916 (CAL).

All trees and specimens of Pinus cembroides Zucc. (sens. strict.) native in southeastern Arizona and southwestern New Mexico are referred here to var. bicolor, having two-colored leaves without dorsal stomata. This new variety of Mexican pinyon is not abundant within its range and does not form extensive woodlands as does Pinus edulis northward. Instead, Mexican pinyon is scattered in evergreen woodlands of junipers and oaks in the Pinyon-Juniper Type (SAF No. 239) and Interior Live Oak Type (SAF No. 241). It is less common than the associated tree species: Juniperus deppeana, Quercus emoryi, Q. hypoleucoides, Q. reticulata, Q. arizonica, Pinus ponderosa var. arizonica.

Jack McCormick and John W. Andresen (A subdioecious population of Pinus cembroides in southeast Arizona. Ohio Jour. Sci. 63: 159-163. 1963) studied Pinus cembroides in Chiricahua Mountains, Cochise County, Arizona, pinyon trees included here within the new variety. They reported that only about 2 per cent of the individuals were monoecious and the others either male or female. When the type collection for this new variety was made, most trees were readily separable into male or female, and a second collection was from a male tree. Madera Canyon, Santa Rita Mountains, is about 90 miles west of Chiricahua Mountains. In Madera Canyon pinyon trees are scattered and not abundant.

The needle anatomy has been described and illustrated under Pinus cembroides by W. M. Harlow (The identification of the pines of the United States, native and introduced, by needle structure. N.Y. State Coll. Forestry Syracuse Univ. Tech. Pub. 32, 21 pp., illus. 1931). His description of the position of stomata, "ventral, rarely if ever dorsal as well," clearly refers to the new variety.

Absence of dorsal stomata in leaves was used to distinguish Pinus cembroides from P. edulis by Maxwell T. Masters (A general view of the genus Pinus. Linn. Soc. London Jour. Bot. 35: 586, 588. 1904). However, George Russell Shaw (The pines of Mexico. Arnold Arboretum Pubs. 1: 6. 1909) added that this character fails in Mexican specimens. Obviously Masters was observing this new variety from Arizona.

Pinus cembroides var. bicolor is easily recognized by the slender leaves in a fascicle of contrasting colors, the outer surfaces dark green without rows of stomata and the inner surfaces white. The two-colored leaves are conspicuous in herbarium specimens though less so in those dried by artificial heat. The whitish lines or rows of stomata are present on the dorsal leaf surfaces of other pinyons with two exceptions of limited distribution. P. quadrifolia Parl., Parry pinyon, of southern California and northern Lower California, has two-colored leaves but stout and mostly 4 in a fascicle, rarely with dorsal stomata. P. culminicola Andresen & Beaman, known only from Cerro Potosí, Nuevo León, has 5 leaves in a fascicle.

Pinus cembroides var. bicolor, like P. edulis, could become a popular Christmas tree in the Southwest. The two-color foliage of slender dark green and white needles is especially attractive. Nearly all plants of this variety in the United States are within the national forests. Accordingly, the U.S. Forest Service would supervise the harvesting of Christmas trees on a sustained yield basis.

The new variety of Mexican pinyon is of no commercial importance for pinyon nuts because of its scattered occurrence, generally poor seed production with no bumper crops, and particularly the small thick-shelled seeds. The wood should be suitable for the same uses as in other pinyon species, for example, mine timbers and pulpwood. The trees should be hardy in semiarid warm temperate regions and could be planted experimentally in marginal areas near the lower limits of trees. However, growth probably would be very slow. The new variety of Mexican pinyon is adapted to a mild winter climate and in hardiness is classed doubtfully in Zone 7, while the typical variety of Pinus edulis is in Zone 4.

Pinyon trees of three different taxonomic groups were collected by me in 1956 growing together where their ranges meet in central Greenlee County, Arizona. The easily accessible locality is along U.S. Highway 666 about 14 miles north of Clifton on the Apache National Forest (T. 3 S., R. 29 E.). Here, side by side, in a shrub type at 6200 ft. altitude, were the following: Pinus edulis var. edulis to 20 ft. high and 8 in. d.b.h.,near its southwestern border and lower altitudinal limit; Pinus edulis var. fallax near its southeastern limit; and Pinus cembroides var. bicolor at its northernmost limit. There were no intermediate plants except that those of the 1-leaf variety had some 2-

leaf fascicles.

Trees of Pinus edulis var. edulis and P. cembroides var. bicolor grow together also along Arizona State Highway 78 in mountains about 15 miles east of Clifton on Apache National Forest (T. 4 S., R. 32 E.). Even though branches of both species were touching one another, I saw no intermediate or hybrid trees.

Pinus cembroides var. cembroides may intergrade in Trans-Pecos Texas with P. edulis var. edulis, which extends southeast into two localities there. Also, P. cembroides var. remota of eastward range into the Edwards Plateau might be partly of hybrid origin or possibly an ancestral intermediate type. Jack McCormick and John W. Andresen (Ohio Jour. Sci. 63: 162. 1963) mentioned that Marion T. Hall had observed in central New Mexico, from the Sacramento Mountains northward to the Sandia Range, trees considered to be introgressants of the two species. Recently George G. Fogg has reported hybridization in the Cembroid pines (Ecol. Soc. Amer. Bul. 49: 71. 1968).

Early in my field work with pinyons in Arizona and New Mexico, I observed the striking characters separating Pinus edulis and P. cembroides there. In the meantime I have studied P. cembroides in Texas and Mexico. After field work in April 1963, I reviewed the pinyons of Texas (Wrightia 6: 181-187. 1966). While working in Mexico in 1945, I observed P. cembroides near the type locality in Hidalgo. In September-October 1960 I made extensive collections of Mexican pines as the United States representative with the Seminar and Study Tour of Latin-American Conifers, under the Food and Agriculture Organization of the United Nations (Mex. Inst. Nac. Invest. Forest. English Ed. No. 1, 209 pp., illus. 1962). Again in March 1963 I collected pinyons and other pines in northern and central Mexico.

The differences between Pinus edulis and P. cembroides in Arizona and New Mexico were summarized 30 years ago in a 3-page mimeographed Research Note (Little, Mexican pinon (Pinus cembroides). Southwestern Forest and Range Expt. Sta. Research Note No. 47, 3 pp. 1938). The essential details, which refer to P. cembroides var. bicolor, are quoted below.

"While the academic question of ranking variations as separate species or merely varieties is unimportant in practical forestry, it so happens that seed characters of pinons, which several recent taxonomists have overlooked, are of great economic importance. Actually, Pinus cembroides and Pinus edulis, as represented in the United States, are so distinct that a single needle, a single winter bud, a single seed, a single immature cone, and in most cases a single mature cone can be assigned with certainty to one of the two species. [Note added in 1968: This statement does not hold for some Texas specimens of other varieties of P. cembroides.]

"Differences between the two species which hold true for trees growing in Arizona and New Mexico are tabulated below. The characters of greatest taxonomic value are indicated by asterisks (*).

CHARACTER	PINUS CEMBROIDES [var. bicolor]	PINUS EDULIS
Needles		
*Number in cluster	usually 3	2, rarely 1 or 3
Shape	slender	stout
*Width	less than 1 mm	greater than 1 mm
*Dorsal stomata	absent	4 to 6 longitudinal rows
Color of outer surface	dark green	light green
Color of inner surface	white all over	more or less white
Winter buds		
*Shape of scales	long tapering point	short-pointed
Immature (year-old) cones		
*Stalk	long, 5 to 8 mm long	short, 2 to 3 mm long
Length	8 to 10 mm	8 to 14 mm
Prickle on cone scale	inconspicuous	nearly 1/2 mm long
Mature cones		
Length	20 to 25 mm	25 to 50 mm
Shape	nearly spherical	longer than broad
Seeds (nuts)		
Length	8 to 13 mm	10 to 15 mm
Thickness of shell	2/3 to 1 mm	less than 1/3 mm
*Strength of shell	cannot be cracked with the teeth	easily cracked with the teeth
Economic importance in United States	none	high

"Other distinguishing characteristics have been proposed. There are a few microscopic differences in wood anatomy. Sudworth (U.S. Dept. Agr. Bull. 460) mentions the different numbers of cotyledons or seedleaves, 8 to 15 in Pinus cembroides and 7 to 10 (the author finds 6 to 12) in Pinus edulis, but these numbers vary widely. The author is unable to detect differences in bark.

"The two species may easily be distinguished by testing the nuts with the teeth. The most practicable vegetative characteristic in the field is the presence or absence of the white longitudinal rows of stomata on the dorsal or outer surface of the needles. This character is less conspicuous in herbarium specimens because the color fades, and, according to Shaw (The Pines of Mexico), does not hold in specimens from Mexico. In the field the slender, spreading needles of Pinus cembroides present a color contrast of dark green and white, while the stouter, light green needles of Pinus edulis, being mostly in twos, do not expose their whitish inner surfaces as much. . . .

"In a few places in Arizona and New Mexico the ranges of Pinus cembroides and Pinus edulis meet, but they do not overlap much. Trees of the two species growing side by side are not distinguishable at a distance but may readily be identified when the characters previously mentioned are examined. No intergrades or hybrids have been observed. It would be interesting to know whether these closely related species shed their pollen at the same time.

"Although it is reported that they are gathered and eaten on a large scale in Mexico, nuts of Mexican pinons are of no commercial value in the United States at present because of their hard shells. Mr. Karl Pitschner, of the Albuquerque Food Products Co., reports that in fairly well dried nuts the shells of Pinus cembroides make up 65 to 67 percent of total weight and shells of Pinus edulis only 48 percent. The abundance of Pinus cembroides is insignificant in compari.. with Pinus edulis. Nut crops of Mexican pinon trees in the United States apparently are light or frequently failures. Only a few nuts are contained in one cone, and many nuts are empty.

"Thus, Pinus cembroides and Pinus edulis in the United States are sufficiently distinct to be regarded as separate species, even under a conservative interpretation. Additional taxonomic study of Mexican trees and specimens, including examination of the type specimen of Pinus cembroides, is needed to test the constancy of the characteristics enumerated here."

KEY TO ARIZONA PINYONS

The following key to the 4 taxonomic groups of pinyons (nut pines) native in Arizona will serve as a summary:

Needles 1 (rarely 2) in fascicle
- Needles stout (1.5-2 mm. wide), light gray green; seeds very thin-walled, with mealy taste; northwestern Arizona . . . . . Pinus monophylla
- Needles slender (1-1.4 mm. wide), light green; seeds thin-walled, with oily taste; central and eastern Arizona . . . . . Pinus edulis var. fallax

Needles 2 or 3 in fascicle
- Needles mostly 2 in fascicle, stout (more than 1 mm. wide), green, with 4-6 rows of dorsal stomata; seeds thin-walled; northern and eastern Arizona . . . . . Pinus edulis var. edulis
- Needles mostly 3 in fascicle, slender (less than 1 mm. wide), two-colored, dorsal surface dark green without dorsal stomata, ventral surfaces white; seeds thick-walled; southeastern Arizona . . . . Pinus cembroides var. bicolor

Forest Service, United States Department of Agriculture, Washington, D. C. 20250.

THE ERUPTION IN HIIAKA CRATER, ISLAND OF HAWAII

Otto & Isa Degener

Hiiaka* Crater, a minor pit crater in Hawaii Volcanoes National Park and named in honor of the sister of the Hawaiian Volcano Goddess Pele, showed activity at 6.45 A.M., August 22, 1968, the first time within the memory of man. Clouds of acrid fumes rose into the air to be carried by the trade wind in a southwesterly direction. Though the activity culminated in a 75-foot lava fountain, and a pool of lava 300 feet in circumference accumulated in the crater before draining away underground, the area became quiescent before noon of the same day.

On August 24 we drove along the Chain-of-Craters Road, turning into the side road leading to Ainahou Ranch. For a distance of about a mile along this road or up to one and a half miles leeward as the crow flies from Hiiaka Crater, we noted the following common plants affected by the fumes: Sadleria cyatheoides (endemic), Lycopodium cernuum var. crassifolium (native), Arundina bambusifolia (naturalized weed), Santalum paniculatum (endemic), Osteomeles anthyllidifolia (native), Dodonaea viscosa s.l. (native), Styphelia tameiameiae (endemic), Vaccinium reticulatum (endemic), Buddleja asiatica (naturalized weed), Pluchea odorata (naturalized weed), and Railliardia ciliolata var. laxiflora (endemic). Their leaves showed signs of wilting andor yellowing and often death. What impressed us was that the endemic Metrosideros, often incorrectly considered conspecific with the New Zealand M. collina, showed no damage from the fumes at all, apparently having developed an efficient immunity over the ages.

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*Incorrectly spelled "Heake" on the United States Geological Survey map, edition of 1933.

NOTES ON NEW AND NOTEWORTHY PLANTS. LI

Harold N. Moldenke

DURANTA CAJAMARCENSIS Moldenke, sp. nov.

Arbuscula valde armata; ramis rigidis tetragonis glabris nitidis parce punctato-lenticillatis, angulis acutis saepe submarginatis; ramulis abbreviatis spiniformibus 2--5 cm. longis rigidissimis apice argutis; laminis decussato-oppositis coriaceis ellipticis integris, apice acutis, ad basin longe attenuatis, juventute subtus pubescentibus, maturitate utrinque glabris; corollis albis.

Very spiny shrub; branches medium-slender, rigid, acutely tetragonal, glabrous, shiny, sparsely lenticillate with more or less punctiform lenticels, the angles often submargined; twigs abbreviated, decussate-opposite, very rigid, 2--5 cm. long, composed of several nodes and internodes, very sharply aculeate at the apex; leaves petiolate, decussate-opposite; petioles about 5 mm. long; leaf-blades coriaceous when mature, elliptic, 3--5 cm. long, 1--1.7 cm. wide, acute at the apex, entire on the margins, long-attenuate at the base, pubescent beneath when immature, glabrous and shiny on both surfaces when mature; flowers apparently a single pair on filiform peduncles about 5 mm. long at the apex of a very much abbreviated filiform twiglet in the axil of the leaf subtending a spine, this twiglet and peduncles puberulent; pedicels less than 1 mm. long, filiform, puberulent; calyx obconic, about 4 mm. long, 2 mm. wide at the top, puberulent; corolla white, its tube equaling the calyx, its limb spreading or reflexed.

The type of this species was collected by A. Sagástegui A. (no. 6384) on a shrubby slope, at an altitude of 2500 meters, at Guzmango, in the province of Contumaza, Cajamarca, Peru, on October 5, 1967, and is deposited in my personal herbarium at Plainfield, New Jersey.

VERBENA OCCULTA f. AURANTIACA Moldenke, f. nov.

Haec forma a forma typica speciei corollis aurantiacis recedit.

This form differs from the typical form of the species in having the corollas orange-red according to notes by the collector on the label of the type specimen.

The type of the form was collected by N. Angulo (no. 1383) in a cultivated field at Humachuco, in the province of Humachuco, La Libertad, Peru, at an altitude of 2170 meters, on July 16, 1951, and is deposited in my personal herbarium at Plainfield, New Jersey. The term actually used by the collector to describe the color of the corollas is "naranjadas". The typical form of the species is described as having purple corollas, and there is an albino form known with white corollas.

BOOK REVIEWS

Alma L. Moldenke

"THE ELEMENTS OF CYTOGENETICS" by G. B. Wilson, 120 pp., illus., Reinhold Book Corporation, New York 10022, Amsterdam & London. 1968. $2.25.

This paper-back is the eighth in the series edited by Peter Gray on SELECTED TOPICS IN MODERN BIOLOGY, and like the others provides the beginning student with a clearcut, interesting and intelligent survey of the field. It develops excellently basic principles, chromosome distributions in mitosis and meiosis or chromosome constitution, analysis, sex determination, and mechanics.

There are included a useful glossary, a good bibliography, a needed index, and very helpful illustrations.

This book will have its greatest use among college freshmen. It should also be used as enrichment for brighter high school biology students and for the interested layman.

"FLORA NEOTROPICA" Monograph I "SWARTZIA" by Richard S. Cowan, 227 pp., illus., Hafner Publishing Company, London & New York 10003. 1968. $13.00.

The Organization for Flora Neotropica has just inaugurated this journal as a vehicle for monographic taxonomic accounts of plants growing spontaneously within the Western Hemisphere tropics. The contributions will have geographic, ecologic, cytologic, anatomic, chemical and economic data; they will be organized in similar formats with bibliographies, citation of specimens and indexes. The executive director is Dr. Bassett Maguire who is at the New York Botanical Garden.

This first issue contains a very carefully developed monographic study of the legume genus Swartzia of this area, omitting Bocoa, which may be a distinct genus. It is the thorough work of a well experienced field botanist and systematist. There are clear geographic distribution maps, excellent drawings, a list of collectors with their collections, a numerical list of 127 species and 67 varieties, an exclusion list, and a correction sheet, all in clear print.

"TAXONOMY OF AMERICAN SPECIES OF LINDEN (Tilia)" by George Neville Jones, 156 pp., illus., Illinois Biological Monographs No. 39, University of Illinois Press, Urbana, Illinois, paperbound. 1968. 50 sh 6 d. or $5.95.

Even though this study is the thorough one of an experienced teacher/field man/taxonomist, the introduction and many descrip-

tive items make interesting and easily comprehended reading. Like the study above, it is well provided with a few geographic maps, specimen photographs, specimen citations, list of collectors, and index.

"THE GENUS PINUS" by N. T. Mirov, viii & 602 pp., illus., Ronald Press, New York 10016. 1967. $15.00.

This book represents a thorough and somewhat monographic study through interesting facts and easy writing style of the economically important and conspicuous pine genus. The topics covered are: history, paleobotany, geography (a specialty of the author), genetics, morphology, reproduction, physiological ecology, biochemistry (omitting lumber studies but including many of the author's studies), classical and modern taxonomy (omitting the citation of specimens and still using the sections Haploxylon and Diploxylon), and an evaluating summary.

Pinus dates back to the Mesozoic, has become a larger group since glaciation even with man's onslaught considered, is well established throughout the North Temperate Zone, has spread effectively into subtropical areas, and reproduces well and freely since all species have the same number and kind of chromosomes.

This book is botanically needed because much has been learned (and published in many isolated places) since Shaw's monograph of 1914 and Pilger's treatment in the Engler & Prantl of 1926. Literature is cited at the end of chapters, diagrams and fine photographs are included, and excellent species distribution and chemical distribution maps are presented. The print is easily read. The index is full.

"A MANUAL OF PENICILLIA" by Kenneth B. Raper and Charles Thom, ix & 875 pp., illus., copyrighted 1942 and reprinted by arrangement, Hafner Publishing Company, London & New York 10003. 1968. $27.50.

The biochemical, medical and industrial development of penicillin from suitable members of the thousands of tested newer strains has meant that there are now thousands of pharmacists, pharmacologists, medical doctors, chemists, chemical engineers, technicians and other research assistants who need handy and accurate sources for the identification of their cultures. This offset printing of this earlier classic with its obvious descriptions, fine line drawings and photographs of many cultures in color and in black-and-white will fill much of that need very effectively. The system of nomenclature followed is more in manual than taxonomic monograph style stressing a workable system of descriptive diagnoses which will enable the user to identify the Penicillium mold in his culture with the genus deemed to include all penicillate green molds with or without ascospores.

It is interesting to note that the authors persist in using

the plural form of the genus as a proper name.

"PLANT NEMATOLOGY" by W. R. Jenkins and D. P. Taylor, xvii & 270 pp., illus., Reinhold Publishing Company, London, Amsterdam, & New York 10022. 1967. $12.50.

Herewith a useful, fine book has been added to the "Reinhold Books in the Biological Sciences" series by eminently qualified authors. After a general introduction it covers anatomy and morphology with many fine original drawings and good photographs, nature and range of nematode damage to plants directly or indirectly in association with other pathogens, and descriptive accounts of the following nematodes -- lancers, lesioners, burrowers, cyst-formers, root-knotters, bulb and stem residents, stylet possessors, seed and leaf gallers, ring-formers, pins, sheathers, leaf dwellers, awlers, daggers, stubby rooters, etc., as well as several typical non-parasitic soil forms. Some chapters are devoted to kinds of chemical, physical and cultural control. Biological control by natural predators, by trap crops that prevent maturation after entry, by growth of antagonistic plants nearby and by development of resistant varieties and make very interesting reading.

With only an estimated 2 percent of nematodes scientifically described to date and with an estimated 10--25 percent crop damage in the United States due to their depredations, this book should prove a fine introductory text and reference work for students in the field now or to be enticed into it. More material of an ecological and physiological nature would have rounded out this survey better.

"THE PRESERVATION OF NATURAL HISTORY SPECIMENS", Volume II by Reginald Wagstaffe and J. Havelock Fidler, xv & 404 pp., illus., Philosophical Library Press, New York 10016. 1968. $17.50.

These British authors have a marked advantage over comparably trained American workers because the country of the former has been effectively preserving a world-wide assortment of nature materials for centuries longer than we in herbaria, museums, universities, etc.

This volume explains clearly the most successful preservation methods for parts of, products of, or all of chordates (including Walter's plastic method for the reproduction of reptiles and amphibians), all types of plants, and geologic materials (rocks, minerals, fossils, relief maps).

The first volume appeared in 1955 and dealt with invertebrates and their preservation.

Several excellent appendices cover apparatus, preservatives, labelling, storage structures and problems, maintenance of collections, photographic records, and microscopy.

This work makes an excellent, easily understood, yet thorough text for museum techniques and an excellent reference for the

professional and the amateur's guidance.

"THE PYRAMID OF LIVING THINGS" by Edith Raskin, 192 pp., illus., McGraw-Hill Book Company, Toronto, London, Sydney, & New York 10036. 1967. $4.50.

In this book the important ecological concept of the title is explained several times over in interesting, simple, quick-reading language. Young students as well as adults could profit from it and enjoy it. The interdependence of all life especially through the food chain is demonstrated among some of the major creatures of the following biomes -- the arctic and antarctic tundras, the tiagas, the deciduous forests, the middle latitude grasslands, the deserts, the tropical rain forests, and the savannas.

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ADDITIONAL NOTES ON THE ERIOCAULACEAE. XIII

Harold N. Moldenke

ERIOCAULACEAE Lindl.

Additional synonymy: Eriocauloneae Desv., Ann. Sci. Nat. 13: 45. 1828. Eriocaulaceae Desv. ex Bullock, Taxon 7: 15. 1958.

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STUDIES IN MANETTIA (RUBIACEAE)
SECTION PYRRHANTHOS SCHUM.

In-Cho Chung, Mansfield State College

The first of this series of papers, section Heterochlora, appeared in Phytologia vol. 15 (no. 4): 272-288, 1967.

Six species are recognized in section Pyrrhanthos in this paper. The morphological characteristics of the section are as follows. The corolla is red, clavate-tubular or infundibular, gradually widened from the base upwards, 2-6 cm. long, mostly glabrous outside, sometimes sparsely puberulent with 1-few-celled hairs, or rarely densely pubescent with slender multicellular hairs outside, glabrous within except for a band of hairs near the base of the tube. Anthers are subsessile to with more or less apparent filaments, the filaments 0.5-5 mm. long, inserted at the summit of the corolla-tube. Stigmas are ovate to oblong, obtuse at the apex. The disk is free from the calyx; calyx-lobes 4.

Key to Species

1. Leaves very small, 7-15 (24) mm. long, with no apparent lateral veins; corolla glabrous outside.
   2. Leaves coriaceous, elliptical, rarely ovate, 4-7 mm. wide, obtuse at apex, rounded to obtuse at base; calyx-lobes oblong, obtuse, about 2 mm. long; stipules coriaceous, truncate, glandular-toothed, hispid outside; branches subtetragonal to subterete, striate, scaberulous, with hispid, short hairs turned upward on the angles of young branches. West Indies. . . . . M. domingensis
   2. Leaves membranous, narrowly lanceolate, 1.5-3 mm. wide, acute to acuminate at apex, attenuate at base; calyx-lobes linear, acute, 3-4 mm. long; stipules membranous, with deltoid, entire, short, free portion, glabrous; branches strongly tetragonal, winged, smooth, glabrous. Uruguay, S. Brazil. . M. tweedieana
1. Leaves large, 2.5-14 cm. long with conspicuous lateral veins.
   3. Flowers 4 or 5 in terminal cymes; calyx-lobes linear, attenuate-acuminate, 11-18 mm. long; free portion of stipules with 3 unequal aristae; corolla glabrous outside. Mexico . . . . . M. zimapanica
   3. Flowers 1 or 2 in leaf-axils and 1 to several at the end of short branches; calyx-lobes broadly ovate to linear, if linear or linear-subulate, then pedicels, ovaries, calyx-lobes, and outer surface of corolla densely pubescent with slender multicellular hairs. Central S. America.

4. Corolla and capsules densely pubescent with slender multicellular hairs outside. S. Brazil. . M. pubescens
4. Corolla and capsules glabrous or puberulent with 1-few-celled hairs.
5. Pedicels capillary, with 2 basally conate bracts at the base; capsules oblong to oblong-turbinate, 5-8 mm. long, 3-4 mm. wide; stigmas oblong. S. Brazil. . . . . M. gracilis
5. Pedicels not capillary, naked or with 2 distinct bracts near the middle; capsules mostly subcompressed ellipsoidal with slightly tapered apex or subglobose, mostly 8-12 mm. long, 6-7 mm. wide; stigmas ovate. Central S. America. . . . . M. cordifolia

M. domingensis Sprague, Bull. Herb. Boiss. II. 5: 266. 1905. Type: Eggers 2178 (K, isotypes BM,G). Fig. 1.

Branches slender, subtetragonal to subterete, striate, scaberulous, with hispid short hairs turned upward on the angles of young branches, internodes slightly shorter than the leaves; stipules truncate without free portion, coriaceous, glandular-toothed, hispid outside; petioles very short, 0.5-2 mm. long, hispid, leaf-blades coriaceous, elliptical, rarely ovate, obtuse at the apex, rounded to obtuse at the base, 7-15 (24) mm. long, 4-8 mm. wide, with no apparent lateral veins, glabrous on the wrinkled upper surface, glabrous beneath except for the short hispid hairs on the midvein, ciliate on the reflexed margins; flowers solitary rarely two at the ends of short lateral and terminal branchlets; pedicels slender, 5-9 mm. long, glabrous; calyx-lobes oblong, mostly about 2 mm. long and about 1 mm. wide, obtuse, glabrous, 1-nerved, connate at the base for about 0.2 mm.; corolla 20-30 mm. long (the lobes 4-6 mm. long), about 1.5 mm. wide at the base, 4-6 mm. wide at the apex of the tube, glabrous outside, glabrous within except for a band of hairs near the base; stamens reaching the apex of the corolla; filaments 3-5 mm. long, inserted at the apex of the corolla tube; anthers 2-2.8 mm. long; style exserted for about 3 mm., stigmas short, ovate, obtuse at the apex; disk free; capsules turbinate to oblong-turbinate, 5-7 mm. long, glabrous. West Indies: Sto. Domingo: Valle Nuevo, Eggers 2178 (BM,G,K), Santiago Bueno 1772 (F,GH); Prov. Azua, Ekman H6284 (S,US), H11988 (S). Prov. La Vega: Fuertes 1754 (G,GH, NY,P,US); Prov. San Juan: Sanbana Nueva, Howard 9012 (BM, NY, P,S, US).

M. tweedieana Schum. Mart. Fl. Brass. 6 (6): 1889.
Type: Tweedie. Fig. 2.

Branches slender, strongly tetragonal, winged on the angles, glabrous, smooth; stipules membranous, glabrous, 1-1.5 mm. long including the deltoid, entire free portion; leaf-blades narrowly lanceolate, acute to acuminate at the apex, attenuate to very short petioles, about 10 mm. long, 1.5-3 mm. wide, with no apparent lateral veins, glabrous on both sides except for the minute hispidulous hairs near the reflexed margins; flowers solitary, terminal; pedicels 8-18 mm. long, glabrous; calyx-lobes linear, 3-4 mm. long, about 0.3 mm. wide, acute, glabrous, connate at the base, alternate with glandular-toothed deltoid lobules (0.5 mm. long); corolla 30-37 mm. long (the lobes 2-3 mm. long), 1.7-2 mm. wide at the base, 6 mm. wide at the apex of the tube, glabrous outside, glabrous within except for a band of hairs near the base; anthers about 2.5 mm. long, nearly sessile, the very short filaments about 0.5 mm. long, inserted at the apex of the tube; style exserted for about 4 mm; stigmas ovate, obtuse at the apex.
Uruguay: Rio Grande, Tweedie (type, B, photo!), Brazil: Santa Catharina, Tweedie (GH, K).

M. zimapanica Hemsl. Diagn. Pl. Nov. Mex. 30. 1878.
Type: Coulter 203 (K).

Flower-bearing branchlets subterete to somewhat compressed, moderately pubescent with short, spreading hairs; free portion of stipules trisetose, the middle arista 2-2.5 mm. long, the lateral aristae 1-1.5 mm. long, the sheath pubescent outside; petioles 4-5 mm. long, sulcate, pubescent; leaf-blades ovate-lanceolate, attenuate-acuminate at the apex, attenuate at the base, 6-9.5 cm. long, 2-4 cm. wide, sparsely pubescent except the upper surface of the midvein with dense short broad hairs and the lower surface of 3 or 4 pairs of lateral veins with moderate hairs; flowers 4 or 5 in terminal cymes; pedicels slender, 5-20 mm. long, minutely puberulent; ovaries semispherical, 1.5-2 mm. long, glabrous; calyx-lobes linear, attenuate-acuminate, 11-18 mm. long, connate at the very base, 1-3-nerved, sparsely ciliate, glabrous on both sides; corolla 35-39 mm. long (the lobes 5-7 mm. long), glabrous outside, glabrous within except the pubescent basal 10 mm; anthers about 3 mm. long, subsessile, inserted near the apex of the tube in short-styled flowers; stigmas oblong, obtuse at the apex.
Mexico: Zimapan, Coulter 203 (K).
The disk is slightly convex and free from the calyx, or nearly flat to slightly concave and adnate to the calyx-tube.

M. pubescens Cham. & Schl. Linnaea 4: 170. 1829.
Type: Sellow. Figs. 4-9.
M. villosa Cham. & Schl. l.c. 172. 1829. Type: Sellow. Sellow 1750 (B, photo)!
M. confertiflora Benth. Linnaea 23: 443. 1850.
Type Regnell I: 368!
M. pubescens var. villosa Schum. Mart. Fl. Bras. 6(6): 173. 1889.

Branches, petioles, lower surface of leaves, pedicels, ovaries, capsules, calyx-lobes, outer surface of corolla densely pubescent with slender multicellular hairs; free portion of stipules erect, mostly lanceolate, often tapering to an arista, frequently 3-lobed, with the lateral ones shorter and setaceous, the middle one up to 11 mm. long; calyx-lobes linear-lanceolate to linear-subulate, 5-13 mm. long, subulate short (1-5 mm. long) lobules usually present; corolla 33-50 mm. long, 4-8 mm. wide; filaments about 1 mm. long, anthers about 5 mm. long; capsules subcompressed ellipsoidal, 6-15 mm. long, 5-7 mm. wide; leaf-blades mostly ovate, rounded to obtuse at the base, acuminate at the apex, 25-80 mm. long, 12-38 mm. wide.
Brazil: Prov. Minas Geraes: Damazio 966 (G), 40153 (NY), Glaziou 17630 (P), Macedo 2895 (BM, G, MO, US), Mosen 905 (S), 1864 (S), Regnell I: 368 (K, P, S), Saint-Hilaire 529 in part (P), Widgren 189 (S), s.n. anno 1845 (GH, K, S); Rio deJaneiro: Widgren (F); S. Paulo: Leite 3951 (F), Loefgren 3445 (F), P. Campos Porto 3273 (F); Prov. Parana: Dusen 16539 (MO, S); Prov. Sta. Catharina: Dusen 8416 (F, S), Ule 1261 (P); Prov. Rio Grande doSul: Leite 2772 (F), Rambo 42076 (F).

M. gracilis Cham. & Schl. Linnaea 4: 169. 1829.
Type: Sellow photo!
Var. gracilis. Fig. 3.

Young branches slender, subterete, striate, densely pubescent; stipules deltoid, erect, toothed; petioles 12-18 mm. long, densely pubescent; leaf-blades ovate-lanceolate, rounded at the base, acuminate at the apex, 3-7 mm. long, 6-25 mm. wide, moderately pubescent beneath, with 4 or 5 lateral veins on each side of the midvein; flowers 1 or 2 in the leaf axils or several at the end of the branchlets; pedicels capillary, 12-18 mm. long, glabrous or puberulent, with 2 small, basally connate bracts at the base; ovary glabrous to puberulent; calyx-lobes deltoid to lanceolate, more or less pubescent, 1-1.5 mm. long, connate at the base for about 0.5 mm; corolla 23-30 mm. long, slender, 3-5 mm. wide, glabrous or sparsely pubescent outside with slender few-celled hairs, glabrous within except for a band (3-5 mm. long) of hairs near the base; stigmas oblong, obtuse; anthers 2.5-4 mm. long; filaments 1.5-3 mm. long, inserted at the apex of the corolla-tube; capsules oblong to oblong-turbinate, 5-8 mm. long, 3-4 mm. wide, glabrous or sparsely puberulent.
Brazil: Prov. Minas Geraes: Regnell I: 366 in part (S); Prov. San Paulo: Hoehne 1642 (F), Weir s.n. (BM); Prov. Parana: Dusen 9984 in part (NY, PH, S); Prov. Santa Catharina: Reitz & Klein 3401 in part (NY, UC, US), 4115 (G, NY, UC, US), 6912 (UC, US).

M. gracilis var. glabra Benth. Linnaea 23: 444. 1850.
Type: Regnell I: 366!
M. burchellii Wernh. Journ. Bot. 57 Suppl. 18. 1919.
Type: Burchell 4855 (K)!

Branches glabrous; petioles ciliate; leaf-blades glabrous except for the puberulent veins on the lower surface; pedicels and calyx-lobes glabrous.
Brazil: Prov. Minas Geraes: Hoehne 10-5-1927 (NY), 19536 (F), Novaes 3634 (F), Regnell I: 366 (S, US), Widgren 191 (S); Rio deJaneiro: Brade 14642 (F), 21224 (F); Prov. S. Paulo: Brade 6314 (S), Hoehne 17637 (F), 42644 (F), Eiten 2793 (NY, US), Mosen 1340 (S), Usteri 128 (K), Weir 226 (F, BM), s.n. (K); Prov. Parana: Dusen 9765 (BM, F, G, S, US), 9904 (NY), 9984 in part (UC), Jonsson 283a (BM); Prov. Santa Catharina: Bowie & Cunningham s.n. (BM), Reitz & Klein 4240 (NY, S, UC, US), Schwacke 123 (F); Burchell 4855 (K).

Key to the Varieties and Forms of M. cordifolia

1. Calyx-lobes connate at the base.
   2. Corolla glabrous outside or nearly so.
      3. Leaves more or less pubescent.
         4. Leaves at least puberulent on the veins beneath, but not tomentose. . . . . .var. cordifolia
         4. Leaves tomentose beneath with gray or yellowish-brown hairs. . . . . .var. cordifolia form. incana
      3. Leaves glabrous.
         5. Branches subterete, glabrous. . .var. glabra
         5. Branches tetragonal, with short, reflexed, hispid hairs on the angles. . . . . .var. glabra form. boliviana
   2. Corolla puberulent outside; leaves and branches puberulent. . . . . var. hassleriana
1. Calyx-lobes free to the base, broadly ovate.
   6. Young branches subterete, densely pubescent; leaves more or less pubescent above; pedicels densely pubescent; ovary glabrous or nearly so; calyx-lobes glabrous or with a few hairs near the base of margins; corolla glabrous outside. . . . . .var. paranensis
   6. Young branches compressed, minutely puberulent; leaves glabrous or nearly so above; pedicels minutely puberulent; ovary minutely puberulent to glabrous; calyx-lobes sparsely minutely puberulent to glabrous except ciliolate margins; corolla more or less puberulent to glabrous. . . var. chrysoderma

M. cordifolia Mart. Denkshr. K. Acad. Muench. 9: 95, t.7 1824.

Var. cordifolia. Figs. 10-16.

M. asperula Benth. Linnaea 23: 444. 1850. Type: Pegnell I: 367 (K)!

M. attenuata Nees & Mart. Nov. Act. Nat. Cur. 12(1): 14. 1824.

M. cordifolia var. attenuata (Nees & Mart.) Wernh. Journ. Bot. 57 Suppl. 20. 1919.

M. grandiflora Miq. Linnaea 22: 803. 1849. Type: Blanchet 3600!

Guaqnebina ignita Vell. Flor. Flum. 45, I. t. 115. 1825.

M. ignita (Vell.) Schum. var. cordifolia Schum. Mart. Flor. Bras, 6(6): 171. 1889.

M. leianthiflora Griseb. Abh. Wiss. Goett. 19: 159. 1874; Plant. Lorentz. 111. 1874. Type: Lorentz 365!

M. Stipulosa Wernh. Journ. Bot. 57 Suppl. 21. 1919. Type: Gardner s.n. (K)!

Branches subtetragonal to subterete, striate, densely pubescent to glabrous; stipular sheath about 1 mm. high, pubescent to glabrous; free portion of stipules erect, deltoid to subulate, mostly 1-2 mm. long rarely 3-4 mm. long, pubescent to glabrous, toothed; leaf-blades membranous to chartaceous, ovate to ovate-lanceolate, rounded to attenuate at the base, acuminate to long-attenuate at the apex, with 3-5 lateral veins on each side of the midvein, densely pubescent on both sides to nearly glabrous except on the veins beneath, 2.5-12 (14.5) cm. long, 1-6.5 (9) cm. wide; petioles 2-15 (rarely up to 40) mm. long, pubescent; upper leaves on flowering branchlets much smaller, nearly orbicular to lanceolate, cordate to obtuse at the base, acute to acuminate at the apex; flowers axillary and terminal on branchlets, solitary to in cymelike inflorescences; pedicels 13-60 mm. long, pubescent to glabrous, naked or with small bracts near the middle or above the basal part; ovaries oblong to oblong-turbinate 3-5 mm. long, pubescent to glabrous; calyx-lobes connate at the base for 0.5-1.5 mm., free portions ovate-lanceolate to lanceolate, acute to acuminate, pubescent to glabrous, 2-8 mm. (rarely 10-11.5 mm.) long and 0.5-2 (rarely 3-4) mm. wide, sometimes with small teeth or lobules in between; corolla 3.5-6 cm. long (lobes 3-5 mm. long), glabrous outside, densely pubescent within for 5-10 mm. near the base of the tube; anthers about 4 mm. long, half-exserted; filaments about 2 mm. long, inserted at the apex of the tube; stigmas exserted, ovate, obtuse; disk free from the calyx-tube; capsules mostly subcompressed ellipsoidal with slightly tapered apex, (6-7) 8-12 (15) mm. long, (4-5) 6-7 (8) mm. wide, mostly glabrous.

Brazil: Prov. Bahia: Blanchet 2092 (BM, G, NY), 3600 (BM, G, K, MO, P); Prov. Goyaz: Gardner 3769 (BM, F, G, K, NY, P); Prov. Mato Grosso: Lindman A3417 (S), Moore 553 (BM), Weddell 3323 (F); Prov. Amazonas: Rio Acre, Ule 9864 (G, K); Prov. Minas Geraes: Brade 17862 (F), Claussen 689 (NY, P), s.n. (BM, G, GH, K, S), Duarte 459 (F), Gardner 4717 (BM), 4718 (K), Heringer 69 (F), Irwin 2338 (F, NY, UC, US), Macedo 1685 (MO, S), Magalhaes 3254 (US), Mexia 5697a (BM, F, G, GH, MO, NY, S, UC, US), Mosen 1863 (F, S), 4474 (s), Regnell I: 367 (K, S, US), Saint-Hilaire 213 (P), Vauthier 208 (G), Williams, L.O. & V. Assis 8218 (F, GH); Prov. Sao Paulo: Glaziou 12774 (P, US), Valio 16 (US); Prov. Parana: Dusen 3426 (F,S), 7582 (S), 23872 (F), Reiss 54 (F, NY, S); Prov. Santa Catharina: Hoehne 24406 (F), Reitz & Klein 3401 in part (US), 4174 (NY); Ceara, Gardner 1699 in part (BM, G, GH, K, NY); Schott 855 (K).

Paraguay: Villarrica, Hassler 4132 in part (S), 8841a(G); Villa Rica: Joergensen 7269 (F); Prov. Tobaty: Hassler 6246 (BM, G, NY, UC); Caballero, Morong 512 (NY).

Argentina: Prov. Misiones: Bertoni s.n.; Prov. Jujuy: Bartlett 20396 (US), Fries 242 (S), Schreiter 11173 (F), Venturi 8352 (BM, F, GH, K, MO, US), West 8360 (GH, MO, UC, US); Prov. Salta: Borrea 37073 (GH), Cabrera 3104 (F, NY), Donell 3137, Ragonesi & Coras 37800 (GH), Schreiter 5422 (F), 10114 (US), 33686 (GH), Venturi 5317 (F, GH, US), 8279 (F, US), West 6131 (MO, UC, US); Prov. Tucuman: Dinelli s.n. (BM), Gonzalez 21657 (G), Lorentz 321 (G), Meyer 9827 (F), Schreiter 748 (US), 2191 (F), Venturi 1204 (US), 1574 (UC, US), 4086 (GH, US), 4244 (BM, F), 7887 (GH, US), 8037 (F), 10359 (BM, MO, S, UC).

Bolivia: Prov. Beni: Rurhenabaque, Fleischmann 215 (S); Huahuanus-Reye, Cardenas 5390 (US); Prov. Cochabamba: Bang 1255 (BM, F, GH, K, MO, NY, PH, US), Kuntze s.n. (US); Nord-Yungas: Milluguaya, Buchtien 252 in part (GH, MO), 4723 (NY, US); Chaco: Cardenas 2605 (F).

Peru: Dept. San Martin: Ferreyra 5067 (US), 7776 (US), 7851 (US), 7911 (US), Klug 3541 (F, G, GH, MO, S, US), Spruce 3929 (K, S), Williams Ll. 7479 (F, G), 7773 (F), Woykowski 35259 (F), 35339 (F); Dept. Junin: Woytkowski 6333 (US); Pozuzo, Macbride 4722 (F, S, US), Pearce 215 (BM).

Gardner s.n. (K), the holotype of M. stipulosa Wernh. (Journ. Bot. 57 Suppl. 21. 1919. Gardner s.n., K) is characterized by the large leafy calyx-lobes which are about 9 mm. long, 4 mm. wide, ovate-lanceolate, acuminate, and glabrous; glabrous petioles and leaf-blades except for the minutely ciliolate margins; erect stipular free postions lanceolate, 2-4 mm. long; and the moderately pubescent young branches. Venturi 7887 (GH) from Argentina and Dusen 9180 (BM) from Parana, Brazil, also have similar, large, leafy calyx-lobes. In some of the stipules on Dusen 9180 (S) the free portion is as long as 4 mm. long. Although the leaf surfaces are glabrous, M. stipulosa Wernh is considered as a form of M. cordifolia var. cordifolia.

M. cordifolia var. cordifolia form. incana (Schum.) Chung, comb. nov.

M. ignita (Vell.) var. incana Schum. Mart. Fl. Bras. 6(6): 171. 1889. Type: Balansa 2135!

M. sublanata Wernh. Journ. Bot. 57 Suppl. 21. 1919. Type: Hassler 8841!

Distinguished from var. cordifolia by the tomentum on the lower surface of the leaves, which is gray or yellowish-brown. Corolla 25-45 mm. long; calyx-lobes 2-4 mm. long; ovaries often tomentose; capsules 7-10 mm. long, pubescent; pedicels and branches pubescent.
Brazil: Minas Geraes, Regnell I: 367 in part (S).
Paraguay: Villa Rica, Balansa 2135 (G); Cordillera de Villa Rica, Hassler 8841 (BM, G, GH, NY, S, UC); Villarrica, Jorgensen 4132 in part (F, GH, NY, PH, US).
Argentina: Prov. Corrientes: Santo Tome, Ybarrola 1503 (S).

M. cordifolia var. glabra (Cham. & Schl.) Standl. Field Mus. Bot. 7(3): 261. 1931.

M. glabra Cham. & Schl. Linnaea 4: 169. 1829. Type: Sellow Photo (B)!

M. ignita var. glabra (Cham. & Schl.) Schum. Mart. Fl. Bras. 6(6): 171. 1889.

M. micans Poepp & Endl. Nov. Gen. & Sp. 3: 24. 1845.

M. ignita var. micans (Poep. & Endl.) Schum. Mart. Fl. Bras. 6(6): 171. 1889. Poeppig 2415 (G)!

M. cordifolia var. filiformis Wernh. Journ. Bot. 57 Suppl. 20 1918. Type: Fiebrig 4636!

Branches, potioles, leaf-blades, pedicels, and calyx-lobes glabrous.
Brazil: Prov. Bahia: Blanchet 3281 (G), Rose 20034 (US); Prov. Mato Grosso: Kuntze s.n. (NY, US); Prov. Sao Paulo: Loefgren 1252 (F), Weir 192 in part (K); Prov. Parana: Dusen 9059 (S), 9180 in part (PH), 11758 (S), 16171 (F, GH, MO, S, US), Hatschbach 3160 (US), 3763 (US); Prov. St. Catharina: Schwacke (F), Tweedie (GH).
Uruguay: Dept. Artigas: Herter 1157 (F, G, MO, NY, UC, US), Rosengurtt B-3663 (US); Dept. Salto: Osten 5451 B (US); Dept. Paysandi: Calot 94 (P), 95 (P); Concepcion, Lorentz anno 1895 (GH); Fray Bentos, Fruchard (P); Islands of the Uruguay River, Tweedie (K).
Paraguay: Between River Apa and River Aquidaban, Fiebrig 4636 (BM, G, GH); Upper River Apa, Hassler 8327 (BM, F, G, GH, MO, NY, S, UC); Sierra de Amambahy, Hassler 11200 (BM, G, GH); Campo Duarte, Hassler 1237 (G, K); Yerbalium de Maracayu, Hassler 4435 (BM, F, G, NY); Central Cordillera, Hassler 7026 (BM, G, NY); Lake Ypacaray, Hassler 11783 (BM, F, G, GH, MO, NY, S, UC, US); Paraguari, Balansa 2134 (G, K).

Argentina: Prov. Misiones: Bertoni 1485 (UC, Ekman 1383, (MO, NY, S), Gruener 35 (F), Meyer 5319 (F), Rodriguez 337 (F), Spegazzini 20715 (F); Prov. Corrientes: Bonpland 599 (P), Ibarrola 1872 (S), Meyer 8972 (S), Wurth 74 (S); Prov. Entre Rios: Lorentz 107 (PH), s.n. (PH), Tweedie s.n. (BM, K).
Bolivia: Dept. Cochabamba: Steinbach 9055 (GH); Dept. Santa Cruz: Maguire 44492 (NY), Steinbach 6240 in part (G, GH); S. Bolivia, Chignica, Fiebrig 2686 in part (BM).
Peru: Dept. Loreto: Rio Marano Valley, Killip, Smith & Dennis 29200 (F, US); Yurimaguas, Killip & Smith 27990 (F, NY, US), Poeppig 2415 (G); Balsapuerto, Klug 3080 (BM, F, G, MO, S, US); Tarapoto, Mathews 1343 (BM, F, G, GH); Haallaya River, Spruce 4592 (BM, F, G, GH, K, NY); Dept. San Martin: Ferreyra 4521 (US), Klug 2606 (BM, F, G, GH, MO, NY, S, US), 4075 (BM, F, GH, MO, NY, S, UC), Woytkowski 7242 (MO, US); Dept. Huannuco: Killip & Smith 26823 (F, NY, US); Dept. Junin: Ferreyra 3603 (US), 3678 (US), Killip & Smith 23519 (NY, US), 24748 (F, NY, US), 25213 (US), Macbride 5585 (F, US), Schunke 480 (F, S), 1430 (F), 1519 (F), Woytkowski 395 (US); 7451 (US); Dept. Cuzco: Sandeman 3646 (K), Vargas 1843 (GH, MO) 3791 (US), 15430 (MO).

The following specimens are rather intermediate between var. cordifolia and var. glabra in that the leaves are glabrous but the young branches are pubescent. Brazil: Bahia: Blanchet 3281 in part (BM, F, NY, P); Ceara, Loefgren 587 (S); Mato Grosso: Malme 1740 (F, S). Argentina: Corrientes: Ibarrola 1234 (S).

M. cordifolia var. glabra form. boliviana (Wernh.) Chung, comb. nov.
M. boliviana Wernh. Journ. Bot. 57 Suppl. 20. 1919.
Syntypes: Bang 1372!, Bridges!

Tetragnal branches with short reflexed hispid hairs or recurved teeth on the narrow wings.
Brazil: Bahia: Lemos Froes 20165 (US); Espirato Santo: Freire 68 (F); Mato Grosso: Kuntze 92 in part (NY); Ceara, Gardner 1699 in part (P).
Bolivia: Dept. Santa Cruz: Brooke 5774 (BM, F, NY), Kuntze (NY), Steinbach 6240 in part (G), 7092 (BM, F, G, GH, MO, NY, PH, S, UC), Yapacani, Kuntze (NY); Dept. Cochabamba: Cardenas 3135 (F, US); Dept. La Paz: Mapire, Rusby 1126 (BM, F, GH, K, MO, NY, PH), Buchtien 1449 (S); Guanai, Bang 1372 (BM, F, G, MO, NY, PH, US), Rusby 1127 (F, NY); Nordyungas, Buchtien 262 in part (BM, F, G, GH, NY); Chignica, Fiebrig 2686 in part (G, K, S, US); Gran Choca, Fries 1372 (S).
Argentina: Prov. Jujuy: Bartlett 20341 (US), Hunziker 1974 (GH), Spegazzini 381 (F); Prov. Salta, Dept. Oran: Hunidoboro s.n. (S, UC), Meyer 5072 (UC), Pierotti s.n. (S), Spegazzini 14280 (F).
Peru: Dept. Cuzco: Storke, Horton & Vargas 10465 (F, UC).

M. cordifolia var. hassleriana (Chod.) Chung, comb. nov.
M. hassleriana Chod. Bull. Herb. Boiss. 7 App. 1: 82. 1899.
Type: Hassler 2509 (from near Rio Apa., Paraguay, not see)
M. angustifolia Wernh. Journ. Bot. 57 Suppl. 22. 1919.
Type: Fiebrig 5734!

Branches subterete, striate, puberulent; leaves lanceolate to ovate-lanceolate, acute to rounded at the base, attenuate-acuminate at the apex, 35-65 mm. long, 10-24 mm. wide, puberulent; calyx-lobes ovate-lanceolate, more or less narrower at the base, acuminate at the apex, 5-8 (12-13) mm. long, 2-5 mm. wide, puberulent; corolla 3-4 cm. long, moderately puberulent with short broad hairs; inside of corolla glabrous except for a band (6 mm. long) of dense hairs in the narrow tube about 4 mm. above the base; filaments about 2 mm. long, inserted at the apex of the tube, anthers 3.5-4 mm. long; stigmas ovate, obtuse; capsules oblong to oblong-turbinate, 6-7 mm. long.
Brazil: Parana: Duarte 1912 (F, NY); Sta. Catharina: Dusen 11894 (GH, MO, S).
Paraguay: River Alto Parana, Fiebrig 5734 (BM, G, GH, K, US).
Argentina: Misiones: Iguazu Falls, Sandeman 4770 (K), Smith 355 (K); Dept. Iguazu: Rodrigo 3681 (F).

M. cordifolia var. paranensis (Standl.) Chung, comb. nov.
M. paranensis Standl. Field Mus. Bot. 8(5): 331. 1931.
Type: Dusen 8964!

Distinguished from var. cordifolia mainly by the large leafy calyx-lobes which are free to the base; short, turbinate ovaries 1-2 mm. long; small subglobose capsules 5-6 mm. long. Branches subterete, densely pubescent; stipular sheath 0.5-1 mm. long; often ill defined, free portion of stipules 1.8-2.5 mm. long, triangular-lanceolate, often bilobed at the apex; petioles 7-13 mm. long, pubescent; leaf-blades ovate, 2.8-5.5 cm. long, 1-3 cm. wide, sparsely pubescent, with 2 or 3 lateral veins on each side of the midvein; calyx-lobes broadly ovate, acute to acuminate, 8-11 mm. long, 4-5 mm. wide, 3-nerved, glabrous or with a few hairs near the base of the margins; corolla 3.5-4.2 cm. long, glabrous outside.
Brazil: Parana: Serra do Mar, Dusen 8964 (G, GH, NY, S, US), 9007 (S), Morretes, Hatschbach 1741 (S); Piraquara, Hatschbach 2840 (US); Guaratuba, Hatschbach 6574 (US).

M. cordifolia var. chrysoderma (Sprague) Chung, comb. nov.
M. chrysoderma Sprague, Bull. Herb. Boiss. II. 5: 264. 1905. Type: Mueller 123 (K)!
M. paulina Standl. Field Mus. Bot. 8(5): 328. 1931.
Type: Saint-Hilaire 1229!

Young branches compressed, puberulent; free portion of stipules deltoid to round and apiculate; leaf-blades ovate to ovate-lanceolate, rounded to acute at the base, acuminate at the apex, 4-6 (-11) cm. long, 1.8-3 (4) cm. wide, glabrous or nearly so above, puberulent beneath mainly on the veins, with 4 or 5 lateral veins on each side of the midvein; pedicels more or less puberulent; calyx-lobes free to the base, ovate to ovate-lanceolate; acute to acuminate, 4-5 mm. long, 2-3 mm. wide, more or less puberulent to glabrous except the ciliate margins; corolla 35-55 mm. long, 6-9 mm. wide, more or less puberulent with short broad hairs or glabrous outside.
Brazil: S. Paulo: Edwall 1900 (F), Krieger anno 1863 (NY), Saint-Hilaire 1229 (F, P); Parana: Dusen s.n. (GH, MO), Glaziou (P), Hatschbach 4136 (US); Sta. Catherina: Mueller 123 (K), Smith & Klein 7450 (NY, US), Reitz 4363 (US), Reitz & Klein 4028 (S, US), 4700 (US), 5218 (UC, US).

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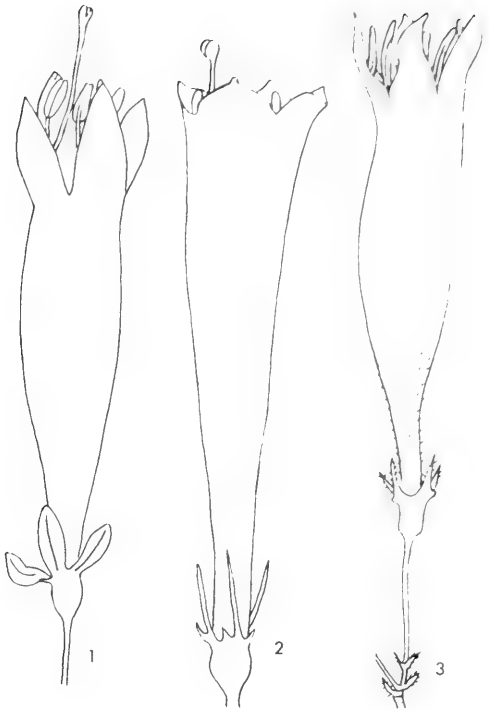
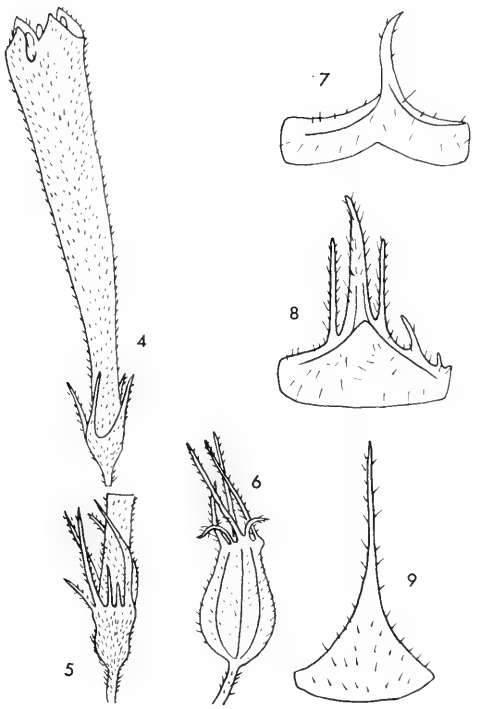
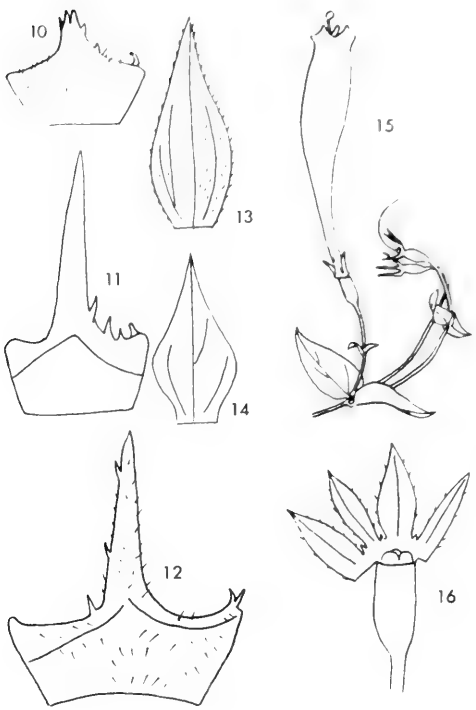


Fig. 1. Manettia domingensis, flower, x4 (Ekman H6284, S)
Fig. 2. Manettia tweedieana, flower, x4 (Tweedie, GH)
Fig. 3. Manettia gracilis, flower, x4 (Reitz & Klein 4115, G)



Figs. 4-9. Manettia pubescens. 4: flower, x2 (Macedo 2895, PH), 5: ovary and calyx, x2 (Damazio 966, G), 6: fruit, x2 (Damazio 966, G); 7-9: stipules, x10 (7: Regnell I: 368, K; 8: Regnell I: 368, S; 9: Macedo 2895, PH).



Figs. 10-16. Manettia cordifolia var. cordifolia. 10-12: stipules, x10 (10: Dusen 3426, S; 11: Gardner, K, M. stipulosa; 12: Dusen 9180, S) 13-14: calyx-lobe, x4 (13: Venturi 7887, GH; 14: Gardner, K, M. stipulosa), 15: flowering branchlet, x1 (Mosen 1863, S), 16: ovary and calyx-lobes, x4 (Gardner 1699,K)

TRANSFERS TO GUAPIRA FROM TORRUBIA (NYCTAGINACEAE)

Elbert L. Little, Jr.

Eight new combinations in Guapira (family Nyctaginaceae) are made here for forthcoming publications on common trees of the United States, Puerto Rico and the Virgin Islands, Province of Esmeraldas in Ecuador, and Venezuela.

Guapira Aublet (Hist. Pl. Guian. Franc. 1: 308; 3: t. 119. 1775) with a single species (G. guianensis) was of uncertain position until identified as a synonym of Pisonia by Hallier (Leiden Meded. Herb. 35: 18-20. 1918). The genus Guapira was not accepted by a second author until 1961, when revived with 1 new species and 1 new combination by Woodson in Woodson and Schery (Fl. Panama 4 (4): 403-406, fig. 125; Mo. Bot. Gard. Ann. 48: 61-64, fig. 125. 1961). Lundell (Wrightia 3: 22. 1962) transferred 2 species to Guapira, and Miranda (Soc. Bot. Méx. Bol. 29: 34. 1965), 1.

My proposal (No. 149) to conserve the generic name Torrubia Vellozo was submitted in August 1963 and published in the proposals for the Tenth International Botanical Congress at Edinburgh (Regn. Veg. 34: 58-59. 1964). Now the Committee for Spermatophyta (Taxon 17: 462-463. 1968) by a vote of 1-9 "declines to recommend Torrubia for conservation, chiefly because the identity of the type-species is uncertain and probably will remain so. No type-specimens of Vellozo are known, and it is impossible to identify his plant from the protologue." However, many of Vellozo's names have been typified and taken up. The type species, Torrubia opposita Vell., was illustrated by a drawing of foliage with male flowers and was described from coastal forests at Rio de Janeiro, Brazil. My suggestion that it may be the same as T. olfersiana (Link, Kl. & Otto) Standl. var. nitida (Mart.) Reitz (Sellowia 12: 169. 1960) could be checked by a local specialist. About 50 names must be transferred to Guapira.

Three species of small trees native in southern Florida (Little, Check List Native Naturalized Trees U.S. 422. 1953.) are:

GUAPIRA BRACEI (Britton) Little, comb. nov. Brace blolly
Torrubia bracei Britton, Torrey Bot. Club Bul. 31: 614. 1904.

GUAPIRA GLOBOSA (Small) Little, comb. nov. roundleaf blolly
Torrubia globosa Small, Man. Southeast. Fl. 490, 1504. 1933.

GUAPIRA LONGIFOLIA (Heimerl) Little, comb. nov. longleaf blolly
Pisonia discolor γ longifolia Heimerl in Urban, Bot. Jahrb. 21: 627. 1896.
Torrubia longifolia (Heimerl) Britton, Torrey Bot. Club. Bul.

31: 614. 1904.
Pisonia longifolia Sarg., Man. Trees No. Amer. 314, fig. 251. 1905.

A fourth species Torrubia floridana Britton (Torrey Bot. Club. Bul. 31: 615. 1904) was described as a low shrub. It was collected at Rock Key near Key West more than a century ago and has not been found since.

The three species listed below are trees native in Puerto Rico. Two were recorded by Britton and Wilson (Sci. Surv. Porto Rico Virgin Is. 5: 286-287. 1924) and by Little and Wadsworth (Common Trees Puerto Rico Virgin Is. 92-93, fig. 1964). Alain Liogier (Rhodora 67: 329. 1965) has suggested the transfer to Guapira. The third species is known from southwestern Puerto Rico also.

GUAPIRA DISCOLOR (Spreng.) Little, comb. nov. barrehorno
Pisonia discolor Spreng., Syst. Veget. ed. 16, 2: 168. 1825.
Torrubia discolor (Spreng.) Britton, Torrey Bot. Club Bul. 31: 613. 1904.

GUAPIRA FRAGRANS (Dum.-Cours.) Little, comb. nov.
corcho, black mampoo
Pisonia fragrans Dum.-Cours., Bot. Cult. ed. 2, 7: 114. 1614.
Torrubia fragrans (Dum.-Cours.) Standley, U.S. Natl. Herb. Contrib. 18: 100. 1916.

GUAPIRA OBTUSATA (Jacq.) Little, comb. nov.
Pisonia obtusata Jacq., Pl. Rar. Hort. Caes. Schoenbr. 3: 35, t. 314. 1798.
Torrubia obtusata (Jacq.) Britton, Torrey Bot. Club Bul. 31: 612. 1904.

The next species was found in 1965 in the Province of Esmeraldas, Ecuador. It was described from Peru, where it was reported to be the only species of Torrubia (Standley in Macbride, Fl. Peru pt. 2 (No. 2): 528. 1937).

GUAPIRA MYRTIFLORA (Standl.) Little, comb. nov.
Torrubia myrtiflora Standl., Field Mus. Pub. Bot. 8: 307. 1931.

The last was selected as an example of the genus in a book on common trees of Venezuela now being edited for publication. Seven species of Torrubia were listed from Venezuela by Pittier et al. (Cat. Fl. Venez. 1: 290-291. 1945).

GUAPIRA PACURERO (H.B.K.) Little, comb. nov. pacurero
Pisonia pacurero H.B.K., Nov. Gen. Sp. 2: 218. 1817.
Torrubia pacurero (H.B.K.) Standley, U.S. Natl. Herb. Contrib. 18: 101. 1916.

Forest Service, United States Department of Agriculture, Washington, D.C. 20250.

REVIEW OF F. E. WIMMER, CAMPANULACEAE-LOBELIOIDEAE SUPPLEMENTUM ET CAMPANULACEAE-CYPHIOIDEAE. DAS PFLANZENREICH, IV. 276c (108. HEFT), I - X, 816 - 1024; WITH DESCRIPTION OF TREMATOLOBELIA WIMMERI DEG. & DEG., SP. NOV.

Otto & Isa Degener
Volcano, Hawaii

Shortly before his death on May 2, 1961, Dr. Franz Elfried Wimmer submitted his completed manuscript about Lobelioideae and Cyphioideae to Dr. K. H. Rechinger. The latter then sent the work to Drs. H. Stubbe and S. Danert. It was published on March 15, 1968, in East Berlin. Of the Lobelioideae there are 29 plates and 11 figures; of the Cyphioideae, 51 plates. The drawings, probably reproduced in the same size as executed by the illustrator instead of being reduced by half, are not as good as the photographs, those borrowed from the late Dr. J. F. Rock being outstanding.

As we are not familiar with the Cyphioideae, we shall not review the almost 100 pages devoted to them. In fact, we shall limit ourselves to the Lobelioideae so far as represented in the Hawaiian Islands. Dr. Wimmer lists the following genera endemic to these islands, with the number of species known up to his time, as:

Brighamia	1	Delissea	8
Clermontia	32	Rollandia	12
Cyanea	74	Trematolobelia	3

For the presumably cosmopolitan genus Lobelia, he lists 388 species for the world.

Being a bit less conservative perhaps than Dr. Wimmer, we prefer Lobeliaceae to Lobelioideae; and so far as the genus Lobelia is concerned, do not recognize it as native to the Hawaiian Archipelago. Instead, we prefer to place most of the taxa reposing there into three small, endemic genera.

As Hawaiian place names are confusing in their spelling and as plant labels, particularly ours, are often a bit illegible in script, we here wish to put on record some necessary orthographic changes:

Page 817, for Kanehaha read Kanahaha; for Hononau, Honaunau.
Page 818, for Anny Greenwell read Amy Greenwell.
Page 820, for McKandles read McCandless.
Page 823, for thelephone read telephone.
Page 825, for Pololo read Pololu; for Maunakui read Mauna Hui; for Kapoho Puna read Kapoho, Puna.
Page 826, for Papaiku read Papaikou; for Kala, Kikala; for Pitso, Piko; for Jao, Iao; for Kaulelewelewe, Kaulalewelewe; for

Pololo, Pololu; for Honokanenui, Honokane Nui; for Pololo, Pololu.
Page 828, for Komakawoi read Komakawai; for McCandles, McCandless.
Page 829, for Olau read Olaa; delete Kohala before Kulani; for Pololo read Pololu; for Honokanenui, Honokane Nui; for Anny Greenwell, Amy Greenwell.
Page 831, for Kawaihe read Kawaihae.
Page 887, for Honokanenui read Honokane Nui; for Kaholuamano, Kaholuamanu; for Hamakue, Hamakua.
Page 888, for Lehua makanoe read Lehuamakanoi.
Page 892, for Waiahuatua read Waiahuakua.
Page 901, for Farn read Fern.
Page 906, for Hiray read Hirai.
Page 909, for Hetheway read Hatheway.

Regarding lobelias in the Hawaiian Islands, we are convinced many new taxa still exist; but most of these probably will be exterminated before they can be collected by the botanist due to the ravages of man's bulldozing, his agricultural and timber industries, his livestock raising, his building boom with apparently a desert-like golf course next to every tourist hotel, and his introduction by accident and design of exotic plants and animals injurious to the endemic biota. One of these many taxa on the verge of extinction we here name,

TREMATOLOBELIA WIMMERI Deg. & Deg., sp. nov. Lobi calycini 7 mm. longi; capsula 15 mm. longa et 16 mm. lata.

Trematolobelia macrostachys sensu Fagerlund & Mitchell, Checklist Plants Haw. Nat. Park Kilauea - Mauna Loa Sect. 58. 1944.

Trematolobelia macrostachya (sic) sensu Fosberg; Doty & Mueller-Dombois in Haw. Bot. Sc. Paper 2: 231. 1966.

Not Trematolobelia macrostachys Zahlbr.; Rock in Coll. Haw. Publ. 2: 45. 1913.

Trematolobelia kauaiensis sensu Wimmer in Pflanzenreich IV.276c (108. Heft). 901. 1968. (As to Island of Hawaii only).

Plant with single slender erect stem 2 meters tall. Leaves oblanceolate, about 14 cm. long and 2 cm. wide, glabrous throughout, acuminate to sessile base, sharply cuspidate at apex, faintly undulate with submarginal hydathode at each indentation. Flowers about 20 per horizontal 30 cm. long branch of inflorescence, with pair of bractlets at lower third of pedicel: in bud with hypanthium 3 mm. long and 2 mm. wide; with calyx lobes 5 mm. long and almost 2 mm. wide, oblong, obtuse at apex but with faint cusp; in anthesis (flower in poor, decayed condition) with staminate column and style and stigma probably about 6 cm. long. Capsule on thickened 3 cm. long pedicel, 20 mm. wide, 13 mm. high without the persistent somewhat incurved 5 mm. long calyx lobes.

Type locality: Hawaii, Kilauea, near Fern Forest, rich moist sunny locality; only this one seen. Degener 7860, February 18, 1922. (Vienna).

The type, collected by Otto Degener in 1922, was not available for study when the writers visited the Natural History Museum, Vienna, in the summer of 1964. Even though the type specimen normally must have died after fruiting, the Degeners combed the type area in August 1968 with the hope of perhaps discovering an offspring of the 1922 plant. Though the area had escaped the usual ravages of "civilization" in the vicinity, no Trematolobelia plants were found. Three sheets (Fagerlund & Mitchell 847) in the Hawaii Volcanoes National Park herbarium, however, evidently belong to this taxon, are considered cotypes, and here have been used to augment the description. Fagerlund & Mitchell collected the young flowering material September 4, 1943, and fruiting material from the same specimen February 22, 1944. As the sheets cite the locality as being "In wet forest between Crater Rim road and Kilauea Iki," the writers visited the area in the hope of finding specimens. The search was of no avail - the area had been devastated by the 1959 Kilauea-Iki Eruption! In place of Trematolobelia, the unwelcome exotics Anemone japonica, Buddleja asiatica and Rubus penetrans were taking over the area. We fear Trematolobelia wimmeri Deg. & Deg., a species with capsules reminiscent in size to those of T. kauaiensis (Rock) Skottsb., to be on the verge of extinction if not already extinct.

ADDITIONAL NOTES ON THE ERIOCAULACEAE. XIV

Harold N. Moldenke

ERIOCAULACEAE Lindl.

Additional & emended bibliography: Petiv., Gaz. pl. 6, fig. 2. 1702; Pluk., Alm. pl. 409, fig. 5. 1769; Lam., Encycl. 3: 276. 1789; Willd. in L., Sp. Pl., ed. 4, 1: 486. 1797; Michx., Fl. Bor.-am. 2: 165. 1803; Pursh, Fl. Am. Sept. 1: 91. 1814; Roem. & Schult. in L., Syst. Veg., ed. 15 nova, 2: 864. 1817; Nutt., Gen. 1: 90. 1818; Ell., Sketch Bot. 2: 565. 1824; Wall., Plant. As. Rar. 3: 28. 1832; Wall., Numer. List 207--208 ["207"]. 1832; Beck, Bot. 370. 1833; Benth. in Hook., Niger Fl. 547. 1849; Hook. f., Fl. Brit. Ind. 6: 571--585. 1893; Jacks. in Hook. f. & Jacks., Ind. Kew., pr. 1, 1: 877--880. 1893; Britton & Br., Ill. Fl., ed. 1, 1: 371--373, 602--604, & 611, fig. 899--903 (1896) and 3: 536, 537, 541, 545, & 577. 1896; Ruhl. in Engl., Pflanzenreich 13 (IV, 30): 1--108. 1903; R. M. Harper, Ann. N. Y. Acad. Sci. 17: 267--268, pl. 24, fig. 1. 1906; Alv. Silv., Archiv. Mus. Nac. Rio Jan. 23: 162, pl. 4. 1921; Fern., Rhodora 48: iv & 58. 1946; Jacks. in Hook. f. & Jacks., Ind. Kew., pr. 2, 1: 877--880 (1946) and pr. 3, 1: 877--880. 1960; B. G. Briggs, Contrib. N. S. Wales Nat. Herb. 4: 24 & 26. 1966; Anon., Assoc. Etud. Tax. Fl. Afr. Trop. Bull. 17: 19. 1966; G. L. Davis, Syst. Embryol. Angiosp. 1966; K. Larsen, Dansk Bot. Arkiv 23: 375--399. 1966; C. C. Townsend, Excerpt. Bot. A.10: 310. 1966; Anon., Assoc. Etud. Tax. Fl. Afr. Trop. Index 1965: 31. 1966; S. V. Ramaswami, Study Flow. Pl. Bangalore [thesis] 219--221 & 1406--1407. 1966; Goodland, Bol. Soc. Venez. Cienc. Nat. 26: 345. 1966; Klots, New Field Book Freshw. Life 94. 1966; Begum, Curr. Sci. [India] 35: 262--263. 1966; R. H. Compton, Journ. S. Afr. Bot. Suppl. 6: 19, 33, & 92. 1966; Subramanyam & Henry, Bull. Bot. Surv. India 8: 214. 1966; Sebastine & Ramamurthy, Bull. Bot. Surv. India 8: 182. 1966; J. L. Ellis, Bull. Bot. Surv. India 8: 329 & 339. 1966; O. D. Evans, Biol. Abstr. 48: 4562 & 4563. 1967; Soukup, Biota 6: 359. 1967; Anon., Pollen & Spores 9: 642. 1967; Kral, Biol. Abstr. 48: 3190. 1967; Anon., Ind. Bibliog. Bot. Trop. 4 (1): 53 & 88. 1967; Y. H. Harrison, Biol. Abstr. 48: 8707. 1967; Anon., Biol. Abstr. 48: 3190 & 4563 (1967), 48 (10): S.60 & S.117 (1967), and 48 (22): S.65. 1967; Moldenke, Biol. Abstr. 48: xxii & 10099 (1967) and 48 (20): S. 61, S.161, S.165, & S.183. 1967; Dombrowski & Kuniyoshi, Araucariana 1: 15 & 18. 1967; J. de J. Jiménez, Archiv. Bot. & Biogeog. Ital. 43: 4. 1967; Begum, Bioresearch Index 1967: 2255. 1967; Anon., Assoc. Etud. Tax. Fl. Afr. Trop. Bull. 18: 45. 1967; Moldenke, Résumé Suppl. 15: [1]--5, 8, 10, 12, 14, 20, & 21. 1967; W. G. Burger, Fam. Flow. Pl. Ethiop. 132. 1967; Sculthorpe, Biol. Aquat. Vasc. Pl. 23, 389--391, 393, & 394. 1967; L. V. Barton, Bibl. Seeds 782. 1967; Satake, Nat. Sci. & Mus. 34: 161 & 162. 1967; Fulling, Ind. Bot. Record. Bot. Review 178. 1967; R. M. Harper, Castanea 32: 17. 1967; Rickett, Wild Fls. U. S. 2 (1): 135, pl.

27 (1967) and 2 (2): 659 & 666. 1967; Friedrich-Holzhammer in Merxmüller, Prodr. Fl. Südw. Afr. 159: 1--2. 1967; Berhaut, Fl. Sénégal, ed. 2, 311. 1967; J. & A. Raynal, Adansonia 7: 329. 1967; L. S. Thomas, Pine Barrens 23. 1967; D. A. Livingstone, Ecol. Monog. 37 (1): 43. 1967; L. O. Williams, Fieldiana Bot. 31: 249--269. 1967; Anon., Assoc. Etud. Tax. Fl. Afr. Trop. Index 1966: 9 (1967) and 1967: 31. 1968; Cronquist, Evol. & Class. Flow. Pl. 335, 336, & 390. 1968; F. A. Barkley, Outline Classif. Organisms, ed. 2, 10. 1968; Moldenke, Biol. Abstr. 49: 4188 (1968) and 49 (9): S.58. 1968; Anon., Biol. Abstr. 49: 1975 (1968) and 49 (7): S.58, S.133, & S.180. 1968; Moldenke, Résumé Suppl. 16: [1], 2, 5--9, 12, 19, 21, 23, 25--27, & 30. 1968; R. M. White, Irish Naturl. Journ. 16: 40. 1968; Meikle, Kew Bull. 22: 141--144. 1968; Justice & Bell, Wild Fls. N. C. 13 & 209. 1968; Moldenke, Phytologia 17: 348--352. 1968; Fassett, Index Rep. Fl. Wisc. [1]. n.d.

Burger (1967) informs us that in this family "a pistillode [is] often present in staminate flowers". Airy Shaw (1966) states that the genus Reilia Steud. may belong in either the Eriocaulaceae or the Juncaceae; he also tells us that the Eriocaulaceae was included by Bentham & Hooker in a "Series" called Glumaceae. Tomlinson (1964) compares the Eriocaulaceae with the genus Aphyllanthes in the Liliaceae. Runner (1961) places the genera Streptolirion and Juncoides in the Eriocaulaceae by the apparent error of omitting the name of family "31" between families "30" and "32". Tamayo (1961) places Leucothoë venezuelensis A. C. Sm. in the Eriocaulaceae instead of in the Ericaceae. Larsen (1966) reports the chromosome numbers for seven species in this family from Thailand.

BLASTOCAULON Ruhl.

Synonymy: Blastocaular Angely, Fl. Bacia Paran. 22: 31, sphalm. 1962.

Additional bibliography: Ruhl. in Engl., Pflanzenreich 13 (IV, 30): 223. 1903; Moldenke, Known Geogr. Distrib. Erioc. 7, 28, 31, 39, 44, 52, 53, 55, & 59. 1946; Moldenke, Phytologia 4: 338. 1953; Angely, Cat. Estat. 10: [2]. 1956; Angely, Fl. Paran. 10: 6, 7, 9, & 10. 1957; Moldenke, Résumé 87, 237, 279, 281, 285, 292, 323, 327, 328, 334, 352, 402, & 479. 1959; Angely, Liv. Gen. Bot. Bras. 19 & 39. 1960; Angely, Fl. Bacia Paran. 22: 31. 1962; Hegnauer, Chemotax. Pfl. 2: 153. 1963; Moldenke, Résumé Suppl. 7: 7 (1963) and 12: 11. 1965; F. A. Barkley, List Ord. Fam. Anthoph. 113 & 145. 1965; Airy Shaw in Willis, Dict. Flow. Pl., ed. 7, 138. 1966.

The generic name is taken from the Greek words, βλαστός, and καυλος, meaning "young branchlet stems" because the stems produce small branchlets.

BLASTOCAULON ALBIDUM (Gardn.) Ruhl.

Additional bibliography: Moldenke, Known Geogr. Distrib. Erioc. 7, 28, 44, & 55. 1946; Moldenke, Phytologia 4: 338. 1953; Moldenke,

Résumé 87, 279, 285, 323, 334, & 479. 1959.

Additional citations: BRAZIL: Minas Gerais: G. Gardner 5273 (B--isotype, N--isotype). MOUNTED ILLUSTRATIONS: drawings & notes by Körnicke (B).

BLASTOCAULON PROSTRATUM (Körn.) Ruhl.

Additional bibliography: Moldenke, Known Geogr. Distrib. Eriocaul. 7, 28, 31, 52, & 55. 1946; Moldenke, Résumé 87, 281, 327, 334, & 479. 1959.

Pereira reports that this plant grows in pure stands with no other plants in the formation. The species has been collected in anthesis in May.

Additional citations: BRAZIL: Minas Gerais: Martius s.n. [Cabo Agosto; Macbride photos 18733] (B--isotype, Mu--292--isotype, N--photo of isotype, W--photo of isotype); E. Pereira 2802 [Pabst 3638] (Bd--3847, Z); J. E. Pohl s.n. (Mu--293). MOUNTED ILLUSTRATIONS: drawings & notes by Körnicke (B).

BLASTOCAULON RUPESTRE (Gardn.) Ruhl.

Additional synonymy: Blastocaulon rupestris (Gardn.) Ruhl. ex Moldenke, Phytologia 4: 338, in syn. 1953.

Additional bibliography: Moldenke, Known Geogr. Distrib. Erioc. 7, 28, 39, 53, 55, & 59. 1946; Moldenke, Phytologia 4: 338. 1953; Moldenke, Résumé 87, 237, 292, 328, 334, 352, & 479. 1959; Moldenke, Résumé Suppl. 12: 11. 1965.

Additional citations: BRAZIL: Minas Gerais: G. Gardner 5272 (B--isotype, N--isotype, W--1067056--isotype); Mexia 5779 (B, Ca-509143, Mi, Ut--50252a, Vi, W--1571904), 5780 (Gg, Go, Mi, Ut--50251a, W--1571905); E. Pereira 2805 [Pabst 3641] (Bd--3846, Z); Schwacke 8485 (B). MOUNTED ILLUSTRATIONS: drawings & notes by Körnicke (B).

BLASTOCAULON SPELEICOLA Alv. Silv.

Additional bibliography: Alv. Silv., Fl. Mont. 274, pl. 182. 1928; Moldenke, Known Geogr. Distrib. Erioc. 7 & 28. 1946; Moldenke, Résumé 87 & 479. 1959.

CARPTOTEPALA Moldenke

Bibliography: Moldenke, Fieldiana Bot. 28: 114. 1951; Angely, Cat. Estat. 10: [2]. 1956; Moldenke, Bull. Jard. Bot. Brux. 27: 118. 1957; J. A. Steyerm., Fieldiana Bot. 28: 1157. 1957; Angely, Fl. Paran. 10: 7, 9, & 10. 1957; Moldenke, Résumé 70, 74, 249, 326, 401, & 479. 1959; F. A. Barkley, List Ord. Fam. Anthoph. 113 & 149. 1965; Airy Shaw in Willis, Dict. Flow. Pl., ed. 7, 202. 1966.

Type: C. insolita Moldenke [=C. jermani (Gleason) Moldenke].

The generic name is derived from the Latin, carptim, and the latinized French, tepala, meaning separate divisions of the perianth, because of the completely free sepals and petals in the flowers of both sexes.

CARPTOTEPALA JENMANI (Gleason) Moldenke

Synonymy: Paepalanthus jenmani Gleason, Bull. Torrey Bot. Club 56: 14. 1929. Carptotepala insolita Moldenke, Fieldiana Bot. 28: 114--116. 1951. Paepalanthus chimantensis Moldenke, Bull. Jard. Bot. Brux. 27: 118, in syn. 1957.

Additional bibliography: Gleason, Bull. Torrey Bot. Club 56: 14. 1929; Moldenke, Fieldiana Bot. 28: 114--116. 1951; Moldenke, Phytologia 4: 338. 1953; Moldenke, Mem. N. Y. Bot. Gard. 9: 278. 1957; Moldenke, Bull. Jard. Bot. Brux. 27: 118--119. 1957; Moldenke, Résumé 70, 74, 249, 326, & 479. 1959.

Collectors describe the roots of this plant as thickish and orchid-like, the leaves borne in dense clusters, rigid, erect, firmly membranous or rigid-coriaceous, varying from rich- or pale-green to grass-green on both surfaces, the involucre buff, the heads white or gray-white with blackish on the outer parts at the base, the flowers white or whitish, and the bracts gray-brown. Gleason's original description was "Leaves densely cespitose, soft and lax, 1--2 mm. wide, 8--12 cm. long, glabrous, subulate-tipped; peduncles 20--25 cm. long, costate, somewhat twisted, glabrous; sheaths strongly twisted, 4--5 cm. long, sparsely hirsute; heads hemispheric, 3--5 mm. in diameter; bracts broadly ovate to ovate-oblong, appressed, imbricate in several series, glabrous."

The type of the species is Jenman 1032, collected on the Kaieteur savanna in British Guiana, and deposited in the herbarium of the Royal Botanic Gardens at Kew. The conspecific C. insolita, on the other hand, was based on J. A. Steyermark 60703, collected by a waterfall in a swampy savanna between Río Karuai and Salto de Itaba-naima along the Río Karuai, at the southwestern base of Ptari-tepui, at 1220 meters altitude, Bolívar, Venezuela, on November 28, 1944, and is deposited in the herbarium of the New York Botanical Garden. Paepalanthus chimantensis was based on Steyermark & Wurdack 365, also from Bolívar, Venezuela.

The plant has been collected at altitudes of 65 to 2600 meters, in anthesis from January to March, and in July, August, October, and November, and in fruit in July. Steyermark records the vernacular name "leut". He also states that the species forms dense mats on wet rocks at the base of waterfalls, that it is common along swift water and rapids, locally abundant in large colonies in rapid water among rocks, and found in the spray zone on top of waterfalls. Maguire found it on moist rocks, while Sandwith describes it as tufted in sand among boulders by falls. Maguire & Fanshawe found it by waterfalls, on sandstone savannas, and locally common by riversides. Steyermark & Wurdack describe it as locally frequent on moist mossy ground, in scrub forests, in dense cushions in thickets, in dry sand, and in large colonies in rapid water among rocks. On the label of their no. 365 they note that its "leaves narrower and caudex more elongate than 364 but probably only an ecological variant". I agree with this conclusion. Whitton found the species growing on wet rocks, in moistish open white sand, and as recently exposed or still below

river water. He notes "buds farther advanced the further up shore one goes".

Additional citations: VENEZUELA: Bolívar: B. Maguire 33516a (N); J. A. Steyermark 6070 (N), 74662 (Z), 76016 (Z), 76057 (Z); Steyermark & Wurdack 72 (N), 364 (N), 365 (N), 476 (N). BRITISH GUIANA: S. G. Harrison 1391 (K, S); Jenman 1032 [N. Y. Bot. Gard. Type Photo neg. 5007] (K--type, N--photo of type, N--photo of type), 7198 (K), 7486 (Ut--9107a); Maguire & Fanshawe 32312 (N), 32643 (Mu, N); Sandwith 1258 (K, Ut--44224a); Schomburgk s.n. (K); Whitton 36 (K), 77 (K), 367 (K).

COMANTHERA L. B. Sm.

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The generic name is derived from the Greek, κόμα, and ἀνθός, meaning "hairy flower", since the anthers are long-hairy.

Mrs. A. Görts-van Rijn, in a letter to me dated March 21, 1966, casts some doubt on the validity of this genus. She says: "We have been looking very thoroughly to some Comanthera kegeliana specimens, partly annotated by you, and also used the publication of L. B. Smith in Contr. Gray Herb. 117: 38. 1937. He gives the description and some illustrations of this new genus and of C. linderi. We cannot agree with him on the characteristics of the flowers. He describes the male flowers as having a very reduced perianth and only one stamen. The sterile flowers, according to him, have reduced stamens. We have been looking to the flowers of Syngonanthus or Comanthera kegeliana, but could not find similar male flowers. We did, however, find overripe female flowers, where the fruits had come out and the perianth-segments had partly fallen off; these had the appearance of the described male flowers of Comanthera L. B. Smith. About the sterile flowers we are not quite sure, but they are supposed to be the immature male ones. They do have stamens, but it is difficult to say whether they are reduced or only very young." In a letter to me dated August 3, 1967, Dr. Smith replies as follows: "I have just gotten around to studying my Comanthera that I borrowed from Harvard at your suggestion. It has staminate flowers as I described them. Your Syngonanthus akurimensis is the same thing as regards the type but the Irwin collection shows no such stamens. Maybe the species is polymorphic and some heads lack functional stamens."

Type: Comanthera linderi L. B. Sm. [=C. kegeliana (Körn.)

Moldenke.

COMANTHERA KEGELIANA (Körn.) Moldenke

Synonymy: Paepalanthus kegelianus Körn. in Mart., Fl. Bras. 3 (1): 438. 1863. Dupatya kegeliana (Körn.) Kuntze, Rev. Gen. Pl. 2: 745. 1891. Syngonanthus kegelianus (Körn.) Ruhl. in Engl., Pflanzenreich 13 (IV, 30): 273. 1903. Comanthera linderi L. B. Sm., Contrib. Gray Herb., ser. 2, 117: 38—39, pl. 2. 1937. Syngonanthus akurimensis Moldenke, Phytologia 2: 371—372. 1947. Syngonanthus akurimensis var. amazonicus Moldenke, Phytologia 3: 42. 1948.

Additional bibliography: Körn. in Mart., Fl. Bras. 3 (1): 438. 1863; Kuntze, Rev. Gen. Pl. 2: 745. 1891; Ruhl. in Engl., Pflanzenreich 13 (IV, 30): 273. 1903; Moldenke, Bull. Jard. Bot. Brux. 27: 119—120. 1957; Angely, Fl. Paran. 10: 5. 1957; Anon., U. S. Dept. Agr. Bot. Subj. Index 5: 4226. 1958; Moldenke, Résumé 70, 75, 77, 88, 280, 326, 351, & 479. 1959; Moldenke, Résumé Suppl. 1: 5, 6, 16, 21, 23, & 25. 1959; Moldenke, Phytologia 13: 218. 1966; Moldenke, Biol. Abstr. 47: 6792. 1966.

The species has been encountered by Lindeman on a large sand savanna. It has been collected in anthesis from March to July and in fruit in May. It is described by Tamayo as growing 5—8 cm. tall. An isotype, Kegel 1473, was photographed by Macbride in the herbarium of the Conservatoire et Jardin Botaniques at Geneva and is his type photograph number 25170. Material has been misidentified and distributed in herbaria as "Compositae".

Additional & emended citations: VENEZUELA: Bolívar: Lasser 1705 (K, N, N, Ve, W—1901897); Tamayo 3234 (F—photo, N, N—photo, Ve, W, Z—photo). Federal District: Lockhart s.n. [Caracas] (K). BRITISH GUIANA: Cox & Hubbard 121 (N); Irwin BG. 20 (W—2141414, Z); Linder 40 [N. Y. Bot. Gard. Type Photo neg. 5006] (G, N—photo, N—photo); Martyn 146 (K). SURINAM: Kegel 1473 [Macbride photos 25170] (N—photo of isotype, W—photo of isotype); Lanjouw & Lindeman 2984 (N, Ut—178768); Lindeman 4018 (Ac). BRAZIL: Amazonas: Fróes 22433 (Ca—28252, N). Pará: Ducke s.n. [Herb. Mus. Goeldi 12088] (Bs).

ERIOCAULON Gron.

Additional & emended synonymy: Erioucaulon L., Mant. 580, sphalm. 1767. Cespa Hill, Herb. Brit. 1: pl. 66 [some copies]. 1769. Nasmythia Huds., Fl. Angl., ed. 2, 2: 414. 1778. Ericaulon Lour., Fl. Cochinch. 1: 60, sphalm. 1790. Eriocaulon L. ex Steud., Nom. Bot., ed. 1, 312. 1821. Randalia P. Beauv. ex Desv., Ann. Sci. Nat. Paris 13: 47. 1828. Sphaerochloa P. Beauv. ex Desv., Ann. Sci. Nat. Paris, ser. 1, 13: 47. 1828. Sphoerochloa P. Beauv. ex Desv., Ann. Sci. Nat. Paris, ser. 1, 13: pl. 5, fig. 1. 1828. Symphachne P. Beauv. ex Desv., Ann. Sci. Nat. Paris, ser. 1, 13: 47. 1828. Leucocephala Roxb., Fl. Ind. 3: 612. 1832. Busseuillia Lesson in Bougainville, Journ.

Navig. Aut. Freg. Thetis & Corv. Espér. 2: 348. 1837. Sympachne P. Beauv. ex Steud., Nom. Bot., ed. 2, 2: 654. 1841. Chaetodiscus Steud., Syn. Pl. Cyp. 2: 261. 1855. Electrosperma F. Muell., Trans. Philos. Soc. Victoria 1: 23. 1855. Dichrolepis Welw., Apont. Phyt.-geogr. 542. 1859. Lasiolepis Boeck. (in part), Flora 56: 90. 1873 [not Lasiolepis Bennett, 1838]. Symphyachna Post & Kuntze, Lexicon 544. 1904. Ericaulon Merr. & Walker, Bibl. East. Asiat. Bot. 343, sphalm. 1938. Lasiolepsis Böck. apud Milne-Redhead, Kew Bull. Misc. Inf. 1948: 472, sphalm. 1948. Randalia Petit apud Moldenke in Humbert, Fl. Madag. 36: 2, in syn. sphalm. 1955. Randalia "Petiv. ex Desv." ex Angely, Cat. Estat. 10: [2], in syn. sphalm. 1956. Sphaerochloa "P. Beauv. ex Desv." apud Angely, Cat. Estat. 10: [2], in syn. 1956. Symphachne "P. Beauv. ex Desv." apud Angely, Cat. Estat. 10: [2], in syn. 1956. Eriaucolon L. ex Moldenke, Résumé 285, in syn. 1959. Randalia Beauv. & Desv. ex Moldenke, Résumé 342, in syn. 1959. Randalia Petiv. ex Moldenke, Résumé 342, in syn. 1959. Sphaerochloa Beauv. & Desv. ex Moldenke, Résumé 345, in syn. 1959. Eriocaullon With. ex Moldenke, Résumé Suppl. 3: 31, in syn. 1962. Eriocaulum Körn. apud Angely, Bibl. Veg. Paran. 155, sphalm. 1964. Randalia "Beauv. ex Desv." apud Airy Shaw in Willis, Dict. Flow. Pl., ed. 7, 950, in syn. 1966. Sympachne Steud. apud Airy Shaw in Willis, Dict. Flow. Pl., ed. 7, 1091, in syn. 1966.

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Nat. Sci. & Mus. 34: 161 & 162. 1967; Fulling, Ind. Bot. Record. Bot. Review 178. 1967; L. O. Williams, Fieldiana Bot. 31: 249—269. 1967; R. M. Harper, Castanea 32: 17. 1967; O. D. Evans, Biol. Abstr. 48: 4562. 1967; Rickett, Wild Fls. U. S. 2 (1): 135 (1967) and 2 (2): 659. 1967; Friedrich-Holzhammer in Merxmüller, Prodr. Fl. Südw. Afr. 159: 1--2. 1967; Berhaut, Fl. Sénégal, ed. 2, 311. 1967; Anon., Biol. Abstr. 48 (10): S.60. 1967; J. & A. Raynal, Adansonia 7: 329. 1967; L. S. Thomas, Pine Barrens 23. 1967; D. A. Livingstone, Ecolog. Monog. 37 (1): 43. 1967; Moldenke, Résumé Suppl. 15: [1], 8, 10, 12, 14, & 20 (1967) and 16: [1], 2, 5, 7—9, 12, 19, 21, & 25—27. 1968; Justice & Bell, Wild Fls. N. C. 13 & 209. 1968; Meikle, Kew Bull. 22: 141—144. 1968; R. M. White, Irish Naturl. Journ. 16: 40. 1968.

The scientific name of this genus is taken from the Greek, ἔριον, and καυλός, meaning "hairy stem", since many species have pubescent scapes or peduncles. Berhaut (1967) describes this genus, as known to him, as "Bractées triangulares, sommet beaucoup plus large, base cunéiforme, 6a bractées de base seulement, dont 3 exterieures débordant la base du capitule....capitules blanc-neigeux". Riley (1963) reports the sporophytic chromosome number as 32 and 36. Thanikaimoni (1965) studied the pollen of 46 species of the genus. Livingstone (1967) tells us that the genus is among the minor taxa in the ericaceous belt of the Ruwenzori Mountains in equatorial Africa. Rickett (1967) records the common names "hatpins" and "pipeworts" for the genus as a whole, and Espirito Santo (1963) records "orô".

The Lasiolepis of Bennett, referred to in the synonymy above, is a synonym of Harrisonia R. Br. in the Rutaceae. The type species of Eriocaulon is E. decangulare L. [as established by Britton & Brown (1913)]; that of Chaetodiscus is C. gilberti Steud., based on Gilbert 153 from Australia [Ruhland reduces this genus to synonymy under Eriocaulon, but fails to dispose of the type binomial anywhere in his work]. The type of Electrosperma is E. australasicum F. Muell. [=Eriocaulon australasicum (F. Muell.) Körn.]. Lasiolepis has no type indicated; three species were proposed in the original publication: L. aquatica Boeck., L. brevifolia Boeck., and L. pilosa Boeck. — of these the first two are members of the genus Eriocaulon, while the last-mentioned belongs in the genus Paepalanthus. The type species of Nasmythia is N. articulata Huds. [=Eriocaulon septangulare With.], that of Randalia is R. decangulare (L.) P. Beauv. [=Eriocaulon decangulare L.], and that of Symphachne is S. xyroides P. Beauv. [=Eriocaulon decangulare L.].

The Poilane 13849, distributed to herbaria as a species of Eriocaulon, is actually Fimbristylis tetragona R. Br. in the Cyperaceae.

ERIOCAULON ABYSSINICUM Hochst.

Additional bibliography: Moldenke, Bull. Jard. Bot. Brux. 27:

122. 1957; Moldenke, Résumé 135, 138, 147, 153, & 479. 1959; Killick, Bot. Surv. S. Afr. Mem. 34: 119. 1963; R. H. Compton, J. S. Afr. Bot. Suppl. 6: 33. 1966; Moldenke, Résumé Suppl. 16: 8. 1968.

Compton (1966) records this species from Swaziland. The H. Wild 1162 [Govt. Herb. 15100], distributed as E. abyssinicum, is actually E. ambosnse Schinz.

Additional citations: ETHIOPIA: Schimper 648 (S), 1944 (B--isotype, Z--isotype).

ERIOCAULON ACHITON Körn.

Synonymy: Eriocaulon heteropeplon Körn. ex Moldenke, Résumé Suppl. 1: 17, in syn. 1959 [not E. heteropeplon Alv. Silv., 1928]. Eriocaulon schlagintweitii Ruhl. ex Moldenke, Résumé Suppl. 1: 18, in syn. 1959. Eriocaulon thomsoni Körn. ex Moldenke, Résumé Suppl. 1: 18, in syn. 1959.

Additional bibliography: Moldenke, Bull. Jard. Bot. Brux. 27: 122. 1957; Moldenke, Résumé 159, 161, 175, 178, & 479. 1959; Moldenke, Résumé Suppl. 1: 11, 17, & 18 (1959), 3: 16 (1962), and 15: 8. 1967.

This species has been collected on wet cliffs in open areas, at altitudes of 50--2000 meters, flowering from January to March and in October, and fruiting in February. Hansen & Smitinand describe it as "common in wet localities" in Thailand, and tell us that the flowers are "whitish" or "dirty-white". Smitinand says of it "common in sandy soil along edge of water hole".

The name, E. heteropeplon Körn., appears to be based on Schlagintweit 2653, from East Punjab, deposited in the herbarium of the Botanisches Museum at Berlin, and 11311, from Sind, deposited in the herbarium of the Naturhistoriska Riksmuseum at Stockholm, while E. schlagintweitii Ruhl. is based on Schlagintweit 188, from Khasia, deposited at Berlin, and E. thomsoni Körn. is based on J. D. Hooker 3, from Sikkim, also deposited at Berlin. Ruhland also annotated the Hooker collection at Berlin as "Eriocaulon n. sp."

Hansen & Smitinand 12388a is a mixture with E. sexangulare L., while Ritchie 1242 is a mixture with E. stellulatum Körn. and E. thwaitesii Körn.

Material has been misidentified and distributed in herbaria as E. sexangulare L. The Smitinand 1982a, distributed as E. achiton, is actually E. alpestre Hook. f. & Thoms.

Additional citations: PAKISTAN: East Bengal: Griffith 5576 (B, C, S). Sind: Schwagintweit 11311 (S). INDIA: Assam: Chand 2978 (Mi); Koelz 31319a (Mi). East Punjab: Schlagintweit 187 (B), 2653 (B). Kerala: Stocks, Law, &c. s.n. [Malabar, Concan, &c] (B). Khasi States: Griffith 47 (B--type); Schlagintweit 188 (B). Madras: Perrottet 1170 (V, V--96838, V--270556). Mysore: S. N. Ramaswamy 20 (Ac), 21 (Rf), 29 (Ac). Sikkim: J. D. Hooker 3 (B).

State undetermined: Ritchie 1242, in part (T). THAILAND: Hansen & Smitinand 11897 (Cp, Rf), 12388a (Cp), 12389 (Cp, Rf); Smitinand 5602 (Cg).

ERIOCAULON ADAMESII Meikle

Additional bibliography: Moldenke, Phytologia 3: 181. 1949; Moldenke, Résumé 136 & 479. 1959; Moldenke, Résumé Suppl. 1: 8 & 9 (1959) and 4: 6. 1962.

This species has been collected in flower in December, growing in poor sandy soil at the uppermost ends of tidal creeks, and also "common in wet ditches, often submerged". Meikle (1948) comments that E. adamesii "is a very distinct Eriocaulon, having closer affinities with the West Indian E. echinospermum C. Wright, and its allies, than with any African representatives of the genus. E. mutatum is the only African species with which it could possibly be confused, but this has blackish capitula, and the sepals of the ♀ flowers have broad wing-like keels."

Additional citations: SENEGAL: J. G. Adam 18299 (Z), 18377 (Z). REPUBLIC OF GUINEA: Boismare 417 [Herb. Chillou 3937] (An); Chillou 1746 (An). LIBERIA: Dinklage 3009 (B).

ERIOCAULON AEQUINOCTIALE Ruhl.

Additional bibliography: Moldenke, Known Geogr. Distrib. Erioc. 5 & 32. 1946; Moldenke, Phytologia 3: 181. 1949; Moldenke, Résumé 70 & 479. 1959.

ERIOCAULON AFRICANUM Hochst.

Additional bibliography: J. Hutchinson, Botanist in South. Afr. 678. 1946; Moldenke, Bull. Jard. Bot. Brux. 27: 122—123. 1957; Moldenke, Résumé 148, 151, & 153. 1959; Moldenke, Résumé Suppl. 2: 9 (1960) and 3: 16. 1962.

This species has been collected at 6000 feet altitude. Hutchinson (1946) cites his no. 4324. The Zeyher 1730, distributed as E. africanum, is actually Syngonanthus wahlbergii (Wikstr.) Ruhl.

Additional citations: SOUTH AFRICA: Transvaal: F. A. Rogers s. n. [Moss & Rogers 1921] (S).

ERIOCAULON AFZELIANUM Wikstr.

Synonymy: Eriocaulon kouroussense Lecomte ex Moldenke, Résumé 289, in syn. 1959. Eriocaulon afzelii Wikstr. ex Moldenke, Résumé Suppl. 1: 16, in syn. 1959.

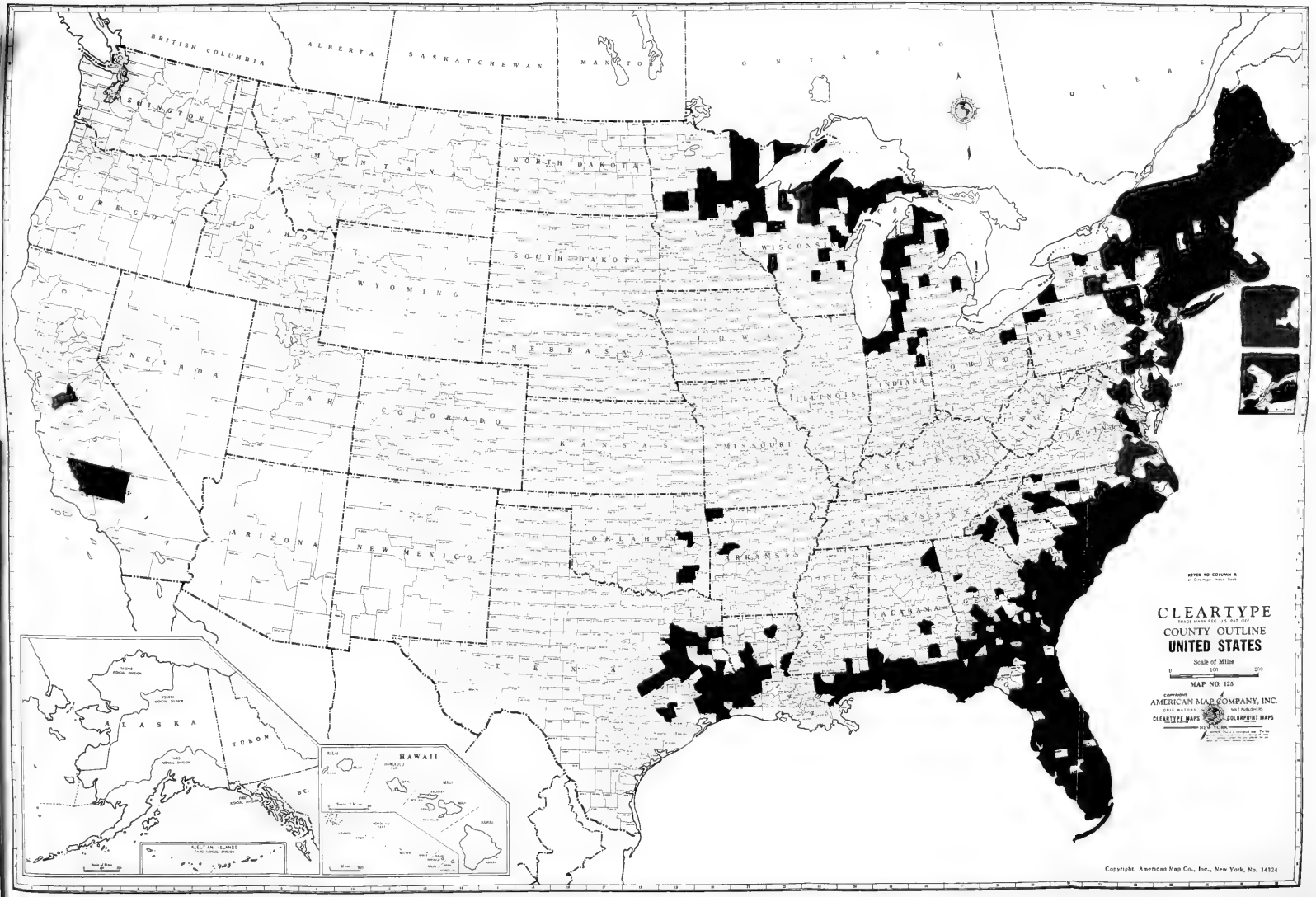
Additional & emended bibliography: Moldenke, Known Geogr. Distrib. Erioc. 20, 21, 32, & 36. 1946; Moldenke, Bull. Jard. Bot. Brux. 27: 123. 1957; Moldenke, Résumé 134—138, 289, & 479. 1959; Moldenke, Résumé Suppl. 1: 16. 1959; Hepper, Bull. Inst. Fond. Afr. Noire 27: 420. 1965; Berhaut, Fl. Sénégal, ed. 2, 311. 1967.

The name, E. kouroussense Lecomte, appears to be based on Raynal & Raynal 6795 in the herbarium of the California Academy of Sciences at San Francisco. Hepper (1965) found the species grow-

Figure 1. Distribution of the Eriocaulaceae in the United States

Herbarium curators who have material of this family from additional counties are asked to send it to the author for verification and record, so that future editions of this map may be more complete

Mapping by counties done by Andrew R. Moldenke



ing in seasonally inundated ricefields in Northern Nigeria. Berhaut (1967) cites his numbers 1636, 6432, 6633, & 6651 from Sénégal. Material has been misidentified and distributed in herbaria as E. bongense Engl. & Ruhl. and under the name Utricularia spiralis Sm.

Additional citations: SÉNÉGAL: J. G. Adam 15887 (Z), 15922 (Z), 15947 (Z), 16968 (Z), 18477 (Z), 18527 (Z); Raynal & Raynal 5231 (Z, Z--drawing), 6795 (Gg); Roberty 16336 (An). REPUBLIC OF GUINEA: Boismare 442 [Herb. Chillou 3962] (An); Chillou 7 (An), 14 (An), 754 (Z), 789 (An, An), 935 (An), 1155 (Z), 3435 (An), 3555 (An), 4010 (An); Pitot s.n. [13.X.1950] (An). SIERRA LEONE: Afzelius 14 (B--type, S--isotype, S--isotype, Z--isotype). NIGERIA: Northern: C. Barter 1019 (B, S, Ut--325). CHAD: Schweinfurth s. n. [Djur, 1869] (B).

ERIOCAULON ALATUM H. Lecomte

Additional bibliography: Moldenke, Known Geogr. Distrib. Erioc. 26 & 61. 1946; Moldenke, Phytologia 3: 181 (1949) and 4: 339. 1953; Moldenke, Résumé 175, 184, 201, & 479. 1959; Moldenke, Résumé Suppl. 1: 13 (1959) and 3: 20. 1962; Thanikaimoni, Pollen & Spores 7: 183. 1965.

Collectors have found this species growing in savannas, describe it as an herb with yellowish heads, at 200 meters altitude, flowering in April, October, and December, fruiting in April, and called "chuk nok yung" in Thailand.

Additional citations: THAILAND: Bunnal 571b [Roy. Forest Dept. 18264] (Bk); Larsen 8425 (Z); Sørensen, Larsen, & Hansen 784 (Cp), 8070 (S). WESTERN PACIFIC ISLANDS: PHILIPPINE ISLANDS: Luzon: Reillo 19270 (N). INDONESIA: GREATER SUNDA ISLANDS: Celebes: Eyma 3383 (Ut--11518b), 3996 (Ut--11514b). Sumatra: H. H. Bartlett 7456 (Mi).

ERIOCAULON ALLEIZETTEI Moldenke

Additional bibliography: Moldenke, Biol. Abstr. 27: 2026. 1953; Moldenke, Bull. Jard. Bot. Brux. 27: 123. 1957; Moldenke, Résumé 156 & 479. 1959.

ERIOCAULON ALPESTRE Hook. f. & Thoms.

Synonymy: Ericaulon alpestre Merr. & Walker, Bibl. East. Asiat. Bot. 343, sphalm. 1938. Eriocaulon alpestre var. alpestre (Hook. f. & Thoms.) Koyama, Philip. Journ. Sci. Bot. 84: 368. 1955. Eriocaulon femineo-spathaceum Ruhl. ex Moldenke, Résumé Suppl. 1: 17, in syn. 1959.

Additional bibliography: Maxim., Diagn. Pl. Nov. As. 8: 25. 1892; Hook. f., Fl. Brit. Ind. 6: 578. 1894; Ruhl. in Engl., Pflanzenreich 13 (IV, 30): 95. 1903; Kawakami, List Pl. Formos. 130. 1910; Nakai, Bot. Mag. Tokyo 26: [93--94]. 1912; Lecomte, Fl. Gén. Indochine 7: 10, pl. 6D. 1922; Mak., Jap. Bot. Journ. 3: 26. 1926; S. Sasaki, List Pl. Formos. 99. 1928; Tu, Chinese Bot. Dict.,

abrdg. ed., 1317. 1933; Merr. & Walker, Bibl. East. Asiat. Bot. 343. 1938; Moldenke, Known Geogr. Distrib. Erioc. 23, 25, 26, 32, & 61. 1946; Koyama, Philip. Journ. Sci. Bot. 84: 367—368. 1955; Moldenke, Résumé 161, 169, 171, 172, 175, 178, 184, 285, & 479. 1959; Moldenke, Résumé Suppl. 1: 11 & 17 (1959), 2: 6 (1960), and 3: 19. 1962; Thanikaimoni, Pollen & Spores 7: 183. 1965; Moldenke, Résumé 16: 21. 1968.

Koyama (1955) cites a Hayata s.n. from Tonkin and remarks: "Having expected the occurrence of the present species in Indo-China, Lecomte included this in his Flora général de l'Indo-Chine, without any citation of extant specimen from Indo-China. This Hayata's record may be the first one based upon a real specimen. E. alpestre in Ruhland's sense is composed of two taxa in the present days, namely E. alpestre in his meaning includes E. robustius, a Japanese allied one. Examining E. alpestre, I, however, found that there was not very important difference between the above two entities, and I was inclined to place E. robustius in a varietal rank as Maximowicz did in his first publication of this taxon." Koyama, therefore, recognizes E. alpestre var. robustius Maxim. and E. alpestre var. nigrum (Satake) Koyama, which I maintain as E. robustius (Maxim.) Mak. and E. robustius var. nigrum Satake, respectively.

Eriocaulon alpestre has been collected in bogs, at pond margins, and in rice paddies near carabao pastures and Chara pools, at altitudes of 5000 to 12,000 feet, flowering in August. Common names recorded for it are "hiroha-no-inunchige", "hiroha-no-inunohige", "kok-cheng", and "kuro-imunohiga". Material has been misidentified and distributed in herbaria under the names E. achiton Körn., E. atrum Nakai, E. japonicum Körn., E. luzulaefolium Mart., and E. wallichianum Mart. The cheironymous binomial, E. femineospathaceum Ruhl., was based by Ruhland on Warburg s.n. from Yulupo, Japan, deposited in the herbarium of the Botanisches Museum at Berlin.

Additional citations: INDIA: Assam: Jenkins s.n. [Assam; h.r. m. 310] (S). Khasi States: C. B. Clarke 18851a (B); Hooker & Thomson 19 (B), s.n. [Mont. Khasia, 5-6000 ped.] (S, S, Ut—304). Sikkim: J. D. Hooker 18 (B), s.n. [Sikkim, 8-12,000 ped.] (S, Ut—305). THAILAND: Smitinand 1982a (Gg). INDOCHINA: Annam: Clemens & Clemens 4212 (Ca—339345). KOREA: Komarov 349 (N). WESTERN PACIFIC ISLANDS: JAPAN: Honshu: Furuse s.n. [16 Sept. 1954] (S), s.n. [17 Sept. 1954] (S, S), s.n. [14 Sept. 1955] (S); Saida s.n. [Matsushiro, Prov. Shinano, Aug. 1885] (B). Kiushu: Hayakawa s.n. (S). Island undetermined: Warburg s.n. [Yulupo] (B).

ERIOCAULON ALTO-GIBBOSUM Ruhl.

Additional bibliography: Moldenke, Known Geogr. Distrib. Erioc. 7 & 32. 1946; Moldenke, Résumé 88 & 479. 1959.

Additional citations: BRAZIL: Mattogrosso: Pilger 757 (B—type, Z—isotype).

ERIOCAULON AMANOANUM Koyama

Bibliography: Koyama, Journ. Jap. Bot. 31: 9—11, fig. 3. 1956; Moldenke, Résumé 181 & 479. 1959; Hatusima, Mem. South. Indust. Sci. Inst. Kagoshima Univ. 3 (1): 123. 1962; Moldenke, Résumé Suppl. 12: 8. 1965.

The type of this species was collected by T. Amano (no. 4) -- in whose honor it is named — at Ogimi-mura, Okinawa, in 1937, and is deposited in the herbarium of the National Science Museum. Koyama (1958) states that this species is related to E. latifolium J. Sm., of Africa, but differs in its pilose receptacle, the sepals of the staminate florets being glaucous-nigrescent, the anthers nigrescent, and the petals of the pistillate florets being smaller. He says that it resembles E. sexangulare L., which differs in being dimerous.

Additional citations: WESTERN PACIFIC ISLANDS: JAPAN: Kiushu: Hatusima & Sako 25289 (Z).

ERIOCAULON AMBOËNSE Schinz

Additional bibliography: Moldenke, Bull. Jard. Bot. Brux. 27: 123. 1957; Moldenke, Résumé 147, 151, & 479. 1959; Moldenke, Résumé Suppl. 3: 16 (1962) and 4: 6 & 7. 1962; Friedrich-Holzhammer in Merxmüller, Prodr. Fl. Südw. Afr. 159: 1 & 2. 1967.

This species has been collected at 5440 feet altitude in Southern Rhodesia. Material has been misidentified and distributed in herbaria as E. abyssinicum Hochst., E. inyangense Arwidsson, and E. sexangulare L.

Additional citations: SÉNÉGAL: J. G. Adam 15709 (Z), 183622 (Z). REPUBLIC OF GUINEA: Schuell 2366 (An). RHODESIA: C. K. Brain 4470 (N), 9010 (N); Horaky H.2388 [Govt. Herb. 13417] (N—photo); H. Wild 1162 [Govt. Herb. 15100] (N). SOUTHWEST AFRICA: Baum 111 (S, Z); Dinter 7220 (S). SOUTH AFRICA: Cape of Good Hope: F. A. Rogers s.n. [Moss & Rogers 1593] (S).

ERIOCAULON AMPHIBIUM Rendle

Additional bibliography: Moldenke, Phytologia 3: 181. 1949; Moldenke, Résumé 148 & 479. 1959.

ERIOCAULON ANDONGENSE Welw.

Additional bibliography: Moldenke, Known Geogr. Distrib. Erioc. 21 & 32. 1946; Moldenke, Résumé 147 & 479. 1959.

Additional citations: ANGOLA: Loanda: Welwitsch 2443 (B—cotype, Z—cotype).

ERIOCAULON ANGUSTIFOLIUM Körn.

Additional bibliography: Moldenke, Known Geogr. Distrib. Erioc. 7 & 32. 1946; Moldenke, Phytologia 4: 340. 1953; Moldenke, Résumé 88 & 479. 1959; Moldenke, Résumé Suppl. 14: 2. 1966.

This plant has been collected in flower and fruit in October.

Additional citations: BRAZIL: Brasilia: Sucre 839 [Luiza 69] (Z). Goiás: G. Gardner 4382 [Macbride photos 10555] (B--type, N-isotype, W--photo of type). MOUNTED ILLUSTRATIONS: drawings & notes by Körnicke (B).

ERIOCAULON ANGUSTISEPALUM H. Hess

Additional bibliography: Anon., Assoc. Etud. Tax. Fl. Afr. Trop. Index 1955: 29--30. 1956; Moldenke, Bull. Jard. Bot. Brux. 27: 124. 1957; H. Hess, Bericht. Schweitz. Bot. Gesell. 67: 83. 1957; Moldenke, Résumé 147 & 479. 1959; Moldenke, Résumé Suppl. 1: 10. 1959.

This plant has been collected at 1850 meters altitude in Angola.

Additional citations: ANGOLA: Huila: Antunes 168b (B); H. Hess 52/1754 (B, Z). MOUNTED ILLUSTRATIONS: fig. 11A (B).

ERIOCAULON ANNAMENSE H. Lecomte

Additional bibliography: Moldenke, Known Geogr. Distrib. Erioc. 26 & 61. 1946; Moldenke, Résumé 175 & 479. 1959.

ERIOCAULON ANNUUM Milne-Redhead

Additional bibliography: Moldenke, Known Geogr. Distrib. Erioc. 21. 1946; Moldenke, Phytologia 3: 181--182. 1949; Moldenke, Résumé 144, 148, & 479. 1959; Moldenke, Résumé Suppl. 1: 9 (1959) and 4: 6. 1962.

Additional citations: REPUBLIC OF GUINEA: Boismare 422 [Herb. Chillou 3942] (An); Chillou 727 (An); Pitot s.n. [4.X.1950] (An), s.n. [13.X.1950] (An). MAFIA ISLAND: Schlieben 2574 (B, N, S).

ERIOCAULON ANTUNESII Engl. & Ruhl.

Synonymy: Eriocaulon antunesii Engl. ex Moldenke, Résumé Suppl. 1: 16, in syn. 1959.

Additional bibliography: Moldenke, Known Geogr. Distrib. Erioc. 21 & 32. 1946; Moldenke, Résumé 147 & 479. 1959; Moldenke, Résumé Suppl. 1: 16 (1959) and 4: 6 & 7. 1962.

Additional citations: VOLTAIC REPUBLIC: Winkony 3 (Z). SÉNÉGAL: Winkony 23 (Z). IVORY COAST: Winkony 1 (Z). ANGOLA: Huila: Antunes 139 (B--type, B--isotype, Z--isotype).

ERIOCAULON APICULATUM H. Lecomte & Moldenke

Additional bibliography: Moldenke, Bull. Jard. Bot. Brux. 27: 125. 1957; Moldenke, Résumé 156 & 479. 1959.

ERIOCAULON AQUATILE Körn.

Synonymy: Paepalanthus aquatilis Mart. ex Moldenke, Résumé 323, in syn. 1959.

Additional bibliography: Moldenke, Known Geogr. Distrib. Erioc. 7, 32, & 44. 1946; Moldenke, Phytologia 3: 321. 1950; Moldenke, Résumé 88, 323, & 479. 1959; Rennó, Levant. Herb. Inst. Agron. 68. 1960; Moldenke, Résumé Suppl. 14: 2. 1966.

The name, Paepalanthus aquatilis, is apparently a cheironym

placed on the type collection of this taxon by Martius himself. The type specimen, Martius s.n., deposited in the Munich herbarium, was photographed there by Macbride as his type photograph number 18684. The species has been collected in anthesis in June.

Additional citations: BRAZIL: Brasilia: Irwin & Soderstrom 5822 (N). Minas Gerais: Martius s.n. [Macbride photos 18684] (N--photo of type, N--photo of type, W--photo of type); Sena s.n. [Herb. Schwacke 14561] (B). MOUNTED ILLUSTRATIONS: drawings & notes by Körnicke (B); drawings of type collection by Martius (B).

ERIOCAULON ARECHAVALETAE Herter

Additional bibliography: Castellanos, Lilloa 20: 244. 1949; Moldenke, Bull. Jard. Bot. Brux. 27: 125. 1957; Moldenke, Résumé 119, 285, 289, & 479. 1959.

The Pedersen 812, distributed as E. arechavaletae, is actually E. magnum Abbiatti.

Additional citations: MOUNTED ILLUSTRATIONS: Descole, Gen. Sp. Pl. Argent. pl. 14 (N), pl. 15 (N).

ERIOCAULON ARENICOLA Britton & Small

Additional bibliography: Moldenke, Bull. Jard. Bot. Brux. 27: 125. 1957; Moldenke, Résumé 53 & 479. 1959.

Additional citations: ISLA DE PINOS: Killip 42715 (S); Marie-Victorin & Alain 166 (Vi).

ERIOCAULON ARISTATUM H. Hess

Additional bibliography: Anon., Assoc. Etud. Tax. Fl. Afr. Trop. Index 1955: 29--30. 1956; H. Hess, Bericht. Schweitz. Bot. Gesell. 67: 83--84. 1957; Moldenke, Bull. Jard. Bot. Brux. 27: 125. 1957; Moldenke, Résumé 147, 151, & 479. 1959; Moldenke, Résumé Suppl. 1: 10. 1959; Friedrich-Holzhammer in Merxmüller, Prodr. Fl. Südw. Afr. 159: 2. 1967.

Hess (1957) records this species from Southern Rhodesia. Friedrich-Holzhammer (1967) reduces E. welwitschii var. pygmaeum Rendle to synonymy under E. aristatum.

ERIOCAULON ATABAPENSE Moldenke

Additional bibliography: Moldenke, Bull. Jard. Bot. Brux. 27: 126. 1957; Moldenke, Résumé 66, 71, & 479. 1959.

The Cruyent 47 collection, cited below, is a mixture with some cyperaceous material.

Additional citations: VENEZUELA: Amazonas: Cruyent 47, in part (Ve); Vareschi & Maegedfrau 6608 (Ve--42903); Ll. Williams 13858 (Z--photo of type).

ERIOCAULON ATRATUM Körn.

Additional bibliography: Hook. f., Fl. Brit. Ind. 6: 574. 1894; Ruhl. in Engl., Pflanzenreich 13 (IV, 30): 69. 1903; Fyson, Journ. Indian Bot. 2: 310. 1921; Moldenke, Known Geogr. Distrib. Erioc. 24 & 32. 1946; Moldenke, Phytologia 4: 340. 1953; Moldenke, Résumé

167 & 479. 1959.

Ruhland (1903), in his monograph of this group, cites the type collection of this species as "Gardner 972", but the actual type seems definitely to be number 932. The Collector undesignated s. n. [18/10/13], distributed as E. atratum, is actually E. atrum Nakai.

Additional citations: CEYLON: G. Gardner 932 (B--type, Z--isotype).

ERIOCAULON ATRATUM var. MAJOR Thwaites

Additional bibliography: Moldenke, Known Geogr. Distrib. Erioc. 24, 32, 33, & 38. 1946; Moldenke, Phytologia 4: 340. 1953; Moldenke, Résumé 167, 286, 291, & 479. 1959.

The Herb. Holtermann s.n. specimen, cited below, has stems to 12 inches long and leafy throughout!

Additional citations: CEYLON: Herb. Holtermann s.n. (B); Thwaites C.V.131 (B--isotype, B--isotype).

ERIOCAULON ATROIDES Satake

Additional bibliography: Moldenke, Bull. Jard. Bot. Brux. 27: 126. 1957; Moldenke, Résumé 172 & 479. 1959.

This species has been found growing in muddy swamps. A common name recorded for it is "kuro-inunohiga". Material has been misidentified and distributed in herbaria as E. atrum Nakai.

Additional citations: WESTERN PACIFIC ISLANDS: JAPAN: Honshu: Furuse s.n. [6 Oct. 1955] (S), s.n. [2 July 1956] (S).

ERIOCAULON ATROIDES f. NANUM Satake

Additional bibliography: Moldenke, Bull. Jard. Bot. Brux. 27: 126--127. 1957; Moldenke, Résumé 172 & 479. 1959.

ERIOCAULON ATRUM Nakai

Synonymy: Eriocaulon atratum Nakai, in herb. [not E. atratum Körn., 1856].

Additional bibliography: Moldenke, Known Geogr. Distrib. Erioc. 25 & 61. 1946; Moldenke, Bull. Jard. Bot. Brux. 27: 127. 1957; Moldenke, Résumé 171, 172, & 479. 1959; Moldenke, Résumé Suppl. 3: 18 & 21. 1962; Koyama in Kitamura, Murata, & Koyama, Col. Illustr. Herb. Pl. Japan 184--185, pl. 48, fig. 310, text fig. 126 (2). 1964.

This species has been found growing in boggy pondsides. The Koyama plate, cited above, is in full color. The Furuse s.n. [6 Oct. 1955], distributed as E. atrum, is actually E. atroides Satake, while Furuse s.n. [17 Sept. 1954] is E. alpestre Hook. f. & Thoms.

Additional citations: WESTERN PACIFIC ISLANDS: JAPAN: Honshu: Collector undesignated s.n. [18/10/13] (S); Furuse s.n. [14 Sept. 1955] (Ca--59916), s.n. [2 July 1956] (S), s.n. [21 Sept. 1957] (S).

ERIOCAULON ATRUM var. INTERMEDIUM Nakai

Additional bibliography: Moldenke, Bull. Jard. Bot. Brux. 27: 127--128. 1957; Moldenke, Résumé 172 & 479. 1959; Koyama in Kitamura, Murata, & Koyama, Col. Illustr. Herb. Pl. Japan 185. 1964.

ERIOCAULON ATRUM var. PLATYPETALUM Satake

Additional bibliography: Moldenke, Bull. Jard. Bot. Brux. 27: 128. 1957; Moldenke, Résumé 172 & 479. 1959.

ERIOCAULON AUSTRALASICUM (F. Muell.) Körn.

Synonymy: Electrosperma australasicum F. Muell., Trans. Philos. Soc. Victoria 1: 24. 1855. Eriocaulon electrospermum F. Muell., Syst. Census Austral. Pl. 123. 1882.

Bibliography: F. Muell., Trans. Philos. Soc. Victoria 1: 24. 1855; Körn., Linnaea 27: 616. 1856; F. Muell., Syst. Census Austral. Pl. 123. 1882; Moore & Betche, Handb. Fl. New S. Wales 440. 1893; Ruhl. in Engl., Pflanzenreich 13 (IV, 30): 114. 1903; Maiden & Betche, Census New S. Wales Pl. 38. 1916; Moldenke, Known Geogr. Distrib. Erioc. 27, 32, & 34. 1946; Ewart, Fl. Vict. 263. 1931; Moldenke, Résumé 208, 284, 286, 287, & 479. 1959; J. H. Willis, Handb. Pl. Vict. 281. 1962; O. D. Evans, Contrib. New S. Wales Nat. Herb. Fl. Ser. 27/28: 10. 1966.

Evans (1966) describes this plant as follows: "Small annual scapigerous herb. Leaves 2--5 cm. long, ca. 1.5 mm. broad, linear-subulate, pellucid, fenestrate, 3- to 5-nerved. Scapes about as long as the leaves, erect, 4- to 5-ribbed. Flower-heads ovate to subglobose, 3--4 mm. diam.; outer bracts almost lanceolate, obtuse to acute, glabrous; inner bracts narrow, acuminate, glabrous; receptacle conical. Male flowers central, pedicellate; 3 outer tepals cohering at the base; 3 inner tepals fused into a tube, with 3 lobes at the apex each bearing a gland; stamens 6. Female flowers on short pedicels; perianth absent; style short with 3 filiform stigmatic branches. Capsule smooth, 3-locular; seeds solitary, smooth." He says that the type was collected by Ferdinand Jacob Heinrich von Mueller, in December, 1853, in wet ground along the Murray River towards the junction with the Murrumbidgee [Nat. Herb. New South Wales 58361, part of the holotype]. He comments "Known only from the type locality; if not extinct, it would be expected to occur on both the New South Wales (South-western Plains) and Victorian sides of the Murray River. Search for it is desirable." It should also be noted that if the above description is correct and there are really no sepals (as well as no petals) in the pistillate florets, then this species does not fit into the generic description of Eriocaulon and Mueller's genus Electrosperma may well be revived for it.

ERIOCAULON AUSTRALE R. Br.

Additional bibliography: Benth., Fl. Austral. 7: 192. 1878; F. Muell., Syst. Census Austral. Pl. 123. 1882; F. M. Bailey, Syn. Queensl. Fl. 578. 1883; Moore & Betche, Handb. Fl. New S.

Wales 440. 1893; F. M. Bailey, Queensl. Fl. 6: 1715. 1902; Kuhl. in Engl., Pflanzenreich 13 (IV, 30): 66. 1903; F. M. Bailey, Compreh. Cat. Queensl. Pl. 584. 1913; Domin, Bibl. Bot. 20: 506. 1915; Maiden & Betche, Census New S. Wales Pl. 38. 1916; Koyama, Philip. Journ. Sci. Bot. 84: 368 & 378, pl. 6. 1955; Moldenke, Bull. Jard. Bot. Brux. 27: 128. 1957; Moldenke, Résumé 169, 175, 208, 211, & 479. 1959; Moldenke, Résumé Suppl. 3: 17. 1962; O. D. Evans, Contrib. New S. Wales Nat. Herb., Fl. Ser., 27/28: 10—11. 1966; Moldenke, Résumé Suppl. 16: 12. 1968.

The specific epithet of this species is sometimes uppercased for no valid reason. Koyama (1955) cites Hayata 99 from Annam. Bailey (1913) records the common name "hat-pin plant". Evans (1966) describes the plant as follows: "Annual scapigerous herb sprinkled with loose hairs at least on the lower parts of the leaves and scapes. Leaves basal, tufted, linear, up to 60 cm. long and 0.8 cm. wide. Scapes about half again as long as the leaves, ribbed when dry with 6—7 distinct ribs. Flower-heads hoary, semi-globose, changing to depressed-globose at maturity, up to 8 mm. wide; involucral bracts closely imbricate, broad, glabrous or nearly so, the margins entire or lacerate; fertile bracts closely imbricate, 3 mm. long, up to 3 mm. wide, obconical, narrowed at the base into a short stalk, broad and rounded at the apex which is covered externally with a very short and dense, white, persistent tomentum. Flowers very numerous, the male and female mixed together or sometimes one sex or the other predominating, the tepals scarious or hyaline. Male flowers: outer tepals 3, irregular, the 2 laterals ca. 2.5 mm. long, 0.5 mm. wide, the middle one linear, much narrower; inner tepals 3, equal, less than 1 mm. long, inserted on the receptacle close beneath the stamens, each fringed with a few white hairs. Stamens 3—6 on very short filaments. Female flowers: parts seen better in fruiting stage as follows: outer tepals 3, irregular, the 2 laterals ca. 3 mm. long, up to 3 mm. wide, complicate, the keel very broadly winged, lacerate on the upper margin, the middle one lanceolate, concave, shorter than the laterals; inner tepals 3, regular, ca. 2.5 mm. long, linear but with a broader base. Ovary 3-lobed, 3-locular; style branches 3, filiform. Capsule similar to the ovary, slightly enlarged, opening by longitudinal slits. Seeds ellipsoid, ca. 0.8 mm. long, brown, shining." He comments that the species flowers in summer "and possibly most of the year," growing in wet places in sandy heathland and on margins of swamps. From New South Wales he cites Collector undesignated s.n. [Nat. Herb. 58391], Constable s.n. [Jan. 1953; Nat. Herb. 22205], Ingram s.n. [Aug. 1941; Nat. Herb. 63340] and s.n. [Jan. 1961; Nat. Herb. 63344], and Maiden & Boorman s.n. [Nov. 1903; Nat. Herb. 58392]. He reports it also from Queensland and Northern Territory.

Additional citations: CHINA: Fukien: En 2141 (Ca—288123). Kwangtung: Tsang 330 [Herb. Lingnan Univ. 19611] (N), 331 [Herb. Lingnan Univ. 19612] (N); Tso 21077 (N, N). AUSTRALIAN REGION: AUSTRALIA: Queensland: Dallachy s.n. [Rockingham Bay] (V—71557).

State undetermined: Collector undesignated s.n. [Nov. Holl.] (V). MOUNTED ILLUSTRATIONS: Baur Icon 249 (V), 250 (V).

ERIOCAULON BARBA-CAPRAE Fyson

Additional bibliography: Fyson, Journ. Indian Bot. 2: 1921; Moldenke, Known Geogr. Distrib. Erioc. 23 & 61. 1946; Moldenke, Phytologia 4: 341. 1953; Moldenke, Résumé 161 & 479. 1959; Thanikaimoni, Pollen & Spores 7: 184. 1965; Moldenke, Résumé Suppl. 15: 20. 1967.

ERIOCAULON BARBEYANUM Ruhl.

Additional bibliography: Moldenke, Known Geogr. Distrib. Erioc. 23 & 32. 1946; Moldenke, Résumé 161 & 479. 1959.

Additional citations: INDIA: Mysore: Ritchie 1247 (B--isotype, Z--isotype).

ERIOCAULON BASSACENSE Moldenke

Bibliography: Moldenke, Phytologia 3: 308--309 & 321. 1950; Moldenke, Résumé 175 & 479. 1959.

ERIOCAULON BAURII N. E. Br.

Synonymy: Eriocaulon bauri N. E. Br. ex Zinderenbakker, S. Afr. Pollen 1: 32, 36, & 79, pl. 7, fig. 33 & 44. 1953.

Additional bibliography: Zinderenbakker, S. Afr. Pollen 1: 32, 36, & 79, pl. 7, fig. 33 & 44. 1953; Moldenke, Bull. Jard. Bot. Brux. 27: 128. 1957; Moldenke, Résumé 153 & 479. 1959; Moldenke, Résumé Suppl. 2: 9 (1960) and 3: 16. 1962; Thanikaimoni, Pollen & Spores 7: 182. 1965; R. H. Compton, Journ. S. Afr. Bot. Suppl. 6: 33. 1966; Moldenke, Résumé Suppl. 16: 8. 1968.

This species has been collected at altitudes of 5600--6000 feet, flowering in November. Killick states that it is "locally very abundant" in Natal. Compton (1966) records it from Swaziland.

Additional citations: SOUTH AFRICA: Cape of Good Hope: Baur 1166 (B--cotype, Z--cotype). Natal: Killick 1164 (S). Transvaal: F. A. Rogers 19580 (S).

ERIOCAULON BEAUVERDI Moldenke

Additional bibliography: Moldenke, Known Geogr. Distrib. Erioc. 35, 61, & 62. 1946; Moldenke, Phytologia 3: 183 (1949), 3: 321 (1950), and 4: 341. 1953; Moldenke, Résumé 88, 288, & 479. 1959.

ERIOCAULON BENTHAMI Kunth

Additional bibliography: H. B. Davis, Life & Works Pringle 56 & 655. 1936; Moldenke, Bull. Jard. Bot. Brux. 27: 129. 1957; Moldenke, Résumé 35, 286, & 479. 1959; Moldenke, Résumé Suppl. 4: 4 (1962) and 12: [1] & 2. 1965; Thanikaimoni, Pollen & Spores 7: 181. 1965.

Recent collectors have found this plant growing in water, in scattered colonies in moist sandy soil of moist open wooded ravines, and in moist to wet places in low wet meadows along with

Cyperus, Eleocharis, Juncus, Mimulus, Ranunculus, Spiranthes, Trifolium, grasses, etc., at altitudes of 1900—2250 meters, flowering in July. Iltis and his associates describe the flowers as "chalk-white".

Material has been misidentified and distributed in herbaria as E. humboldtii Kunth. On the other hand, the Hitchcock & Stanford 7201 and Pringle 2665, distributed as E. benthami, appear to be E. ehrenbergianum Klotzsch. The E. benthami of Schlechtendal is a synonym of E. ehrenbergianum Klotzsch.

Additional citations: LOUISIANA: Beauregard Par.: R. L. Crockett 8280 (Ld). MEXICO: Chihuahua: E. W. Nelson 6028 (W—359745). Federal District: Collector undesignated s.n. [Chapultepec, August 31, 1872] (W—45278). Jalisco: Hartweg 258 (B—type); R. L. McGregor 16617 (Lw); R. McVaugh 20473 (Mi). México: Gilly, Alexander, & Hernandez Xolocotzi 83 (Mi); Hinton 627 (S), 3638 (Rf, S), 4549 (Rf. Rf, Ur); Matuda 30855 (Z); Pringle 11871 (Mi). Michoacán: Iltis, Koeppen, & Iltis 409 (S). Nayarit: J. N. Rose s.n. [Aug. 8, 1897] (W—842909). Tlaxcala: Arsène 1725 (W—1032741). Veracruz: Pringle 11871 (Gg—423400, W—461266, W—1586488).

ERIOCAULON BIFISTULOSUM Van Heurck & Muell.-Arg.

Additional & emended synonymy: Eriocaulon fluitans Griff., Itin. Notes [Posth. Papers 2:] 65. 1848. Eriocaulon fluitans J. G. Baker, Journ. Linn. Soc. Lond. Bot. 20: 227. 1893. Eriocaulon limosum Engl. & Ruhl. in Engl., Bot. Jahrb. 27: 74. 1899. Eriocaulon schweinfurthii Engl. & Ruhl. in Engl., Bot. Jahrb. 27: 74. 1899.

Additional & emended bibliography: Griff., Itin. Notes [Posth. Papers 2:] 65. 1848; A. Chev., Sudania 1: 7. 1911; Moldenke, Known Geogr. Distrib. Erioc. 20—23, 27, 32, 34, & 39. 1946; Moldenke, Bull. Jard. Bot. Brux. 27: 129. 1957; Anon., Biol. Abstr. 29: 3248. 1957; H. Hess, Bericht. Schweitz. Bot. Gesell. 66: 87—88. 1957; Moldenke, Résumé 133, 134, 136—138, 140, 146—148, 156, 161, 208, 288, 289, 292, & 479—480. 1959; Razi, Rec. Bot. Surv. India 18: 19. 1959; Moldenke, Résumé Suppl. 3: 15 & 16. 1962.

The binomial, E. limosum Engl. & Ruhl., is a cheironymous designation placed by Ruhland on the specimen of Barter 1021 from Nupe, Nigeria, in the Berlin herbarium, while the same workers apparently regarded Schweinfurth 224, from "am Biri, Dar-Fertit, Gasalquellen-gebiet", in the same herbarium, as the type of their E. schweinfurthii.

Hess (1957) claims that E. bifistulosum should be reduced to synonymy under the earlier E. melanocephalum Kunth of the New World, affirming that the differences which I list as differentiating the two taxa do not hold up. He records the taxon from Angola. Griffith (1848) records it from Assam. Recent collectors have found it at altitudes of 1000—1830 meters. Milne-Redhead

& Taylor describe it as a "plant varying in height and size depending on age and depth of water; leaves very delicate, entirely submerged; heads blackish", growing in water 8—50 cm. deep in the open, rooting in crevices of laterite, flowering in April.

Chevalier (1911) cites his no. 302. Material has been misidentified and distributed in herbaria as E. heudelotii N. E. Br. and E. melanocephalum Kunth.

Additional citations: MALI: Collector undetermined s.n. [26. II.45] (An). CHAD: Schweinfurth 2476 (B, S). SENEGAL: J. G. Adam 17442 (Z); Couey 1 (Z); Raynal & Raynal 6846 (Z). REPUBLIC OF GUINEA: Boismare 418 [Herb. Chillou 3938] (An); Chillou 1737 (An); Schuell 2141 (An). NIGERIA: Northern: C. Barter 1021 (B—isotype, S—isotype, Ut—324—isotype). TANGANYIKA: Milne-Redhead & Taylor 9929 (B, S). ANGOLA: Huila: H. Hess 52/1678 (B). PORTUGUESE EAST AFRICA: Gazaland: Schweinfurth 224 (B). MADAGASCAR: Loher s.n. [Tananarivo, II.1911] (Mu—395).

ERIOCAULON BILOBATUM Morong

Additional & emended bibliography: H. B. Davis, Life & Works Pringle 94 & 141. 1936; Moldenke, Known Geogr. Distrib. Erioc. 4, 32, & 36. 1946; Moldenke, Bull. Jard. Bot. Brux. 27: 130. 1957; Moldenke, Résumé 35, 41, 289, & 480. 1959; Moldenke, Résumé Suppl. 7: 3. 1963; Langman, Select. Guide Lit. Flow. Pl. Mex. 911. 1964.

Recent collectors have found this plant growing on slopes by streams in meadows in pinewoods, at altitudes of 2300—2400 meters, flowering in September. Ruhland, on a label of the type collection in the Berlin herbarium, states that he feels that this is the "E. sexangulare Auct." and that the taxon is probably conspecific with E. cinereum R. Br. (which he called E. sieboldtianum Sieb. & Zucc.). The two taxa are certainly very similar. Pringle 6146 is a mixture with E. schiedeanum Körn.

Additional citations: MEXICO: Durango: Moore & Bunting 8690 (Z). Jalisco: Barnes & Land 159 (S); R. McVaugh 17578 (Mi); Pringle 3855 (B—isotype, B—isotype, Ca—2415—isotype, Ms—15465—isotype, S—isotype), 6146, in part (Ca—115172), 6299 (B, Ca—115173, Ms—15464, S, S). GUATEMALA: Jutiapa: J. A. Steyermark 30405 (W—2022037).

ERIOCAULON BLUMEI Körn.

Additional bibliography: Moldenke, Known Geogr. Distrib. Erioc. 27 & 32. 1946; Moldenke, Résumé 190 & 480. 1959; Moldenke, Résumé Suppl. 1: 13. 1959.

Backer found this plant growing at 1725 meters altitude, flowering in October. Koorders is of the opinion that E. blumei is conspecific with and should be regarded as a synonym of E. brownianum Mart. and he so identified Pulle 3079.

Additional citations: INDONESIA: GREATER SUNDA ISLANDS: Celebes: Eyma 4009 (Ut—11516b), 4009 bis (Ut—11515b).

ICONOGRAPHIA CYPERACEARUM II*

Tetsuo Koyama

The New York Botanical Garden

As the second part of this series of illustrations the present paper presents ten species, which are: Carex doenitzii, C. curvicollis, C. mitrata, C. Breviscapa, C. jackiana (ssp.), C. brownii, C. olivacea (ssp.), C. idzuroei, C. michauxiana (ssp.), and Scirpus juncoides (ssp.). The selection of these species was made from the species that are endemic to the Japanese floristic region, or from those of which the main area of distribution lies in that particular floristic region.

It has been known among the cyperologists that the genus Carex shows its highest endemism in the Japanese floristic region. In 1962 I made a revision of Japanese Carices. In my revision of Japanese Carices (1962)** an emphasis was made on the taxonomic relationships of Japanese species with those of other floristic regions to elucidate the actual endemism of Japanese Carices. The following table reflecting the high endemism of Carex in the Far East was based on 422 species that I recognized to be valid in my above-mentioned study. The Japanese floristic region as regarded here includes the Japanese Archipelago from Kuriles to northern Ryukyus, Korea and the montane region of Formosa.

I would like to express my appreciation to Miss Josephine H. Ueno, who so ably typed my sometimes difficult manuscript in the form that suits the off-set printing.

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* Part I. Phytologia 15 (3): 201-221, pls. 1-10. 1967.

** Koyama, T. Classification of the Family Cyperaceae (2). Journ. Fac. Sci. Univ. Tokyo, III, 8(4): 149-278. 1962.

Table 1. Geographical distribution of Carex occurring in the Japanese floristic region.

1.	Species endemic to the Japanese floristic region.....	59.3%
2.	Far Eastern species:	
2a.	Species extending to eastern Siberia and Manchuria.	16.3%
2b.	Species extending to Central China.	4.9%
3.	Discontinuous species:	
3a.	Species also occurring in Indian Himalayas, Southern China and occasionally as well as in Malaysia.	5.0%
3b.	Species also occurring in North America.	3.7%
3c.	Species also occurring in Australia and adjacent Malaysian Archipelago.	0.8%
4.	Wide species:	
4a.	Circum-polar and circum-boreal species.	6.5%
4b.	Eurasian species.	2.9%
4c.	Cosmopolitan species.	0.6%

Plate 11. CAREX DOENITZII Böckeler

Carex doenitzii Böckeler, Flora 65: 61. 1882.

Synonymy. Carex plocamostyla Maximowicz, Mél. Biol. 12:565. 1887.

Carex dicuspis Franchet, Bull. Soc. Philom. Paris 8^{e}sér. 7: 42. 1895.

Carex chrysolepis Franchet & Savatier var. modesta Léveille & Vaniot, Bull. Acad. Intern. Géogr. Bot. 10: 279. 1901

Carex dicraea C. B. Clarke, Kew Bull. Add. Ser. 8: 71. 1907.

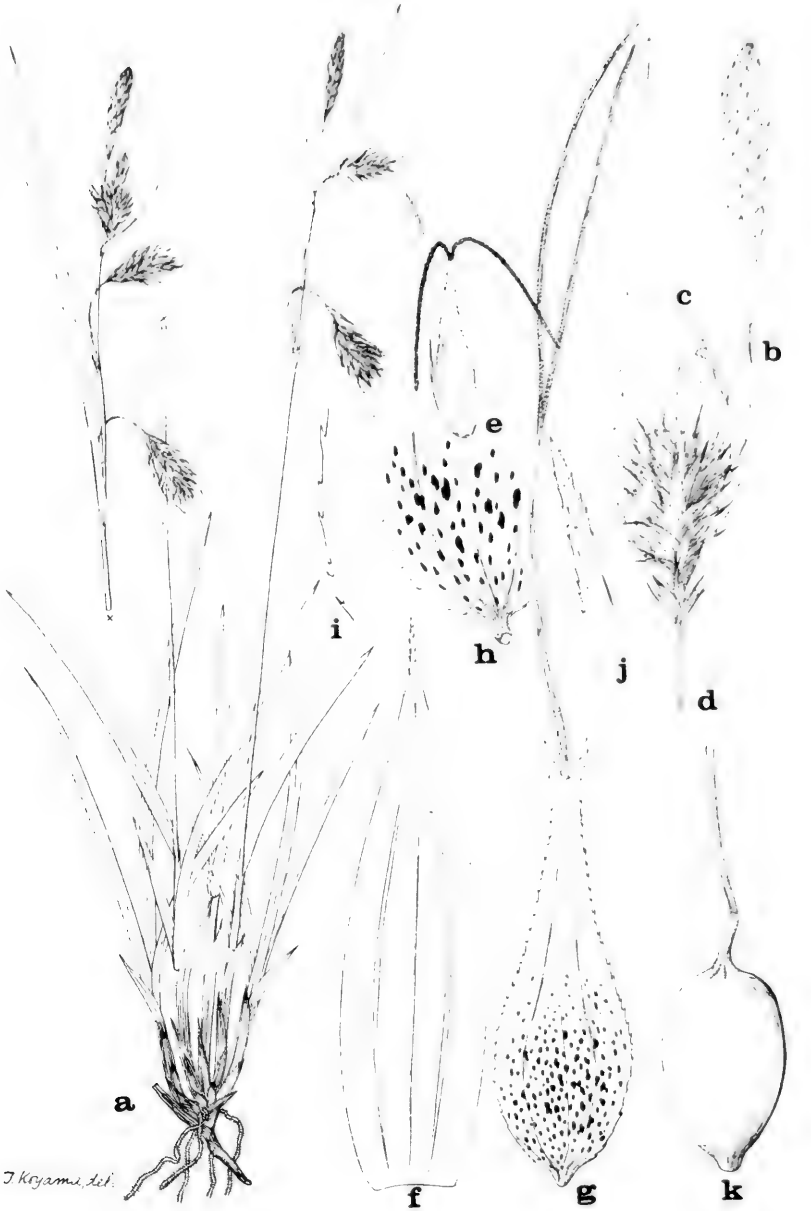


Plate 11. Carex doenitzii Böckeler

Carex nagatadakensis Masamune, Fl. Geobot. Stud. Yakushima, 526. 1934.

Carex doenitzii Bockeler var. mollis Akiyama, Journ. Jap. Bot. 13: 648. 1937.

Tufted in clumps; rhizome short, erect or erect-ascending, divided; roots densely yellow-hairy. Leaves radical, narrowly linear, shorter than to slightly longer than culms, linear, 3-5 mm wide, flat, rather soft, lightly green above, densely papillose and white-powdery beneath, gradually acute at apex; sheaths dorsally reddish- or purplish-brown, ventrally yellow-brown, the basal sheaths short-bladed or cataphylloid; ligule auriculate, membranous. Culms slender, 10-60 cm tall, ca. 1 mm thick, 3-sided, scaberulous, erect or slightly curved above. Spikes 2 to 4; upper 1 or 2 staminate, clavate, 0.7-2 cm long, 3-6 mm thick, deeply purple-brown; other spikes pistillate or rarely androgynous, obovate to elliptic, 1-3 cm long, 5-7 mm thick, densely many-flowered, cernuous or filiform peduncle, the lowest one often spaced and long-peduncled, the upper ones somewhat approximate and short-peduncled. Lower 1 or 2 bracts leaf-like equalling or slightly exceeding the inflorescence, not sheathing at base. Pistillate glumes lanceolate or ovate-lanceolate, 6-10 mm long, deeply purplish-fuscous, deeply red-purple or rarely greenish, gradually tapering above to an acute aristate apex; the awn scabird 0.1-0.2 mm long, the costa green, 3-veined. Perigynia slightly shorter than glume, erect, lanceoblong or ovate-oblong, 4-6 (-10) mm long, unequally biconvex, membranous, lightly ferrugineous-green to yellowish-green, densely dotted with reddish purple, sparsely hispidulous on both sides, minutely serrulate on both margins, contracted at short-stipitate base, gradually tapering above to a long flattish beak, the orifice deeply bifurcate, the teeth shortly awn-shaped, serrulate. Achenes rather tightly enveloped, obovate-elliptic, biconvex, 2-2.2 mm long, contracted at both ends; style elongated, long-exserted beyond the orifice of perigynia; stigmas 2, filiform, up to 6 mm long, persistent.

Voucher specimen: Japan, Mt. Fuji, U. Faurie 15570 (KYO).

Wet open grassland or on rocks in subalpine regions. Distribution Endemic to Japan; from Hokkaido southwards to central Japan and southwestwards to Toyama Prefecture of Japan Sea side of the Mainland.

Plate 11. A. Total plant; B. Staminate spike; C. Staminate glume; D. Pistillate spike; E. Perigynium at anthisis; F. Staminate glume; G. Perigynium; H. Basal part of perigynium; I. Portion of the margin of perigynium; J. Tooth of the orifice of perigynium; K. Achene with style-base.

Plate 12. Carex curvicollis Franchet & Savatier

Plate 12. CAREX CURVICOLLIS Franchet & Savatier

Carex curvicollis Franchet & Savatier, Enum. Pl. Japon. 2: 579. 1879.

Synonymy. Carex viridula Franchet & Savatier, Enum. Pl. Japon. 2: 2: 151 & 579. 1879. Not of Michaux, 1803.

Carex Savatieri Franchet, Nouv. Archiv. Muséum 3e sér. 10: 71. 1898.

Densely tufted in large clumps; rhizome short, branching, stoloniferous; stolons slender, covered with reddish-brown scales, the inter-nodes 0.5-0.8 cm long; roots densely yellow-pubescent. Leaves many, narrowly linear, 2-4 mm wide, equalling or somewhat shorter than culms, flattish, soft, lightly green; sheaths pale-brown to reddish-fuscrous, the basal ones short-bladed to cataphylloid, eventually split into soft brown fibers. Culms slender, acutely 3-angled, 10-35 cm long, soft, smoothish, inclined to nodding. Spikes 3-6 (-8), all approximate to subfastigiate; terminal spike staminate, clavate, 0.8-2.5 cm long, 1.5-3 mm thick, purplish-fuscous, erect on a short peduncle or nearly sessile; lateral spikes pistillate, oblong to cylindrical, 1.5-4 cm long, 5-8 mm thick, densely many-flowered, the upper 3 or 4 subsessile or short-peduncled, the lower ones on a capillary elongated peduncle, the lowest spike sometimes with 1 or 2 additional spikes at the base of the body of the spike through branching. The lower 1 or 2 bracts leaf-like, equalling to slightly longer than inflorescence, the upper bracts glumaceous or setaceous, none seathing at base. Pistillate glumes ovate, 1.5-2.25 mm long, deeply purplish-fuscous to pale-ferrugineous, contracted to obtusish or mucronulate apex, the costa green, obscurely 3-nerved. Perigynia much exceeding glumes, erect to erect-patent, lanceolate, 4-5 mm long, compressed trigonous, thinly membranous, pale-green, weakly and densely many-veined, smooth, glabrous, suddenly contracted at obtuse short-stipitate base, gradually tapering above to a long terete often slightly recurved beak, the orifice truncate or somewhat emarginate. Achenes loosely enveloped, elliptic-obovate, compressed-trigonous, 1.5-1.7 mm long, contracted at both ends; style elongated, slender, subpersistent, not thickened at base; stigmas 3, 2.5 mm long, recurved.

Voucher specimen: Japan, Mainland, base of Mt. Bukosan in Saitama Prefecture, ca. 850 m alt., T. Koyama 6,703 (NY).

Plate 12. A. Total plant; B. Prophyll at the base of peduncle; C. Staminate glume and its triandrous flower; D. Apex of anther showing the connective; E. Perigynium at anthesis; F. G. Pistillate glumes; H. Dorsal view of perigynium; I. Orifice of perigynium; J. Fruiting pistil showing mature achene.

Plate 13. Carex mitrata Franchet

Plate 13. CAREX MITRATA Franchet

Carex mitrata Franchet, Bull. Soc. Philom. Paris 8e sér. 7: 88. 1895.

Tufted in large clumps with divided slender ascending rhizome. Leaves rather many, slenderly linear, stiffish, 1.5-2 mm wide, grass-green, folded, longer than culms, gradually attenuate to acute tip; sheaths yellow-brown or brown, eventually weakly split into brown parallel fibers. Culms many, slender but stiffish, 6-30 cm tall, obtusely trigonous, nearly smooth, glabrous. Spikes 3-5, the upper 3 or 4 approximate to contiguous at culm apex, the lowest one often basal; terminal spike staminate, linear, 5-15 mm long, 0.8-1 mm wide, whitish-brownish, short-peduncled to nearly sessile, slightly exceeding the next pistillate spike; lateral spikes pistillate, densely many-flowered, narrowly cylindrical to oblong, 0.5-1.5 mm long, 2-2.2 mm thick, green, erect, nearly sessile or on a short peduncle enclosed in bract sheath. Bracts short, setaceous or spathaceous, much shorter than the subtending spike, the base hardly or short-(±0.5 mm)-sheathing. Staminate glumes oblong, whitish-brownish, the margins broadly white-hyaline. Pistillate glumes oblong to oblong-obovate, 1.25-1.5 mm long, ca. 2/3 mm wide, membranous, pale, truncate at hyaline apex, the keel green, 1-nerved, projecting beyond the glume apex into a short upright mucro. Perigynia nearly erect, slightly longer than glume, fusiform-obovate to fusiform, 2-3 mm long, ca. 1-75 mm wide, 3-sided, membranous, lightly green, weakly many-veined, sparsely pubescent, the base gradually attenuate, the apex contracted to a short conical occasionally slightly incurved beck, the orifice minute, nearly entire. Achenes tightly enveloped, elliptic, triquetrous, 1.5 mm long, the sides shallowly concave below, the beck discoid-annulate, 0.25 mm wide; style thickened at base; stigmas 3, short, slender.

Voucher specimen: Japan, Mainland, Urawa in Saitama Prefecture, T. Koyama 6881 (NY).

Grassy hillsides somewhat sheltered by loose woods. Distribution. Endemic to Japan, central and western Mainland, Shikoku, Kyushu and southern Korea.

Plate 13. A. Total plant; B. Staminate spike; C. Staminate glume; D. Pistillate spike; E. Pistillate glume; F. Perigynia; G. Achene.

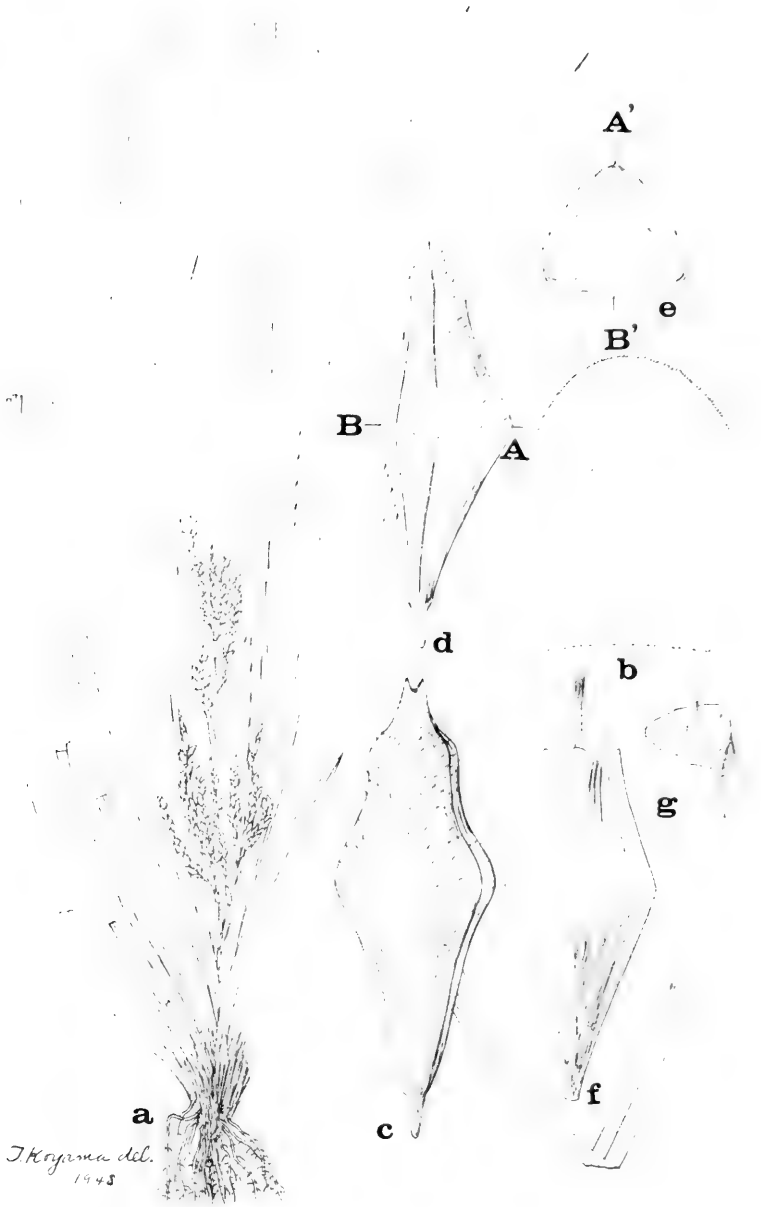


Plate 14. Carex breviscapa C. B. Clarke

Plate 14. CAREX BREVISCAPA C. B. Clarke

Carex breviscapa C. B. Clarke, Fl. Brit. Ind. 6: 736. 1894.

Synonymy. Carex jackiana Boott var. breviculmis Thwaites & Hook. f., Enum. Pl. Zeyl. 356. 1884.

Carex curtisii Ridley, Mater. Fl. Malay Penins. 3: 117. 1907.

[Carex obtuso-bracteata Hayata, Icon. Pl. Formos. 6: 131. 1916. Nomen nudum.]

Carex lutchuensis Ohwi, Mem. Coll. Sci. Kyoto Univ. B, 5: 270. 1940.

Densely tufted from short erect rhizome clothed with dark brown parallel fibers; roots rather stout. Leaves many, crowded, all radical, linear, elongated, 4-7 mm wide, 25-60 (-90) cm long, herbaceous, somewhat roughned above, 3-costate, flat-plicate, gradually tapering above to long acute apex, the base short-sheathing, dark purplish-brown on veins, eventually disintegrating into dusky-brown fibers. Culms much shorter than the leaves and almost hidden in leaf tussocks, 10-20 (-30) cm tall, slender, obtusely 3-angled, ca. 1 mm thick, 3- to 6-noded, bearing spikes from above the base. Spikes usually paniculate through branching; terminal spike staminate, slenderly linear, 1-2 cm long, 1 mm thick, pale-brownish, erect on a short peduncle, equalled or surpassed by the next lateral spike; lateral spikes pistillate or with short staminate part at apex, narrowly cylindrical, erect to erect-patent, 1-3 cm long, 3-4 mm thick, loosely many-flowered, the upper spikes short-peduncled or nearly sessile, the lower ones on exserted peduncles. The lower 2 or 3 leaf-like bracts elongated, much exceeding the inflorescence, reaching 40 cm in length; upper bracts much reduced, short-bladed or spathaceous, the sheathing base 1-2.5 cm long. Pistillate glumes elliptic-oblong or ovate-oblong, 2-3 mm long, 1-1.75 mm wide, membranous, pale- or whitish-brown, white on hyaline margins, obtuse or rounded at cilio-late apex, faintly several-nerved on both sides, the midvein greenish ending below the glume apex or projecting beyond the glume apex into a short straight mucro 1/2 to 1 mm long. Perigynia about twice as long as glumes, rhombic-lageniform, 3-sided, 3.75-5 mm long, broadest at about the middle, 1.25-1.5 mm wide, membranous, pale-green, glabrescent or sparsely puberulent on the upper half, slenderly many-nerved, cuneate at short-stiped base, contracted above to a short conical beak 1/2 to 1 mm long, the orifice 2-toothed. Achens tightly enveloped, rhombic-fusiform, 2.5-3 mm long, triquestrous, 1.25-1.5 mm wide, cuneate at base, gradually narrowed above the middle to transversely truncate apex with annulate margin ca. 1 mm in diameter; style short,

Plate 15. Carex jackiana Boott
subsp. parciflora Kükenthal

often with thickened base; stigmas 3.

Voucher specimen: Formosa, Taipei-hsien, Shirin, Ohwi Hb. TNS 55,925 (TNS).

Undergrowth of dense forest in the tropical high mountain zone and on hills in the subtropics. Distribution. From Ceylon through Malaysia eastwards to northern Queensland of Australia, and northeastwards to Annam, Formosa and the Ryukyu Islands.

This species is recognizable at once by the slender short culms hidden in the well-elongated leaf blades as well as in the peculiar lageniform perigynia.

Plate 14. A. Total plant; B. Pistillate glume; C. Dorsal view of perigynium; D. Lateral view of perigynium; E. Transverse section of perigynium at the level marked A - B in Fig. D; F. Dorsal view of achene; G. Annulate apex of achene.

Plate 15. CAREX JACKIANA Boott subsp. PARCIFLORA Kükenthal

Carex jackiana Boott subsp. parciflora (Boott) Kükenthal, Pflanzeru. 4(20), Cyper-Caric. 638. 1909. Incl. forma ochrolepis (Franchet) Kükenthal.

Synonymy. Carex parciflora Boott, Mem. Amer. Acad. N.S. 6: 418. 1859.

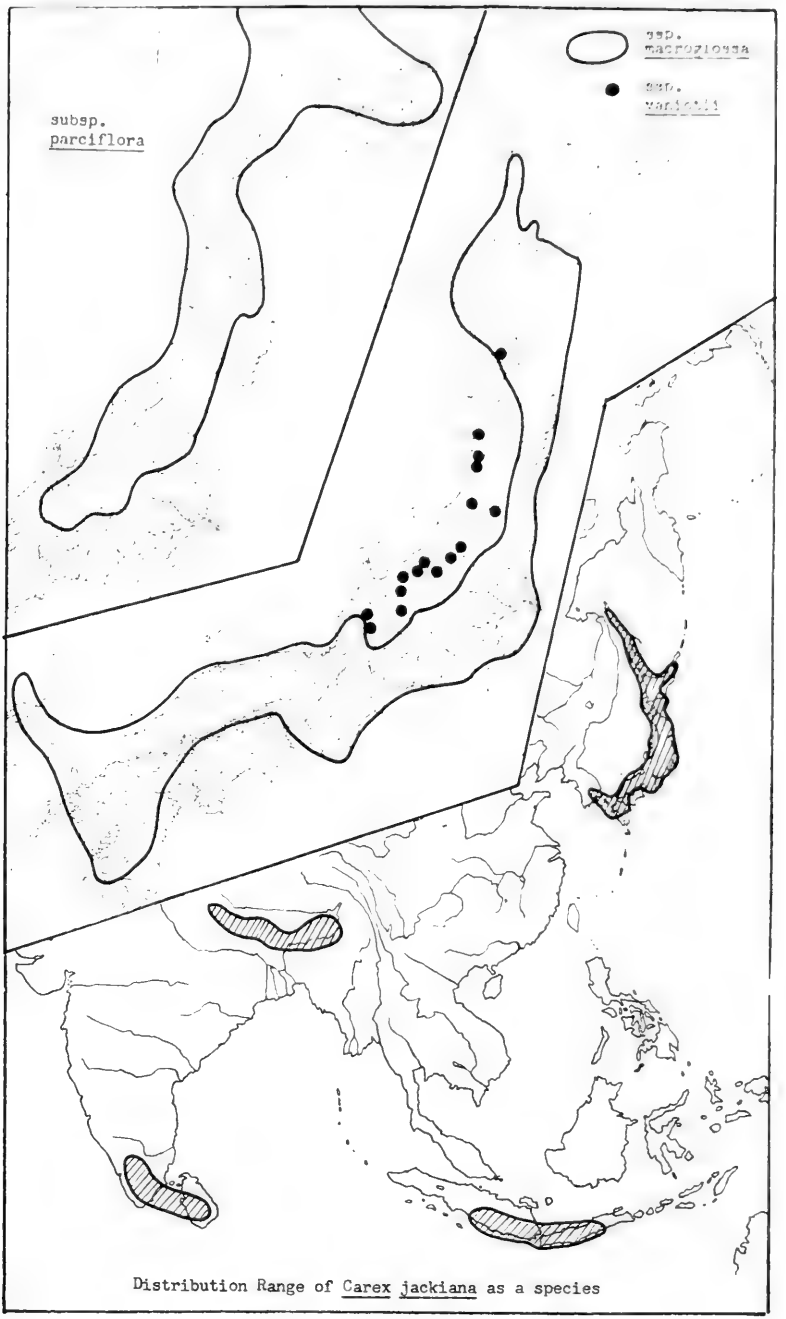
Carex ochrolepis Franchet, Nouv. Archiv. Muséum, 3e sér. 10: 48, t.2, f.2. 1898.

Carex jackiana Boott var. parciflora (Boott) Kükenthal ex Matsumura, Index Pl. Japon. 2(1): 115. 1905.

Carex kamikochiana Nakai [Rep. Veg. Kamikochi 34 & 42. 1928. Nomen nudum] ex Akiyama, Journ. Fac. Sci. Hokkaido Univ. 5, 2: 163. 1932.

Carex parciflora Boott forma ochrolepis (Franchet) Miyabe & Kudo, Fl. Hokkaido & Saghal. 2: 267. 1931.

Loosely tufted; rhizome decumbent, short or slightly elongated, covered with brown fibers. Leaves basal and 1 or 2 upper on the lower part of culms, linear or broadly linear, 5-10 mm wide, shorter than culms, soft, 3-costate, flattish-plicate, whitish-green, sheaths pale-green or pale, elongated, ventrally thinly membranous, the ligule shortly produced, rounded, white-hyaline, the basal sheaths short-bladed, brownish to fuscous,



Distribution Range of Carex jackiana as a species

eventually more or less split into soft brown fibers. Culms erect, acutely 3-angled, 50-80 cm tall, smooth, whitish-green. Spikes (3-) 4 or 5, the upper 2 or 3 approximate and nearly sessile or on short peduncle, the lower 2 or 1 much spaced and on long-exserted peduncle; terminal spike staminate, clavate, 1-1.7 cm long, ca. 1.3 mm thick, pale or becoming stramineous later, nearly sessile and fastigiate with the next pistillate spike, or short-peduncled (forma ochrolepis Kükenthal); lateral spikes pistillate, elliptic to oblong, subdensely flowered or in the lower spikes loosely flowered toward the base of spike, 1.5-3 cm long, 5-7 mm thick, whitish-green. Leaf-like bracts about 3, slightly overtopping the inflorescence, the upper 1 or 2 hardly or only shortly sheathing, the lower ones long-sheathing. Pistillate glumes ovate or broadly ovate, 3-4 mm long, 1.7-2 mm wide, membranous, pale or pale-green on both sides, the apex acute or obtusish, mucrovate or cuspidate, the costa obscurely 3-nerved, green. Perigynia slightly longer than glume, ovoid or ovoid-ellipsoid, 4-5.5 mm long, 1.5-1.75 mm wide, 3-sided, membranous, whitish-green, finely many-veined, contracted at spongy-stipitate base, tapering above to an erect or somewhat curved beak, the orifice obliquely truncate with white hyaline margin. Achenes tightly enveloped, obovate or broadly so, triquetrons 2.2 mm long, 1.7-2 mm wide, contracted at both ends; style slender elongated, not thickened at base; stigmas 3.

Voucher specimen: Japan, Hokkaido, Hamatombetsu in Kitami Province, T. Koyama 11,080 (NY).

Moderately wet grassy places mostly as the undergrowth of forest at the Fagus belt. Distribution. Saghalien, southern Kuriles, Hokkaido, Japan Mainland from North-eastern District and the Japan Sea side of Central District.

Subspecies parciflora is the Far Eastern counterpart of Indo-Malasian Carex jackiana subsp. jackiana. It differs from the latter chiefly in its smaller perigynia and shorter pistillate glumes. Subspecies parciflora tends to form looser tufts due to its decumbent rhizome.

Plate 15. A. Total plant; B. Portion of leaf blade; C. Ligule; D. Portion of culm; E. Staminate glume; F, G. Two views of prophyll; H. Pistillate glume; I. Perigynium; J. Orifice of perigynium; K. Transverse section of perigynium; L. Achene.

Plate 16. CAREX BROWNII Tuckerman

Carex brownii Tuckerman, Enum. Meth. Caric. 21. 1843.

Synonymy. Carex brownii Tuckerman var. viridis

Böckeler, Linnaea 41: 151. 1877.

Carex nipposinica Ohwi, Act. Phytotax. Geobot. 11: 255. 1942.

Loosely tufted from decumbent or short-creeping rhizome. Leaves rather loose, basal and subbasal, sometimes the upper 1 or 2 on the lower part of culms, linear, shorter than or equalling culms, 3-5 mm wide, weakly folded, stiffly herbaceous, grass-green above, pale-green beneath, scabrid, gradually attenuate to acute apex, long-sheathing at base; sheaths ventrally white-membranous, dorsally greenish, the basal sheaths short-bladed and tinged with light brown, eventually spilit into brown or dark brown parallel fibers. Culms rigid, erect, acutely to obscurely trigonous, 27-80 cm tall, 1-1.75 mm thick, striate, smooth and 1- or 2-noded toward the base, scaberulous above the middle. Spikes 3 or 4 (occasionally 5); terminal spike staminate, linear-cylindrical, erect on short peduncle, 1-3 cm long, ca. 2 mm thick, pale green; lateral spikes pistillate, erect, two upper approximate or contiguous, the lowest spaced, cylindrical, 1.5-3 cm long, 5-6 mm thick, densely many-flowered, grass-green (but, olivaceous when dried), the uppermost one nearly sessile or on a very short peduncle, others on a peduncle increasingly exserted from bract-sheath downward. Bracts leaf-like, longer than subtending spike, usually slightly overtopping the inflorescence, shortly to longly sheathing. Pistillate glumes ovate or elliptic, 1-2 mm long excluding awn, 1-1.5 mm wide, thinly membranous, whitish, the green keel excurrent into a flat long scabrous awn 0.5-4 mm long. Perigynia ellipsoid, ellipsoid-obovoid or subglobose, much inflated, 3.5-4.5 mm long, 1.5-2.25 mm wide, thickly membranous, distinctly many-veined, glabrous, patent when mature, green and olivaceous when dried, abruptly contracted at non-stipitate base, abruptly contracted at apex with a short subterete beak 0.5-1 mm long, the orifice hyaline, obliquely truncate or 2-toothed. Achene loosely enveloped, obovate-elliptic or elliptic, 3-sided, 2.25-2.5 mm long, 1.5 mm wide, the faces somewhat concave, contracted at both ends, the apex with a short bent beak; style slightly thickened at base; stigmas 3, short.

Voucher specimen: Japan, Mainland, Boso Peninsula, Torami, T. Koyama 11,052 (NY).

Sporadically occurring in wet grasslands. Distribution. Japan, New Guinea, Australia and New Zealand.

Plate 16. A. Total plant; B. Portion of leaf blade showing the upper surface; C. Portion of leaf blade showing the lower surface; D. Orifice of leaf sheath; E. Lower part of culm; F. Upper part of culm; G. Staminate glume; H. Rhachilla of spike with a pistillate floral unit; I. Prophyll at the base of peduncle of spike; J. Dissected prophyll; K. Pistillate glume; L.

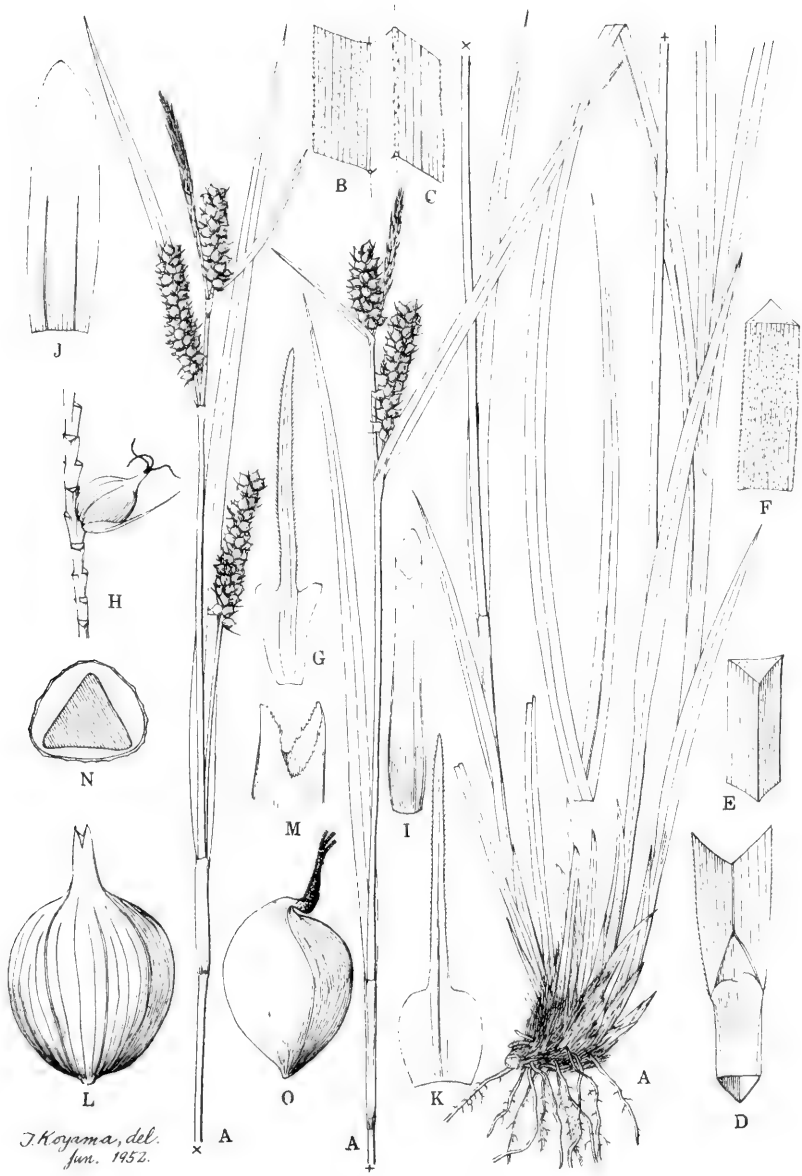


Plate 16. Carex brownii Tuckerman

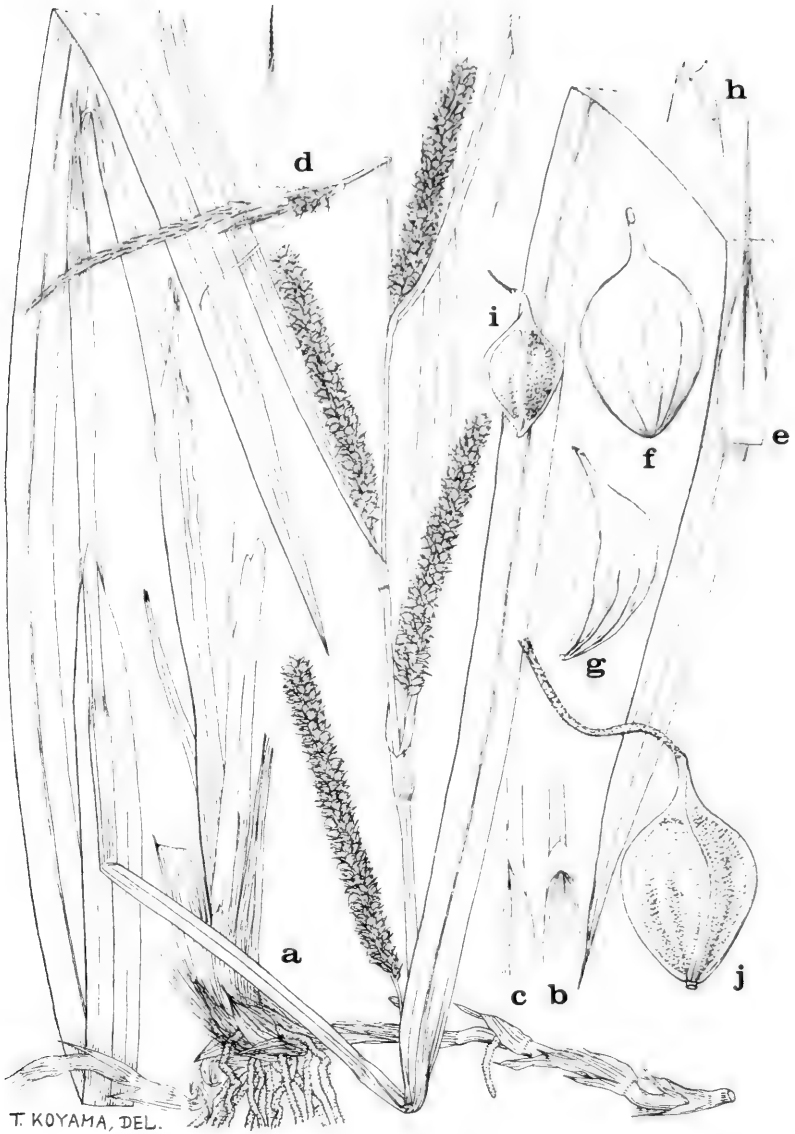


Plate 17. Carex olivacea Boott

subsp. confertiflora T. Koyama

Perigynium; M. Orifice of perigynium; N. Transverse section of perigynium; O. Achene.

Plate 17. CAREX OLIVACEA Boott subsp. CONFERTIFLORA T. Koyama

Carex olivacea Boott subsp. confertiflora (Boott) T. Koyama, Bot. Mag. Tokyo 72: 307. 1959.

Synonymy. Carex confertiflora Boott ex A. Gray, Mem. Amer. Acad. N.S. 6: 418 (= Bot. of Japan 418). 1859.

Carex olivacea Boott var. angustior Kükenthal, Pflanzenr. 4(20), Cyper-Caric. 618. 1909.

Rhizome robust, horizontally long-creeping, stoloniferous. Shoots solitary or few together at nodes or rhizome. Leaves basal and few (1 or 2) upper on culms, broadly linear, 8-15 mm wide, shorter than to exceeding the inflorescence, rather thickly herbaceous, soft, conduplicate with 3 conspicuous costas, grass-green above, white-powdery beneath, acute at apex, long-sheathing at base; basal sheaths short-bladed or cataphylloid, brown to rusty-brown, hardly or loosely split into brown fibers. Spikes 3 to 7, terminal one staminate, linear, 3-7 cm long, ca. 2 mm thick, yellowish-brownish, erect on short peduncle; all lateral spikes pistillate or occasionally the uppermost lateral spike staminate or androgynous, the pistillate ones cylindrical, 2.5-7 cm long, 7-9 mm thick, densely many-flowered, green and becoming olivaceous when dried, erect on short rather stout peduncle. Bracts 4-6 leaf-like, 1 or 2 upper setaceous, the leaf-like bracts erect-patent, exceeding inflorescence, short-sheathing at base. Pistillate glumes oblong-elliptic, ca. 2.5 mm long, membranous, pale-white, spotted with brown, acute obtusish or sometimes shallowly emarginate at apex, the costa green, 3-nerved, excurrent beyond the glume apex into a straight scabrous awn 0.5-2 mm long. Perigynia broadly elliptic or obovate-elliptic, longer than subtending glume, 3.75-4 mm long, patulous to spreading, rounded at non-stipitate base, herbeceous, pale- or cinereous-green and becoming dark olivaceous when dry, many-veined, contracted to a short erect or recurved beak 0.8-1 mm long, the orifice hyaline, obliquely truncate with minute teeth. Achenes loosely enveloped, broadly obovate or broadly elliptic, 2 mm long, trigonous, short-beaked at apex; style thickish, hardly enlarged at base; stigmas 3.

Voucher specimen: Japan, Mainland, along Katashina River ca. 8 km south of Lake Ozenuma in Gumma Prefecture, 1,000 m alt., T. Koyama, s.n., 3 Aug. 1949 (NY).

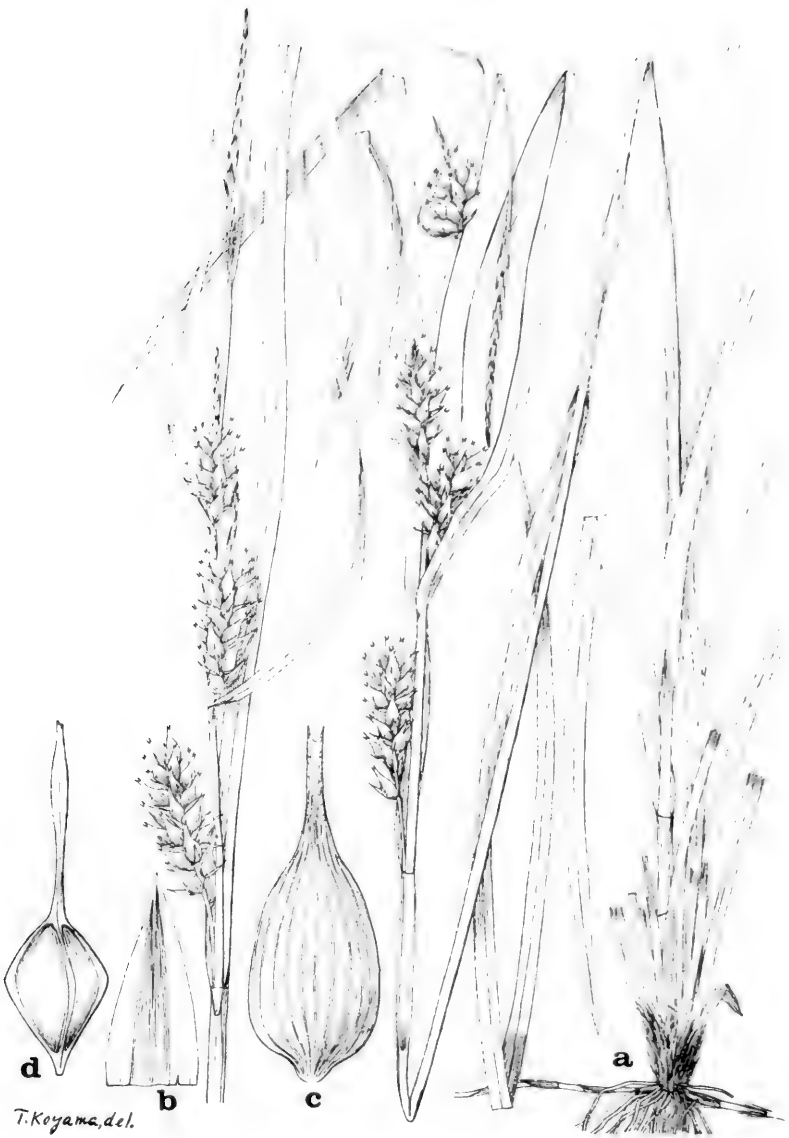


Plate 18. Carex idzuroei Franchet & Savatier

Forming large colonies in shallow water of lake margins or narrow rivers. Distribution. Endemic to Japan (Hokkaido and the mainland). As a species Carex olivacea is distributed in the Indian Himalayas, Java, Lower Yanzgtze River Valley of Central China, and Japan.

Subspecies confertiflora is the Japanese counterpart of Carex olivacea subsp. olivacea of Indian Himalayas and Java. The taxonomic differentiation and phytogeographical relationships between the two subspecies were fully discussed in my previous publication (T. Koyama, Bot. Mag. Tokyo 72: 298-308. 1959).

Plate 17. A. Total plant; B, C. Two views of prophyll at the base of peduncle; D. Staminate glume; E. Pistillate glume; F, G. Dorsal and lateral views of perigynium; H. Orifice of perigynium; I. Achene; J. Achene further enlargement of achene.

Plate 18. CAREX IDZUROEI Franchet & Savatier

Carex idzuroei Franchet & Savatier, Enum. Pl. Japon. 2: 155 & 583. 1879.

Synonymy. Carex pseudo-vesicaria Léveillé & Vaniot, Bull. Acad. Intern. Géogr. Bot. 11: 180. 1902.

[Carex multinervia Kükenthal ex C. B. Clarke, Journ. Linn. Soc. 36: 298. 1904. Invalid name in synonymy.]

Subloosely tufted in small clumps; rhizome stoloniferous; stolons slender, ca. 1.5 mm thick, clothed with lightly brown scales. Leaves basal and subbasal, 1 or 2 upper on the culm, linear, flattish, 3-9 mm wide, usually shorter than culms, soft but somewhat thickish, lightly green, obscurely septate-nodulose, gradually acute at apex, long-sheathing at base; basal sheaths bladed, pale-brownish tinged with red-brown, not conspicuously disintegrating into fibers. Culms 20-60 cm tall, trigonous, smoothish. Spikes 3-5; terminal spike staminate, occasionally with a short sessile additional staminate spike immediately below the body of spike, linear, 2-5 cm long, 1.5-2 mm thick, pale-greenish, erect on long peduncle; lateral spikes pistillate or the upper ones with a short staminate portion at apex, ellipsoid or oblong, 1.5-4 cm long, 7-10 mm thick, subdensely many-flowered, lightly green and becoming olivaceous when dry, erect-patent, nearly sessile, or the lowest one on a short or slightly exserted peduncle. Bracts 2-4, leaf-like, the lowest equalling or slightly overtopping the inflorescence, hardly to short-sheathing at base, the upper ones shorter than the inflorescence, non-sheathing at base. Pistillate glumes ovate

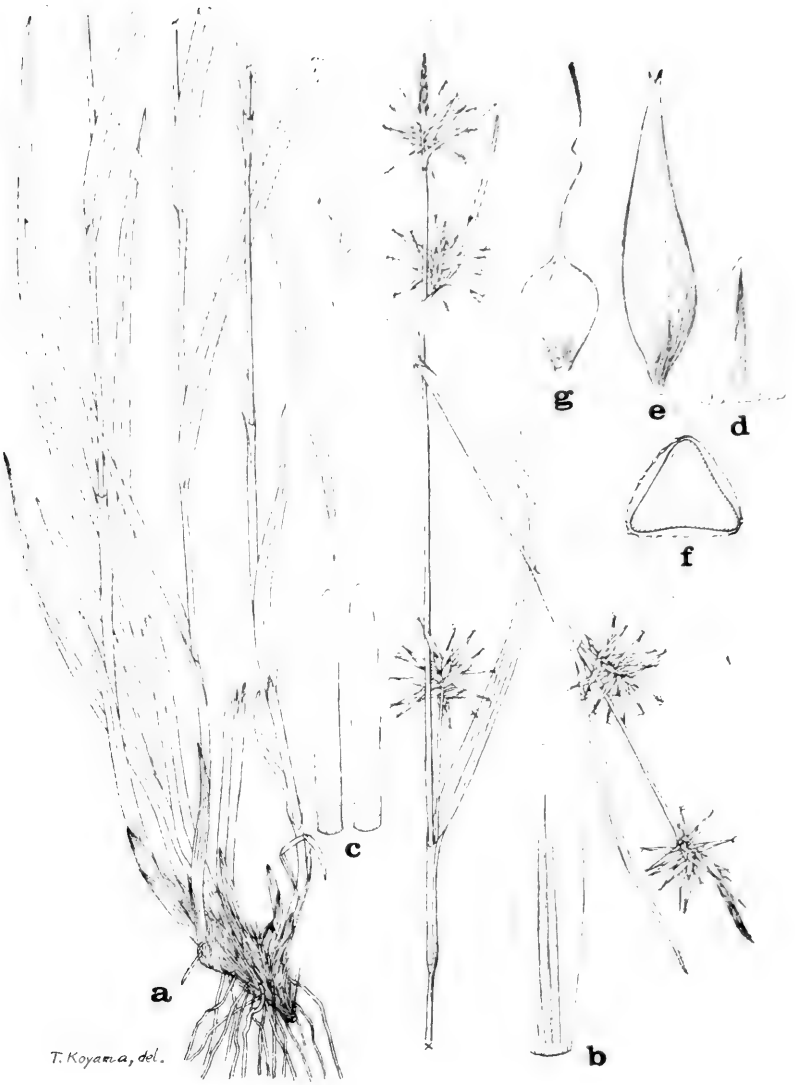


Plate 19. Carex michauxiana Bockeler
subsp. asiatica Hultén

or deltoid ovate, 4.5-5.25 mm long, membranous, pale or tinged with straw-colored on both sides, narrowed from above the base to briefly acutish muticous apex, the costa broadly green, indistinctly 3-nerved. Perigynia about twice as long as the subtending glume, ovate-elliptic, 10-12 mm long, erect-patent, subcoriaceous, strongly swollen, finely many-veined, glabrous, abruptly rounded-contracted at short-stipitate base, tapering above to a long slender hisdulous beak, the orifice white-membranous, 2-toothed, the teeth acute. Achenes loosely enveloped, rhombic-elliptic, 2.75-3 mm long, acutely triquetrous; style rigid, persistent, not thickened at base; stigmas 3.

Voucher specimen: Japan, Mainland, Tajimagahara Swamp along Arakawa River in Saitama Prefecture, ca. 50 m alt., T. Koyama, s.n., 27 May, 1951 (NY).

Sporadically occurring in lowland swamps. Distribution. Japan (the Mainland, Shikoku, Kyushu) and China (Yangtze River Valley).

Plate 18. A. Total plant; B. Staminate glume; C. Perigynium; D. Achene.

Plate 19. CAREX MICHAUXIANA Böckeler subsp. ASIATICA Hultén

Carex michauxiana Böckeler subsp. asiatica Hultén, Fl. Kamtsch. 1: 207. 1927.

Synonymy. Carex michauxiana Böckeler forma asiatica (Hulten) Akiyama, Journ. Fac. Sci. Hokkaido Univ. 5, 2: 220. 1932.

Carex dolichocarpa C. A. Meyer ex V. Krecz., Fl. URSS. 3: 458 & 623. 1935.

Carex michauxiana Böckeler var. asiatica (Hultén) Ohwi, Mem. Coll. Sci. Kyoto Univ. B, 11: 491. 1936.

Carex michauxiana of many authors not of Böckeler.

Subloosely tufted in small or large clumps; rhizome stout, obliquely ascending, divided, clothed with grayish-brown fibers. Leaves few to a culm, 1 or 2 basal and 1 to 3 upper on culms, all spaced, linear, 3-5 mm wide, 8-25 cm long, stiffish, thin, lightly green, 3-costate, weakly folded, acute at apex, the sheathing base 2-6 cm long, pale; basal sheaths cataphylloid or short-bladed, brown, eventually disintegrating into parallel fibers. Culms slender, 20-50 cm tall, 0.8-1 mm thick, obtusely trigonous, smoothish or scaberulous below inflorescence. Spikes

3-5, the uppermost 2 approximate, remainder spaced; terminal spike staminate, linear, 0.7-1.5 cm long, 1-1.2 mm thick, pale-green, erect on very short peduncle, slightly exceeding or surpassed by the pistillate spike immediate below it; lateral spikes pistillate, subglobose at maturity with spreading perigynia, 1-1.7 cm long and as wide, subloosely flowered, yellowish-green, the upper ones on short inclosed peduncle, the lowest on a long exserted peduncle. Bracts 2 or 3 leaf-like, shorter than to slightly overtopping inflorescence, short- or in the lowest long-sheathing at base. Pistillate glumes ovate or broadly ovate, 4-5 mm long, pale-green or lightly yellow-brown , acutish or obtusish at apex, the costa broadly green, sub-5-nerved, ending below the hyaline apex of glume. Perigynia spreading or divergent at maturity, lanceolate or lance-oblong, 9-13 mm long, obtusely trigonous, coriaceous, yellowish green, finely many-veined, glabrous, suddenly contracted at slightly spongy base, gradually attenuate above to a long erect beak, smoothish or hispidulous on upper margins, the orifice distinctly bi-lobed with erect rigid teeth. Achenes rather tightly inclosed, obovate, trigonous, 2.3-2.5 mm long, contracted at both ends; style elongated, rigid, slightly thickened at base forming a mucro at achene apex; stigmas 3, ca. 3 mm long.

Voucher specimen: Japan, Mainland, Ozegahara Moor in Nikko National Park, 1,600 m alt., T. Koyama, s.n., July 21, 1950 (NY).

Wet peaty sedge swamp or in the Sphagnum moor at upper temperate zone. Distribution. From the Mainland of Japan (the Japan Sea Side of Central District, upper Kwanto District and Northeast District), Hokkaido, northward to Saghalien, and northeastwards to Kuriles and Kamtschatka.

Carex michauxiana, as a species, shows the distribution of American-Japanese floristic link. Since subspecies michauxiana occurs in eastern North America, Aleutian Islands, Alaska and western Canada are the interferent regions between the two disjunct areas. Morphologically Asiatic subsp. asiatica differs from subsp. michauxiana by more robust habit, larger perigynia and relatively shorter bracts. In subsp. asiatica the pistillate glumes are about 2/5 the length of the subtending perigynium, while in subsp. michauxiana they are less than 1/3 the length of the perigynia.

Plate 19. A. Total plant; B. Staminate glume; C. Two views of prophyll at the base of peduncle of spike; D. Pistillate glume; E. Perigynium; F. Transverse section of perigynium; G. Achene with persistent style.

Plate 20. SCIRPUS JUNCOIDES Roxb. subsp. HOTARUI T. Koyama

Scirpus juncoides Roxburgh subsp. hotarui (Ohwi) T. Koyama, stat. nov.

Basionym. Scirpus hotarui Ohwi, Repert. Sp. Nov., Fedde, 36: 44. 1934.

Synonymy. Scirpus juncoides Roxburgh var. hotarui (Ohwi) Ohwi, Mem. Coll. Sci. Kyoto Univ. B, 18: 114. 1944.

Scirpus erectus of many authors, not of Poiret.

Annual, tufted in dense clump without distinct rhizome; roots fibrous, soft, light brownish. Culms erect, slender to very slender, 13-40 cm tall, 0.7-1 mm thick, deeply green, quite smooth, terete or very finely striate when dry, clothed at base with 2 or 3 bladeless sheaths. Sheaths the longest up to 6 cm long, the shorter 5 to 20 mm long, pale-green, ventrally white-membranous, the orifice obliquely truncate, acute, sometimes with a sublate elongation of green dorsal portion up to 1 mm long; basal sheaths cataphylloid or scale-like, brownish. Inflorescence of 1 to 3 sessile spikelets in pseudo-lateral head. Lowest involucral bract upright, continuing to the culm, culm-like, 3-7 cm long, terete, 1-furrowed ventrally, acutish at apex, the base dilated with membranous margins. Second and third bracts when exist broadly oval, membranous, the midrib excurrent into a subulate projection 0.2-5 mm long. Spikelets ovoid to ovoid-globose, terete, 6-14 mm long, 4-6 mm across, acutish to rather rounded at apex, greenish and straw-colored later. Glumes broadly ovate to oval, or almost orbicular, boat-shaped, 2.8-4.5 mm long, 3-4.8 mm wide, membranous to papyraceous, pale and densely brown-lineolate on both sides, the costa broadly green, 3-nerved above, forming a minute mucro at rounded or shallowly emarginate apex of glume. Achenes broadly obovate, slightly adpressed-triquetrous with flat or shallowly concave sides, (1.8-) 2-2.5 mm long, 1.7-2 mm wide, contracted at base, rounded to mucronate apex, the sides punctate and distinctly transversely wrinkled, blackish-brown when mature. Hypogynous bristles 6, needle-like, lightly yellowish-brown, retrorsely scabrous, the longer (2 or 3) slightly longer than achene, remainder 2/3 to 3/4 the length of achene; style caducous, slightly thickened above the middle, glabrous; stigmas 3-cleft, recurved. Anthers 1 mm long, the connective oblong.

Voucher specimen: Japan, Mainland, Boso Peninsula, swamp near Yatsumi, sea level, T. Koyama 5,000 (NY).

Wet places of varying conditions such as rice fields, wet meadows, wet sand, from warm region to upper temperate zone. Distribution. Japan (Hokkaido to Kyushu), Korea, Manchuria,

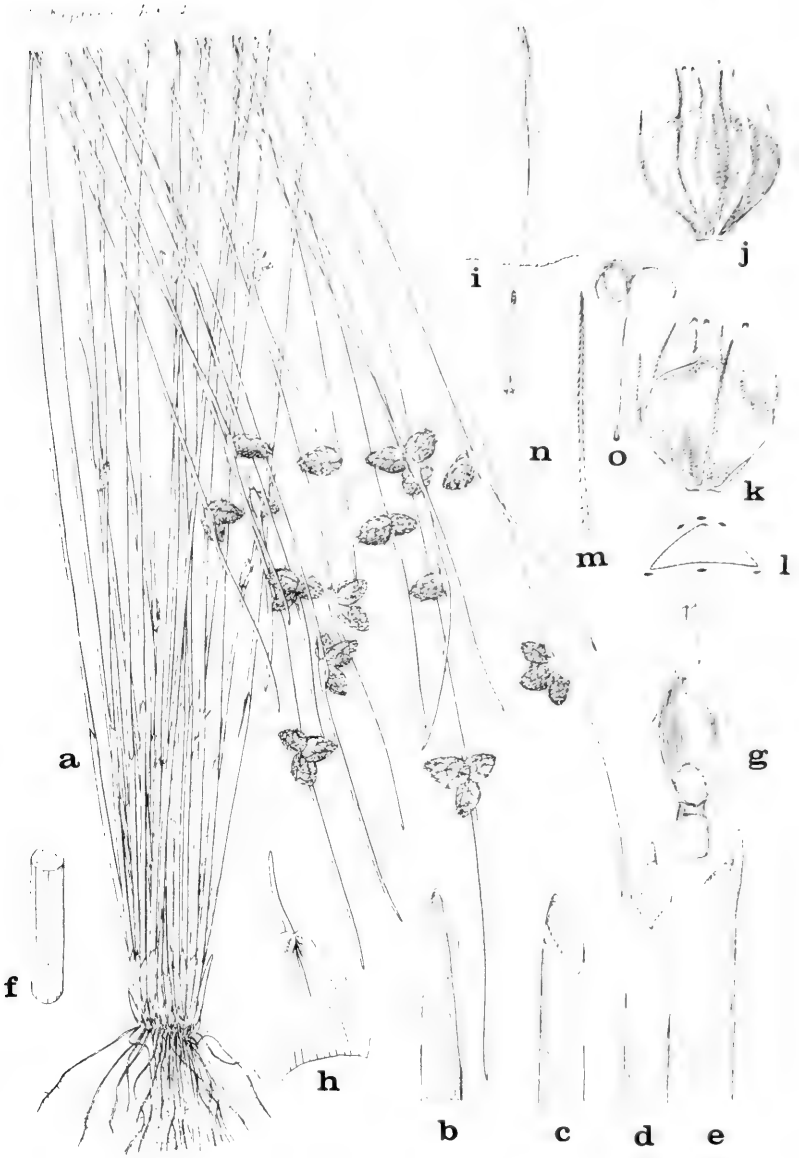


Plate 20. Scirpus juncoides Roxburgh

subsp. hotarui T. Koyama

and the northern Ryukyu Islands.

Plate 20. A. Total plant; B & C. Dorsal and ventral views of the upper part of sheath without notch; D & E. ventral and lateral views of the upper part of sheath with a notch; F. Portion of culm; G. Basal part of lowest involucral bract; H. Second bract; I. Glume; J & K. Dorsal and ventral views of mature achene with hypogynous bristles and withered filaments; L. Transverse section of achene; M. Hypogynous bristle; N. Stamen; O. Style and stigmas.

BOOK REVIEWS

Alma L. Moldenke

"WILDFLOWERS OF CAPE COD" by Harold R. Hinds & Wilfred A. Hathaway, xv & 172 pp., illus. Chatham Press, Chatham, Massachusetts 02633. 1968. $2.95 paper, $5.95 cloth.

Here is a delightful book produced in cooperation with the Cape Cod National Seashore for the Cape (or any New England coastal plain spot) vacationer who is attracted to the wild life of the area. It presents over 200 flowering plants in excellent color photographs or fair line drawings by the authors, in well worded descriptions, and in well explained habitat keys for the following areas: woodlands, disturbed areas, heaths, dunes, seashores, salt marshes, ponds, bogs, fresh marshes, meadows, and swamps allowing for intergradations and overlappings.

Over 600 plants have been identified from Cape Cod with many of them found only rarely and in isolated spots. The third of them treated in this book are the common ubiquitous ones.

"THE NATURAL GARDENS OF NORTH CAROLINA" with Keys and Descriptions of the Herbaceous Wild Flowers Found Therein by B. W. Wells, xix & 458 pp., illus., University of North Carolina Press, Chapel Hill, North Carolina. 1967. $7.75.

How fortunate that this book originally published in 1932 is available again, especially for the author's excellent descriptions of the various ecological areas of the state. Reading this new edition recalled for this reviewer a wonderful series of field trips led by the author through a few of these areas almost three decades ago.

These natural gardens include: the windy and salt-strayed dunes, the marine live oak forest, the salt marshes, the inland fresh water marshes, the swamp forest, the aquatic vegetation, the warm evergreen shrub bogs, the savannahs or grass-sedge bogs, the wire-grass sandhills, the old fields with natives and adventives competing and mingling, the upland forest with its shade gardens, and the boreal forests of the high mountains serving as the southern limit to the Canadian flora. For each of these areas there are simple keys often by flower color and easily understood descriptions of the herbaceous wild flowers.

Unfortunately many of the 224 photographs are too dark and too indistinct when contrasted with modern book illustrations.

An addendum at the beginning of the book offers the only changes. It explains that salt spray rather than wind is the main source of damage to the seaside community; it shows the origin of the high mountain grass balds as expanded trails of the early hunter Indians; and reports the sad fate of the now doomed Big Savannah near Burgaw where over half of its acreage is now an expansive

and productive corn field despite the author's (and others') urging that it be kept as a natural area since it "was probably the most beautiful wild flower garden in the eastern United States."

This book is dedicated to the members of the Garden Club of North Carolina that helped sponsor the earlier edition as well as this one. What a really worthwhile service for this group to perform!

"HUMBOLDT, BONPLAND, KUNTH and TROPICAL AMERICAN BOTANY", a miscellany on the "Nova Genera et Species Plantarum" by William T. Stearn, 159 pp. and map, Verlag von J. Cramer, Lehre, Germany, paper. 1968.

Dr. Stearn has performed a valuable service to the field of botany by editing this volume, by authoring seven of its articles, and by compiling the collective index and map of the Humboldt and Bonpland localities in Mexico, Venezuela, Cuba, Colombia, Ecuador and Peru. The writers of the other articles, often previously published elsewhere, are Barnhart, McVaugh, Beck, Sandwith, Sprague and Sarton.

For a brief but not superficial introduction to, an appreciation of, a review about the personages, trips, collections and publications of the famous H.B.K., and a direction to some of the major bibliographic sources of information (which in turn lead to much more through their references) this work is uniquely excellent.

"A FIELD GUIDE TO WILD FLOWERS" of Northeastern and North-central North America by Roger Tory Peterson and Margaret McKenny, xxviii & 420 pp., illus., Houghton, Mifflin Company, Boston, Massachusetts. 1968. $4.95.

This is an excellent addition to the Peterson Field Guide Series directing access to identification through simple keys based on a visual approach by color, form and structure. Color tabs are marked on the corners of pertinent pages. All this is mainly the work of the second author.

The black/white and color plates are very well done by the first author, placed immediately opposite the descriptive text, and marked with arrows pointing out diagnostic features. What could be easier for the interested amateur?

The terminology is kept simple, well explained and illustrated by excellent diagrams. Older, classical scientific names are used.

The book is priced very reasonably, especially in view of the many color plates.

"THE BIOLOGY OF FUNGI" by C. T. Ingold, revised and expanded edition, 144 pp., illus., Hillary House Publishers, Ltd., New York, N. Y. 10010. 1968. $2.75 paper.

This book provides a simple presentation or review of these

organisms as phycomycetes, ascomycetes, basidiomycetes or imperfecti explaining clearly and interestingly their life histories, their effects upon the environment, their nutrition patterns, their habitat relations, the spore dispersal means, and their overwhelming role in plant pathology. Structure is always presented in relation to function.

The illustrations are usually plain line drawings that surely make understanding easier. Some of them are new for this edition as is the greater emphasis on ecology.

This author's efforts will surely help to postpone the "sad day when students of fungi cease to marvel at the beauty of structure in moulds and toadstools, and cease to enquire into how they function as living mechanisms".

"TAXONOMY" A Text and Reference Book by Richard E. Blackwelder, xiv & 698 pp., John Wiley & Sons, Inc., London, Sydney & New York, N. Y. 10016. 1967. $19.95.

It is interesting for the botanically trained to look over the zoologist's shoulder at his taxonomic concepts and problems as applied to his part of the world of living things, and especially so when the zoologist is this very competent author. Even though this work is zoologically, even entomologically, and classically oriented it has much of value to offer to all advanced students and practicing taxonomists. After defining and explaining the place and importance of taxonomy, the author describes the practical use of it in classification, identification, curating and data recording and states that "It is the presence of this diversity and the presence of uniformity within each kind that makes classification necessary and possible. The rest of taxonomy is largely the prelude to, or mechanical operation of, the classification system." The latter is then interpreted in detail. Theoretical taxonomy is explained as a science. Zoological nomenclature with its international rules, taxa and names are presented. Crystallizing summaries are given at the end of the chapters.

There is a fine, topically classified bibliography and a needed index.

This is a most valuable book.

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STUDIES IN THE EQUITANT ONCIDIUMS II

W. W. G. Moir +

Introductory Notes

This is a continuation of the work presented in Phytologia Vol. 15, No. 1, 2-12, June 1967. These notes are to describe two new species and insert the description of two varieties omitted from the first article.

Oncidium variegatum, the type species, is a loose growing mass of plants on medium length rhizomes and with masses of aerial roots. It is not a strong grower and therefore falls all over itself. It has a wider distribution in the West Indies than any other species but is not found in Jamaica, the Bahamas or Florida. There are only six species of this type with long rhizomes - O. bahamense, O. scandens (which is described herein), O. velutinum, O. hawkesianum, O. sylvestre and O. variegatum. The first three named are tetraploid with 84 chromosomes while the fourth (O. hawkesianum) has 133. O. variegatum has 40 and the count for O. sylvestre is not known.

There was published in Cytologia Vol. 27, No. 3: 306-313 Oct. 1962 the results of a study on the chromosome numbers of the Oncidium alliance. In this list there are many changes to be made in the names of the plants. The name O. knescoffii was not a described species and is described as O. scandens herein: O. sp. from Abaco = O. lucayanum, Nash ex Britt., O. Moir = O. bahamense, Nash ex Britt., O. sylvestre Ldl. = O. velutinum Ldl. and O. leiboldii Reichb. f. fma album Hort. = O. Leiboldii Reich. f. var album Moir.

O. sylvestre has horizontal rhizomes, grows in short grass in Cuba, and has very few, terete, erect leaves. It has a great similarity to O. bahamense. However O. bahamense has rhizomes groing straight upwards and O. sylvestre grows horizontal.

+Associate Editor, Na Pua Okika O Hawaii Nei, and Honorary Associate Editor, The Orchid Review, P. O. Box 2298, Honolulu, Hawaii 96804.

ONCIDIUM VARIEGATUM Sw.

This species has a loose mass of growths on short rhizomes and many aerial roots. Several colors occur and in various habitats but all have the same crest. The following two varieties are worthy of validation botanically.

ONCIDIUM VARIEGATUM Sw. var ROSEUM Moir, var. nov.

Differt a form typica planta dimidia, foliis tenuis, erecta, habitu compactis. Floribus roseis, cristis labello flavis.

Plant one-quarter as large as typical species, more compact, with short rhizomes. Inflorescence erect, short, few flowered. Leaves more erect and falcate than typical, flowers in addition to being of deep pink color have a fuller lip that makes up about 90% of the flower. Crest deep yellow and same as O. variegatum.

Hispaniola: Collected in south-eastern area near El Seibo. Flowering in cultivation in Honolulu for 15 years.

ONCIDIUM VARIEGATUM Sw. var. PURPUREUM Moir, var. nov.

Differt a form typica planta bis majoribus. Floribas griseo purpureis.

Plant grey green and more erect than type, with shorter rhizomes. Inflorescence long, of fewer flowers. Flowers large, greyish purple, with a mottled design on both front and back. Crest same as type.

Virgin Isles: St. Thomas: Water Isle in shrubs and tall grass altitude about 25 feet, summer 1963; Walter Phillips, s.n., flowering in cultivation, Honolulu 1966.

ONCIDIUM SCANDENS Moir, sp. nov.
(Oncidium "kenscoffii" hort.)

Pseudobulbi nulli. Rhizoma erecta 8 - 30 cm longa, planta flabelliforma, scandens, folia sessilis, falcata, 5 - 18 cm longa, 5 - 7 mm lata. Inflorescentia racemosa, ad 40 cm long, erecta.

Pseudobulbs absent. Growth rampant, climbing, erect on long vertical rhizomes 8 cm to 30 cm long. Growth large, wide, flabelliform, with many aerial roots at base of leaves. Leaves sessile, green, 8 - 30 in number, very falcate, rigid, top surface lightly grooved, roughly denticulate margins, 5 - 18 cm long, 5 - 7 mm broad, acute to apiculate. Inflorescence racemose, many flowered, rarely branching, scape up to 40 cm long, often shorter, rigid, erect; floral bracts linear, the tips often recurved, to 3 mm. long. Sepals obovate - oblong, subspatulate, apically truncate and apiculate, 7 - 9 mm long 3 mm broad, laterals connate into a 2

apiculate synsepal. Petals obovate, spatulate, retuse, apiculate to 8 mm long, apically 4 - 6 mm broad. Lobes broadly triangular, rounded ends, isthmus narrow, somewhat tubular to make lower lobes reflex on sides, margin of isthmus slightly denticulate, lower lobes broadly circular because of tubular isthmus, 1.2 - 1.6 cm long, 1.3 - 1.5 cm broad when flattened out; crest with upper section horizontally linear, lower section of 3 parts turned upwards, center one longest, total 5 parts. Column wings membranaceous, acute, semiovate marginally entire. Flowers light to dark rose color depending on media on which it is growing: on acid media very pale color, on alkaline media deep rose.

Haiti: 6000 ft. elevation in pine forests and grass above and beyond Kenscoff.

This species is found in many areas in Hispaniola in the upper elevations, never at low elevations. It has 84 chromosomes. Flowers similar to O. variegatum but thinner in texture, with tubular isthmus and top of crest level - not like water buffalo horns as in O. variegatum.

ONCIDIUM CAYMANENSE Moir, sp. nov.

Planta parvissima, caespitosa, pseudobulbi nulli. Folia flabelliforme, triangularis, oblonga, acuta, margine denticulata, ad 3 cm longa, ad 8 mm lata. Inflorescentia gracilis, racemose; scapus ad 4 cm altus, spica pauciflor, flores rotundatis, bracteae minutae, triangulae, 2 mm longae, pedicelli cum ovarii circ, 1 cm longi. Sepalum dorsale oblanceolatum, 1 cm longa vix 2 mm lata; lateralia in synsepalum formantia. Petala e basi cuneata obovata, rotundata, brevi-apiculata, 1 cm longa vix 5 mm lata. Labellum lobi lateralibus parvi, lobum medium reniforme, 1 cm longa vix 1.5 cm lata; isthmi nulli; cristae callis 5 pars, superior 2 pars libratis, inferior 3 pars.

Very small tufted plant without pseudobulbs. Leaves triangular, oblong, acute with toothed edges, 3 cm long by 8 mm broad. Inflorescence thin, a raceme of 4 cm length with 2 - 4 small round flowers of pale pink color. Dorsal sepal oblanceolate, 1 cm long by 2 mm wide; lateral sepals forming a synsepal. Petals obovate in a wedge shape, rounded and with small apicule, 1 cm long by 5 mm broad. Labellum 1 cm long by 1.5 cm broad, side lobes small, middle lobe reniform; essentially no isthmus; crest in two sections, upper parts horizontal, lower three parts in triangular arrangement, making a total of 5 parts.

Cayman Islands: Grand Cayman, precise locality and original collector unknown. The plants were sent to Mr. Oris Russel in Nassau, Bahamas, who in turn gave them to the late Mr. Stanley Smith, of Nassau, who sent one speciman in flower to Hawaii, blooming during

May - June.

The O. variegatum var. roseum plants are so minute at times and without rhizomes that they could be mistaken for small seedlings or even O. leiboldii. They flower on short spikes with never very many flowers, but the size of the labellum is very full compared to the rest of the flower. It has the definite O. variegatum crest, however. Flowers in March - April.

Oncidium variegatum var. purpureum is very unusual and not very common on Water Isle in the Virgin Isles, but has produced O. x floride-phillipsae as the natural hybrid with O. prionochilum that was described in Phytologia Vol. 15, page 6, June 1967.

The name O. scandens was chosen as more descriptive of the plant, which occurs at higher elevations throughout Hispaniola. Also since the town Kenscoff is a considerable distance from the habitats of the species it was felt that the name should be changed. It also occurs in the Dominican Republic at somewhat lower elevations in the grass between Jarabacoa and Constanza and also on the road going to Bonao from Jarabacoa. In the areas in Haiti the long roots going down through the grass and pine needles often make club-like endings on the limestone rocks and the bauxite-like soil. There the color of the flowers is deep rose. However, by placing the plants on acid tree fern slabs or into trees the flowers are pale pink, in fact almost white. In very good conditions of growth the distance from tip to tip of leaves across the fan can exceed 12 inches and have as many as 15 leaves on each side in a beautiful arc with a notch in it at the top. From a single fan or two one can get a mass of plants about 12 inches deep and 2 feet up and down and 2 feet across in about 3 years.

This plant was first mistaken by me to be O. sylvestre but that species has terete erect leaves in tufts of 5 - 6 terete leaves, with long rhizomes going sidewards as illustrated in the article on page 235 of The Orchid Journal Vol. 2, No. 5 (May - June 1953). All the plant and floral characteristics of O. scandens are very dominant in breeding and these carry on into the F 2 and F 3 generations even when crossed with species with tufted non rhizome forming growth.

O. caymanense is the smallest tufted species while O. hawkesianum is the smallest species with rhizome growth. O. lucayanum in the Bahamas is a bit larger than O. caymanense in native habitats.

STUDIES IN THE EQUITANT ONCIDIUMS III

W. W. G. Moir

The monograph on Oncidiinae by Krazlin originally published in 1922 lists the following oncidiums as being native to Jamaica, O. berenyce (written berenice), O. pulchellum, O. tetrapetalum and O. triquetrum.

Krazlin used the crest on the labellum as a means of separating these Variegata oncids. However, he misplaced one other in the Oblongata group - O. prionochilum, so there were fifteen known at that time. Today we have about double that number. In 1964 Withner and Jesup added another to the Jamaican group as O. gauntlettii.

Oncidiums have a crest on the labellum of the flower. The crest is probably the most reliable floral part to use in separating oncidium species whose flowers look similar. There are other characteristics that are useful but the crest is the best as it is not influenced by environment nor geographical distribution.

O. variegatum, the type species for this group, has the widest distribution in the West Indies and probably has the most varietal forms, yet in every case the crest is the same as the type species. The grooved upper projections of the crest turn downwards to give the effect of water-buffalo horns. O. variegatum does not exist in Jamaica.

There is considerable discussion as to whether the species O. berenyce exists. There are not plant or leaves preserved and the description of the flower with a partial sketch was all that was reported by Reichenbach in 1862. Others feel it is a natural hybrid. But in this article there is presented the description of the missing parts.

In the discussion to follow we shall leave out both O. triquetrum and O. gauntlettii for these two have only a slightly raised shiny area for a crest. These two do not seem to be closely associated in nature with the others. Man-made hybrids between them and the others have no resemblance to natural hybrids found in Jamaica.

In the hybrid complex that occurs in the somewhat triangular area between Alexandria, Claremont and Brown's Town in St. Ann Parish in Jamaica is found many forms of flowers that have characteristics not found in the three species O. berenyce, O. tetrapetalum and O. pulchellum. These characteristics are (1) a much dentated or fringed isthmus area, even as far as the edge of the lateral upper lobes, (2) many short points to the parts of the crest, (3) concave flowers, (4) dark purplish red flowers, and (5) heavy veination on the labellum in the darker purplish red flowers. Where did these characteristics come from?

About twenty five years ago I purchased many plants from a Honolulu orchid nursery. These plants had been imported from Jamaica. There were some plants easily recognizable as O. berenyce, O. pulchellum and O. tetrapetalum but among the others there were several different types that did not fit the description of these three species.

After flowering these and using them in breeding I did considerable photographing of their flowers and plants. These included closeup front and side views of the flowers to determine the makeup of the crests. All these plants were smaller in stature and in flower size and nubers than the plants later obtained.

Later among the many plants from St. Ann sent by Mr. George Hart of Kingston we found still another unusual species that quickly answered several of the questions on where the concave flower characteristics came from in the hybrid complex. A couple of years later while collecting in St. Ann I picked up another specimen of this odd colored concave flowered plant.

Going through the same photographic study of these species and hybrids, as before, the smaller plants and their peculiar crests gave most of the answers as to why the peculiar characteristics were in the hybrids. The result of this study has shown me the need to present the description of 3 species and to clearly determine and supply the additional data on O. berenyce.

The flower that agreed with the description of O. berenyce in Kranzlin's monograph also agreed completely with the sketch by Reichenbach. The names chosen for the others were the descriptive words for the most prominent parts of the flower or crest. All the plants were of the same general growth as the larger species in Jamaica but somewhat smaller, that is, they were tufted plants without rhizomes like in O. variegatum.

ONCIDIUM CUNEILABIUM - Moir sp. nov.

Planta caespitosa, pseudobulbi nulli, folia flabelliforma, rhizoma nulli. Folia lanceolata, acuta, 6 - 8 cm longa vix 8 mm lata. Inflorescentia ex axilla foliorum. Sepalum dorsale oblongatum, acutum; lateralia in synsepalum formantia, convexa, apice biapiculata, 1 cm longa vix 8 mm lata. Petala obovata, obtusa, margine undulata, 1 cm longa vix 8 mm lata, omnia pallide-rosea, bruneo maculata. Labellum trilobum, basis profunde cordatus, lobis lateralibus lineares, obtusa, divergentes vel leviter reflexi; lobum intermedium semilunatum; isthmus elongata, tubulosa; crista tuberculis 6, lata, laterales magnae profunde cuneatae, mediana minuta, bruneus maculata. Gynostemia alae magnae, lata, acuta, denticulata.

Medium small plant, tufted in growth, fan shaped, with no bulb nor rhizome. Leaves lancolate, acute, 6 - 8 cm long by 8 mm wide. Inforescence from axil of the leaves, 6 - 8 cm long, few flowered. Dorsal sepal oblong, acute, 1 cm long by 6 mm wide; laterals forming a synsepal, convex, with two apices, 1 cm long by 8 mm wide. Petals obovate, obtuse with very small apex, margin undulated, 1 cm long by 8 mm wide in pale rose with brown spots. Lip trilobed, the base cordate to round, lateral lobes linear, obtuse and reflexed slightly backwards; lower lobe crescent shaped, only slightly undulated; isthmus long and tubular; crest in 6 parts, the lateral parts very large, wedge shaped in a vertical position, the upper middle projection small, the lower projections with two smaller ones and a larger center one in a complete sweep like the crest of a wave. The wings on the column are large, broad at the base and pointed at the top as if a wing in flight, toothed.
Jamaica; locality unknown. Flowering in cultivation Honolulu 1948 Moir s.n.

The heavy wedge-shaped side lobes of the crest are vertical and very prominent, therefore the name O. cuneilabium.

ONCIDIUM BERENYCE Rchb. f.

The next in order is O. berenyce but the description in Kranzlin is not complete. Here are the missing parts:-

Pseudobulbless, tufted growth shaped as a fan, with no rhizomes. Leaves lanceolate, acute, 6 - 10 cm long by 8 mm broad, curved outward after the mid distance to a sharp point, three sided leaves, purplish green color, upper side grooved. Inflorescence or scape up to 25 cm long, bearing several flowers.

It comes from Jamaica and is not twice as large as the present day O. variegatum flowers. It is not closely related to O. variegatum but much closer to O. cuneilabium described above, from which it differs mostly in a very different crest. The upper parts of the crest are straight, as they go out sidewise. Underneath these parts are 2 pearl-like projections and then below are three more projections to make a total of 7. The rest of the description in Kranzlin applies to this plant I have studied.

ONCIDIUM APICULATUM Moir sp. nov.

Planta caespitosa, pseudobulbi nulli, folia laxa flabelliforma, rhizoma nulli. Folia lanceolata, acuta, falcata, 4 - 6 cm longa vix 5 mm lata. Inflorescentia ex axilla foliarum, 6 - 8 cm alta, racemosa, flores 3 - 5. Sepalum dorsale, erectum, apiculatum, bruneus, 8 mm longa vix 5 mm lata, lateralia in synsepalum formantica. Petala oblanceolata, 8 mm longa vix 5 mm lata, alba, bruneo maculata. Labellum 1.5 cm longa vix 1 cm lata, lobis lateralis minuta; isthmus elongata, lata, profunde dentata, maculata; lobum intermedium semi-lunatum; crista profunde apiculata, lata.

Compact plant with few short slender falcate leaves, 4 - 6 cm long by 5 mm broad. Inflorescence short, 6 - 8 cm tall, flowers 3 - 5 in a raceme. Dorsal sepal erect, pointed, brown; laterals forming a synsepal. Petals oblanceolate, pointed, 8 mm long by 5 mm wide, white. Labellum 1.5 cm long by 1 cm broad, lateral lobes short, narrow and small; isthmus elongate, broad, heavily toothed or fringed; lower lobe crescent shaped; crest with upper two lobes long, horizontal, then tips turned down and very apiculate (giving name to this species); lower parts of crest also sharp pointed, short and turned upwards.
Jamaica; location unknown. Flowered in cultivation Honolulu 1949 Moir s.n.

Characteristics of this flower prominent in the hybrid complex in St. Ann Parish in which the fringed edge to the isthmus and the very sharp pointed parts to the crest are prominent.

ONCIDIUM CONCAVUM Moir, sp. nov.

Planta caespitosa. Pseudobulbi mulli, folia laxa flabelliforma, rhizoma nullii. Folia lanceolata, acuta, carnosa, laevis, purpurea, falcata, 4 - 8 cm longa vix

1 cm lata. Inflorescentia ex axilla foliorum, 6 - 8 cm alta, racemosa, flores 3-5, sepalum dorsale concavum, apiculatum, 1 cm longa ad 3 mm lata; lateralia in synsepalum formantia, 9 mm longa, 4 mm lata. Petala oblanceolata, acuta, ad 9 mm longa, 5 mm lata, concava. Labellum quadrilobum, venosum, rubro-purpureum, concavum, 1.8 cm longa vix 1.5 lata, isthmia 8 mm lata; cristae minutae, 5.

Plant medium size, with few leaves, in fan shape, no pseudobulbs nor rhizome. Leaves light greenish purple in color, falcate, 4 - 6 cm long and 1 cm broad at middle, lanceolate, acute. Inflorescence 4 to 6 cm long, with 3 - 5 flowers in raceme. Dorsal sepal concave and apiculate, 1 cm long by 3 mm broad. Petals oblong lanceolate, acute, 8 mm long, 4 mm broad, concave as well as thrust forward as dorsal sepal. Labellum divided into four almost equal lobes, heavily veined in darker reddish purple (the color of entire flower), entire labellum heavily concave; isthmus narrow and lobes quickly flaring outward; crest projections 5, small, rounded and compressed.
Jamaica: 1500 - 2000 feet elevation, St. Ann Parish, near Claremont, first collected 1955 by Mr. George Hart, second time in 1958 by Moir. Its characteristics found very dominant in hybrid complex in St. Ann Parish. Flowered in cultivation Honolulu 1954 Moir s.n.

ONCIDIUM x HARTII Moir nat. hybr. nov.

(O. pulchellum Hook x O. concavum Moir)

Habitu inter parentiis intermedium, inflorescentia 8 ad 15 cm racemos, floris concavum, venosum.

Plant intermediate between parents, also in leaves and colors. Characteristics, except flowers, like a smaller edition of O. pulchellum, however the flowers are very dark rose, concave, intermediate in size between parents, heavily veined in darker red, crest more like that of O. pulchellum, but pale pink.
Jamaica: St. Ann Parish, near Claremont. Flowered Honolulu 1954. Moir s.n. Verification made by crossing O. pulchellum and O. concavum. Characteristics from O. concavum are dominant in all subsequent hybridizing. This attractive natural hybrid is named for Mr. George Hart, of Kingston, Jamaica.

In addition to those described above are plants of the same stature as O. tetrapetalum and O. pulchellum

which have 7 rounded and blunt tipped projections to the crest, just as in the description of O. berenyce, but decidedly different in their size and arrangement. This has not been clearly placed in the alliance. O. tetrapetalum and O. pulchellum have only 5 projections to the crest and all are mor or less blunt tipped.

In the present day hybrid mixture in St. Ann Parish, the species described above show their characteristics. O. x hartii has also bred with the others and the deep purple flowers that are somewhat concave or with labellum at a 4 o'clock angle to the top portion show its characteristics and its parental species O. concavum.

But just how O. apiculatum with pointed crest parts and fringed isthmus got into this hybrid complex is more of a mystery. However, the largest dark hybrids have very pointed crest parts and many of them bear 8 or more sharp projections, while an occasional one has a fringed isthmus or even a fringed upper lobe to the labellum.

In this hybrid complex are the three other named hybrids described in the article in the Phytologia Vol. 15, No. 1: 3 - 12 (June 1967). This article is a supplementary article to that one. Although these species are very difficult to find or may even now be extinct the descriptions are necessary to understand the hybrid complex. Most of those described are not attractive, nor would they be easily noticed by a collector but they have left their mark. I have had this data for many years but have only now published it, so that everyone can understand the complexity of the hybrid swarm. There are still many pure forms of O. pulchellum and O. tetrapetalum in Jamaica. An easy test to determine whether these are pure is to hybridize them with O. triquetrum and note the characteristics of the offspring. The first cross I made between a pure O. pulchellum and O. triquetrum gave a distinct pattern not found in the subsequent crosses using what looked like O. pulchellum in darker colors. The "blood" of O. concavum rises to the surface in the dished flowers and heavy veinations. These are the most prominent flowers today in the plants sold as O. pulchellum.

TWO NEW SPECIES OF PIPEWORT

Harold N. Moldenke

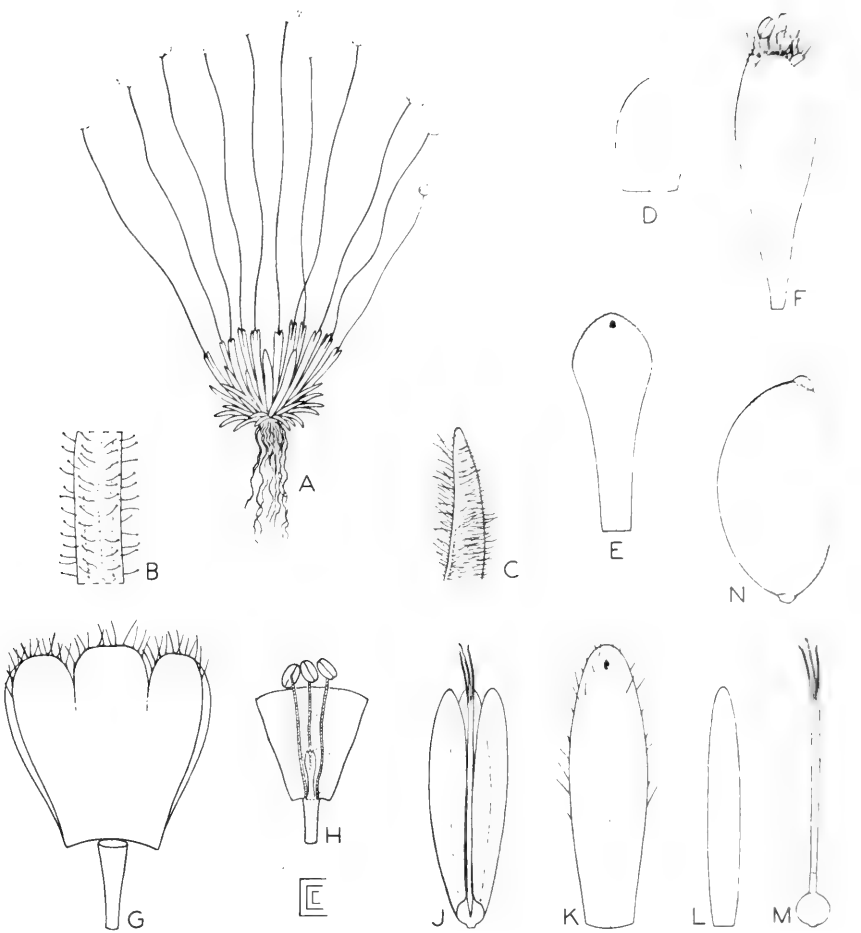
PAEPALANTHUS RESTINGENSIS Moldenke, sp. nov.

Herba acaulescens; foliis rosulatis ca. 1 cm. longis 2 mm. latis, apice subacutis vel acutis juventute utrinque densiuscule villoso-pubescentibus, senectute glabrescentibus opacis olivaceis; pedunculis pluris 9—20 erectis 7—9 cm. longis villosulis brunneo-stramineis 4-sulcatis, pilis divergentibus tenuissimis capitulatis; vaginis ca. 2 cm. longis, arcte adpressis densissime villosulis, ad apicem fissis; capitulis ovato-subrotundatis vel hemisphaericis 6—8 mm. longis latisque griseis.

Acaulescent herb; leaves rosulate-cespitose, about 1 cm. long and 2 mm. wide, subacute or acute at the apex, rather densely villous-pubescent on both surfaces when young, glabrescent in age, opaque, olivaceous, not fenestrate; peduncles usually many, 9—20 per plant, straight, erect, 7—9 cm. long, 4-dulcate, only very slightly twisted, brownish-stramineous, villosulous throughout, the hairs diverging at right angles, very slender, very slightly capitulate; sheaths about 2 cm. long, surpassing the leaves, closely appressed to the peduncle base, very densely villosulous throughout, 2—4-split at the apex; heads ovate-subrotund or hemispheric, 6—8 mm. long and wide, gray; involucral bractlets stramineous, oblong-elliptic, about 1.5 mm. long and 0.8 mm. wide, pilosulous on the outer surface; receptacular bractlets spatulate, concave, gray, about 3 mm. long and 1 mm. wide, obtuse at the apex, with a black spot at the center near the apex; staminate florets pedicellate: sepals 3, united for almost 2/3 their length, about 3.5 mm. long and 1.4 mm. wide, concave, rounded and pubescent at the apex; stamens 3, slightly exserted; anthers 2-celled; pistillate florets sessile: sepals 3, separate to the base, narrow-elliptic, concave, about 5 mm. long and 1.4 mm. wide, obtuse at the apex, pilose, with a small blackish spot at the center near the apex; petals 3, separate to the base, narrow-elliptic, about 4 mm. long and 0.6 mm. wide, glabrous; pistil one; style capillary, glabrous, about 3.5 mm. long; stigmas 3, about 1 mm. long; ovary rotund, about 0.7 mm. long and wide, glabrous.

The type of this species was collected by R. P. Belém and R. S. Pinheiro (no. 3181) in the restinga at Maraú, Bahia, Brazil, on January 18, 1967, and is deposited in my personal herbarium at Plainfield, New Jersey. The collectors describe the plant as "Planta de 5 cm.; infl. arroxeada". Plate I: A — habit x 1/2; B — hairs on peduncle x 10; C — portion of leaf x 4; D — involucral bractlet x 10; E — receptacular bractlets x 10; F — staminate floret x 15; G — calyx of staminate floret x 15; H — corolla dissected from young staminate floret x 15; J — pistillate floret x 15; K — sepal from pistillate floret x 15; L — petal from pistillate floret x 15; M — gynoecium x 15; N — seed x 50. [Drawn by Charles C. Clare, Jr., August 1968].

Plate I



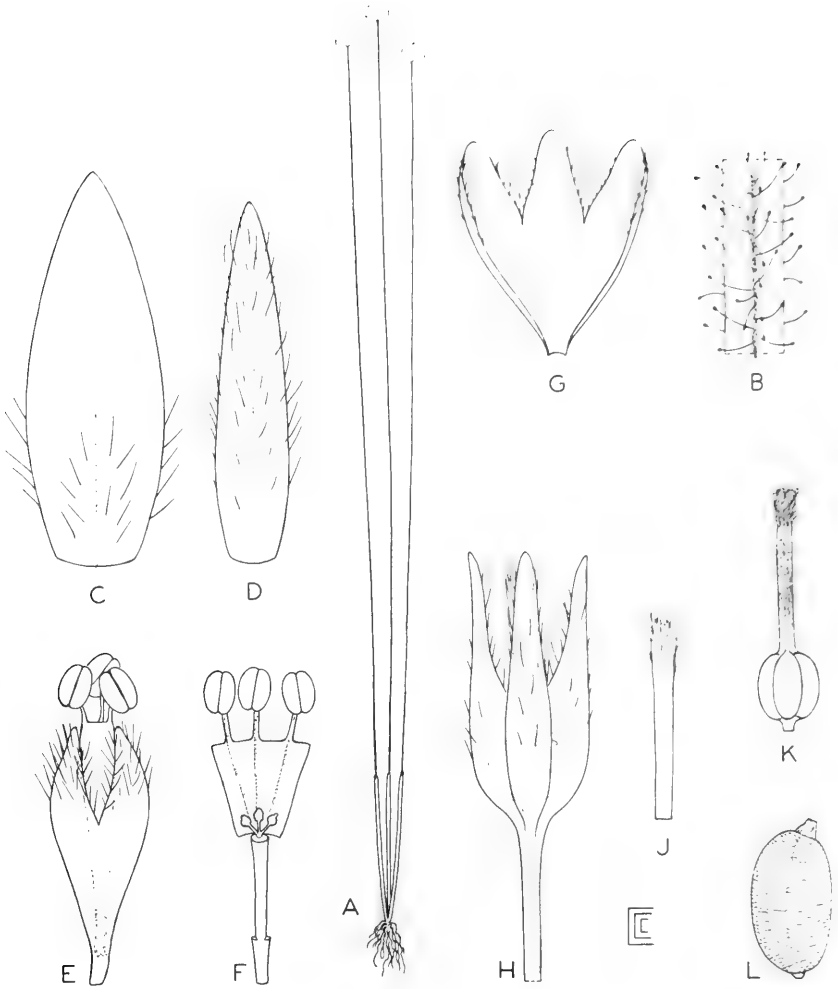
SYNGONANTHUS ROBINSONII Moldenke, sp. nov.

Herba acaulescens; foliis rosulatis usque ad 1 cm. longis 1 mm. latis ubique dense adpresseque albido-pilosulis, ad apicem subacutis, ad basin lanigeris; pedunculis plerumque 3 erectis stramineis 15--28 cm. longis 3-costatis nitidis minute pilosulis; vaginis 3.5--4 cm. longis arcte adpressis minute pilosulis ad apicem fissis; capitulis hemisphaericis albis ca. 6 mm. latis.

Acaulescent herb; leaves rosulate, cespitose, numerous, linear, to 10 mm. long and about 1 mm. wide, densely appressed-whitish-pilosulous on both surfaces, subacute at the apex, densely white-lanate at the base; peduncles mostly 3 per plant, erect, straight, 15--28 cm. long, 3-sulcate and 3-costate, slightly twisted, shiny, minutely pilosulous throughout with short and irregular, weak, gland-tipped hairs at right angles to the peduncle; sheaths brown, 3.5--4 cm. long, closely appressed to the peduncle, minutely pilosulous throughout with hairs similar to those on the peduncle, split at the apex, the blade erect and appressed; heads hemispheric, white, about 6 mm. wide; involucral bractlets lanceolate, stramineous, about 2.5 mm. long and 0.9 mm. wide, concave, pilose on the lower 1/3, acute at the apex; receptacular bractlets narrow-lanceolate, about 2.4 mm. long and 0.5 mm. wide, concave, acute at the apex, pilose throughout on the back; staminate florets short-pedicellate: sepals 3, united for about 1/2 their length, about 1.5 mm. long and 0.4 mm. wide, obtuse at the apex, pilose on the back except at the very apex; petals 3, united into a tube about 0.6 mm. long, glabrous; stamens 3, the filaments adnate to the corolla to its apex, the free portion about 0.2 mm. long, glabrous; anthers 2-celled; pistillate florets long-pedicellate; sepals 3, separate, lanceolate-ovate, about 1.9 mm. long and 0.4 mm. wide, concave, bluntly subacute at the apex, sparsely pilosulous on the back; petals 3, connate at about the middle, linear-lingulate, about 1.1 mm. long and 0.15 mm. wide, barbulate-pilose at the apex; pistil one; style about 0.9 mm. long, glabrous; stigmas 3, about 0.25 mm. long; style-branches 3, similar to the stigmas in size; ovary 3-celled, 3-seeded.

The type of this species, compared at the Royal Botanic Gardens in Kew and there confirmed as new, was collected in shallow soil over sandstone at Kasanshi Dambo, 55 km. east-southeast of Mporokoso, Northern Nigeria, by E. A. Robinson (no. 5167) -- in whose honor it is named -- on May 13, 1962, and is deposited in the Britton Herbarium at the New York Botanical Garden. Plate II: A -- habit x 1/2; B -- glandular hairs on peduncle x 20; C -- involucral bractlet, exterior view x20; D -- receptacular bractlet x 20; E -- staminate floret x 20; F -- corolla of staminate floret dissected, sepals removed x 20; G -- sepals of staminate floret x 20; H -- pistillate floret x 20; J -- petal of pistillate floret x 25; K -- gynoecium x 20; L -- seed x 50. [Drawn by Charles C. Clare, Jr., August 1968].

Plate II



PINUS HARTWEGII IN HONDURAS

ELBERT L. LITTLE, JR.

Four species of Pinus, pine, have been recorded from Honduras, near the southern limit of this genus in the New World in Nicaragua. A fifth, Pinus hartwegii Lindl., is noted here.

In his article on the conifers of Honduras, Antonio Molina R. (Coníferas de Honduras. Ceiba 10: 5-21, illus. 1964) has described these four species, summarized their geographic distribution, and prepared a key for their identification. The three which extend into Nicaragua are widespread, occupying mainly different but overlapping altitudinal zones. According to Molina, Pinus caribaea Morelet (var. hondurensis Barrett & Golfari) is found between 20 and 900 meters. The most widely distributed species, P. oocarpa Schiede, grows at 600 to 1,700 m. P. pseudostrobus Lindl. is confined to higher mountains from 1,600 to 2,300 m.

The fourth, Pinus ayacahuite Ehrenb., is known from Honduras only on Cerro Santa Bárbara, from 1,800 m. to the summit at 2,750 m. (9,300 ft., or 2,835 m., on one map). Its discovery during the difficult ascent in April 1951 was described by Paul H. Allen (The conquest of Cerro Santa Bárbara, Honduras. Ceiba 4: 253-270, illus. 1955). That mountain, perhaps the second highest in the country, is located in northwestern Honduras between Santa Bárbara and Lake Yojoa.

On the summit of Cerro Santa Bárbara, Allen found a strange relic forest in which the following conifers were dominant, making up the bulk of the stand: Abies guatemalensis, Cupressus lindleyi [C. lusitanica], "Pinus pseudostrobus," P. ayacahuite, and Taxus globosa. Though not stated, four of these conifers probably were first records for Honduras. He mentioned also P. pseudostrobus as probably the pine observed on a hill summit at lower altitude.

In January 1965, I made a brief study of pines in Honduras. Several areas were examined where many trees had been killed during the destructive epidemic of the southern pine beetle or bark beetle or gorgojo del pino (Dendroctonus frontalis Zimm.). All three common species of pine were attacked by these insects. At the time I was employed as consultant in dendrology and professor in the forestry program of the Interamerican Institute of Agricultural Sciences, Turrialba, Costa Rica, with a special Fund Mission of the Food and Agriculture Organization of the United Nations.

The record of Pinus hartwegii Lindl. is based upon my examination of the following specimen in the large herbarium of Escuela Agrícola Panamericana (EAP) at Zamarano near Tegucigalpa: Paul H. Allen, Robert Armour, and Alphonse Chable 6096, Cerro Santa Bárbara, Depto. Santa Bárbara, Honduras, April 5-6, 1951. The label adds that it was a tree to 150 ft. (45 m.) frequent on summit, altitude 2750 m. As reported above, this specimen was labeled P. pseudostrobus Lindl. However, another visitor had annotated it as P. montezumae Lamb.

The specimen has stiff, moderately stout needles 5 in a fascicle, 1.0-1.1 mm. broad (dry), 15-20 cm. long (slightly long for this species), with 3 medial resin canals in cross section; stout twigs 8-13 mm. in diameter; and 2 sessile dark-colored cones 7-8 cm. long and 5-6 cm. broad (open), with dark brown, horizontally keeled apophysis and slightly raised blackish umbo.

Pinus hartwegii Lindl., as interpreted here, includes P. rudis Endl. Paul C. Standley and Julian A. Steyermark (Flora of Guatemala Pt. 1, pp. 48-50. 1958) stated that the pine of higher elevations in Guatemala (as Pinus montezumae var. rudis (Endl.) Shaw) was not easily distinguishable at lower elevations from typical P. montezumae. The Honduran specimen is intermediate in needle length but has the smaller, dark-colored cones of the former.

Pinus hartwegii and P. ayacahuite (but not P. montezumae) are known also from the summit of the highest peak in El Salvador, altitude about 2,800 m. (9,200 ft.) and located near the Honduras boundary about 125 km. southwest of Cerro Santa Bárbara. Both should be sought on Cerro Pacayas, altitude about 2,865 m. (9,400 ft.). The last named peak, apparently the highest in Honduras, is between the other two.

The range extension of Pinus hartwegii from El Salvador to Cerro Santa Bárbara is not unexpected, as P. ayacahuite has the same disjunct distribution pattern. The geographic distribution of all these species of Pinus has been mapped by William B. Critchfield and Elbert L. Little, Jr. (Geographic distribution of the pines of the world. U.S. Dept. Agr. Misc. Pub. 991, 97 pp., maps. 1966).

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A POSSIBLE NEW PLANT HORMONE

A. K. Khudairi*

There are three major families of plant hormones, phytohormones: (1) auxins, (2) gibberellins, and (3) cytokinins. These are growth promoting hormones; the first two result in cell elongation and cell division, while differentiation is controlled by a combination of an auxin and a cytokinin. Other physiological effects of these hormones are known, e.g., auxin is connected with apical bud dominance, rooting, curvature of coleoptiles, partherocarpy of fruits, abscission of leaves and others. Gibberellin causes bolting of rosette plants, germination of seeds and production of reducing sugars. Cytokinins delay senescence and have an important role in cell differentiation.

From the definition of a hormone, three points have to be considered: (1) biosynthesis of the hormone within the organism, (2) translocation of the hormone from the source where it is produced to the site of action, (3) specific physiological effect of the hormone, Ascorbic acid was found to fit these requirements. First of all, ascorbic acid (AA) has been found in many plant tissues, i.e., buds, leaves, certain stages of floral development, and root tips of flowering plants (2,3,4). Ascorbic acid was found to occur in Chlorophyceae, Rhodophyceae, Pheophyceae, mosses, ferns, and conifers (1). It has been known as vitamin C to animals, hence it is essential to growth but animals cannot produce it.

Xanthium pensylvanicum leaves contain 100-500 mg. AA per 100 gr. fresh weight. The content depends on the physiological condition of the leaf as well as age. AA, when applied exogenously, moves from Xanthium

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leaves to the tested (receptor) bud. AA also was found to move downward when applied to decapitated Xanthium plants. The site of action is the undeveloped lateral bud. Such lateral buds developed more rapidly in the presence of AA than the water controls. Upward movement of AA was also observed with derooted plants immersed in AA solution. Translocation of AA within the plant satisfies the second point in the definition of a hormone.

The physiological effects of AA are: (1)enhancement of seed germination in lettuce seeds including percent germination and seedling growth (Fig.1), (2) removal of apical dominance executed by auxin over later bud development (AA application overcomes the inhibitory effect of auxin on the development of lateral buds), (3) enhanced development of flower buds, (4) increased growth of young leaves when applied to intact leaves or excised leaves floated in water or sugar solution. The increase in size of leaves treated with AA is small due to the presence of endogenous ascorbic acid in normal leaves.

Ascorbic acid is unlike gibberellin or cytokinin in its action; where gibberellin overcomes the dark inhibition of Grand Rapids lettuce seeds germination, AA cannot. AA increases the germination rate in the presence of red light, whereas AA is inactive in lettuce seed germination (Table 1). The hormonal action of AA is red - far-red reversible. It appears that AA action is phytochrome mediated. This effect of hormonal activity is not limited to lettuce seeds, but also found in Xanthium bud development (Table 1). Lateral bud development was more pronounced when the plants were given 5 minutes of red irradiation in the presence of exogenous AA applied to the leaves. Five minutes of far-red inhibits AA

action and the lateral buds develop like the control, without AA. The biosynthesis of AA was observed with other plants. Schopper, 1966, 1967 (5 & 6), found more endogenous AA synthesized in mustard seedlings (Sinapis alba L.) in the presence of red light. Far-red irradiation resulted in less biosynthesis of AA.

This new hormonal action of AA may lead to the suggestion of a fourth family of growth hormones, "the Photophytohormones."

Table - 1

Photoresponse of ascorbic acid to red and far-red irradiation in the development of lateral bud of Xanthium and Grand Rapids lettuce seeds germination. Single-leafed Xanthium plants were treated for 3 days and 100 mg/L AA solution was applied to the upper surface of the leaf. Grand Rapids lettuce seeds were germinated in the presence of AA (100 mg/L) or distilled water. Germination percent was measured three days after the beginning of water or AA solution inbibition.

Light Treatment	Bud Development of Xanthium (mm length)*		Grand Rapids lettuce seeds (% Germination)**	
	+ AA	- AA	+ AA	- AA
Red (5 min.) then in Darkness	4.95	3.7	38	23
Far-Red (5 min.) then in Darkness	3.6	3.4	0	2

* Mean of eight plants.
** Mean of two lots of 100 seeds each.

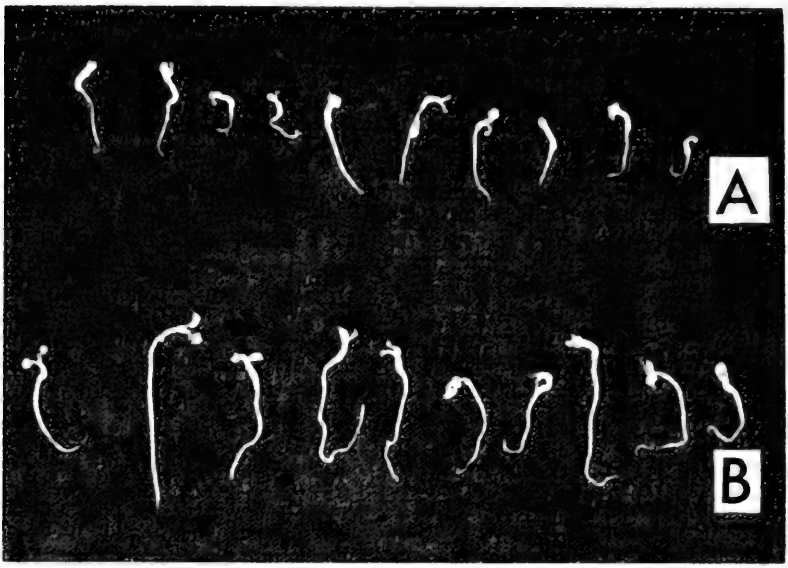

Figure 1- A. Seedlings of lettuce, Lactuca sativa var. Grand Rapids germinated in distilled water at 23° C in lighted growth chamber. B. Lettuce seedlings of the same variety germinated under the same conditions with the exception of the presence of 100 mg/L AA solution as the germinating medium. Photograph taken when seedlings were 6 days old.

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BOROJOA AND TOCOYENA (RUBIACEAE) IN PANAMA

By John D. Dwyer, St. Louis University and
Missouri Botanical Garden

The genus Borojoa (Tribe Gardenieae) has been treated recently by Dr. Julian Steyermark (Bol. Soc. Venez. Cienc. Nat. 26: 416-478. 1966). The genus has not been reported north of South America. Principally through the efforts of Dr. James Duke of Battelle Memorial Institute, Columbus, Ohio, three species have been collected recently in the Republic of Panama. One of these is a new species, one is sterile, and the third is the familiar Colombian B. patinoi Cuatrecasas. Despite the fact that Cuatrecasas (the author of the genus Borojoa) has provided an excellent description of B. patinoi, I have elected to describe the Panamanian collections, with the exception of the flowers (here male) as they are in bud only.

1. BOROJOA PATINOI Cuatrecasas, Rev. Acad. Colombia Cienc. 7: 474. 1949.

Trees up to 7 m tall, the branchlets smooth, subplano-compressed, glabrous, the bark thin and peeling easily, the internodes here up to 6 cm apart, the uppermost pedicel scars often prominent. Leaves with the petioles up to 3.8 cm long, glabrous; lamina elliptic, cuneate at the apex, cuneate to truncate-obtuse at the base, up to 36 cm long, up to 17 cm wide, thin-coriaceous, presumably glabrous, the costa prominulous above, prominent beneath, up to 1.8 mm wide, obviously porcate above distally, the principal veins ca 15, broadly arcuate, up to 3 cm apart, usually 1-1.5 cm apart, the tertiary veins pinnatiform, patulous, tending to persist and later often reflexed, connate below the middle to form an appressed cylinder, ovate-elliptic to ovate, up to 4 cm long, up to 1.2 cm wide, acute (or obtuse?) at the apex, stiffly chartaceous, with a slender median carina on the outside, venose, the veins ascending, crowded, prominulous, the intervenal areas delicately patulous-reticulate. Flowers (here male) crowded into a terminal capitate cluster, ca 2.5 cm long, the corolla at first enclosed within the calycine cup. Fruit sessile, rotund, ca 7 cm in diameter, crowned by a persistent calyx, the fruit wall thick, smooth, glabrous, ca 1 cm thick, the seeds here ca 0.5 cm long, embedded in a pulp.

PANAMA: Darien: Finca Othon nr Yape, Duke 11820 (MO); Santa Fe, Duke & Bristan 310 (MO); 311 (MO); Rio Morti, Drill Site 7, ca 250 m elev, Duke 11181 (MO); between Rio Punusa & Rio Pucro, Duke 11637 (MO); without specific locality, Duke 8332 (MO).

Duke records that the tree is cultivated for its fruit; these take more than a year to ripen; the falling away of the terminal stipuloid bracts signal the maturation of the berry. The wood is described as soft. The mass of male flowers with the corolla tube stillwithin the calyx has the appearance of a young Morinda fruit in Duke 8332. Common names recorded by Duke are "Borojo", "Borojo Hembra", "Borojo Macho", "Borojo del Monte" (Choco Indians), and "Buriyo" (Choco). Borojoa is closely related to Genipa and therefore should be of interest biochemically.

2. BOROJOA PANAMENSIS Dwyer, spec. nov.

Arbores parvae, ramulis subteretibus fere rimosis ultime subplano-compressis fortasse glabris, internodis ad 9 cm distantibus, cicatricibus petiolorum subrotundis vel cordatis prominentibus, ca 0.4 cm diam. Folia petiolis ad 2 cm longis, in medio ad 0.2 cm latis, laevibus proximaliter turgidis; lamina elliptico-rotunda, apice lato-cuneata, brevi-acuminata, basi cuneata et subaequilaterali, ad 19 cm longa, ad 12.5 cm lata, rigido-chartacea, fortasse glabrescenti praeter costam minute diffuso-auro-pubescentem et praeter axillas venarum principalium saepe auro-barbellatas, costa supra prominula, subtus prominenti et porcata praecipue proximaliter, venibus lateralibus ca 10, supra prominulis, subtus subprominentibus ad prominentibus, ad 3 cm distantibus, plerumque ca 2 cm distantibus, venis tertiariis pinnatiformibus; stipulae superiores persistentes ad medium connatae, tubo cylindrico, ad 1 cm longo, basi prominentia triangulari, ad 6 mm longa, ca 0.5 cm lata notato, aestate provecto fisso reflexoque, partibus liberis obovato-rotundis ad ellipticis, acuminatis, ad 2 cm longis, ad 1 cm latis, plerumque supra medium latioribus, tenui-coriaceis, pallido-brunneis minute venosis, extus carina tenui media ornatis. Flores non visi. Fructus terminales, sessiles, solitarii, globoso-rotundi, ad 4.6 cm longi, ad 1.2 cm diam, ca 0.4 cm alto.

PANAMA: Cocle: Cerro Pilón nr. El Valle de Antón, ca 2700 ft elev, Duke & Dwyer 15014 (MO, holotype); Lallathin 5014 (MO). Panama: Cerro Jefe to Eneida, ca 2700 ft elev, Dwyer, Duke & Dressler 8243 (MO).

Borojoa panamensis is the first new species of the genus to be described north of South America. It is readily distinguished by its elliptic-rotund blades with few lateral veins; these are glabrous except for minute tufts of hairs in the majority of the axils of the secondary veins on the lower side. The common name is "Madrono".

3. BOROJOA SP.

Shrubs small, the branchlets drying tan, diffuse-pilulose.

Leaves with the petioles up to 3 cm long, 0.35 cm wide, puberulent; blades elliptic, cuneate and briefly acuminate at the apex, cuneate to vaguely obtuse and subequilateral at the base, up to 36 cm long, to 13 cm wide, thinly chartaceous, drying black above, moderately diffuse-golden-pilose beneath especially on the veins and the lateral nerves, the costa prominulous above, porcate proximally, prominent beneath, up to 1.8 mm wide, the secondary veins ca 10, widely arcuate, up to 2 cm apart, occasionally with 1-2 irregular and evanescent veins diverging between a pair of lateral veins; stipules not seen; bracts terminal, stipuloid (?), crowded, imbricate, the mass up to 4 cm long and wide, each bract elliptic, cuneate toward the apex but finally obtuse, up to 2.5 cm long, up to 1.5 cm wide, thin-coriaceous, drying black venose, medianally carinate on the outside, golden pilose, the hairs tending to persist only on the margins.

PANAMA: Darien: Cerro Pirre, Bristan 495 (MO).

Unfortunately the collection is sterile. The aggregation of bracts seems particularly noteworthy; these simulate in form and texture the stipules of known species of Borojoa but are not connate at the base, a fact which may be significant.

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In 1928 Standley described Posoqueria pittieri and later transferred this to Tocoyena Aubl. T. pittieri (Standley) Standley ranges from Costa Rica to Panama. Steyermark in his recent treatment of Tocoyena (Mem. N.Y. Bot. Garden 12: 192-197. 1965) considers the genus to be restricted to South America, presumably unaware of T. pittieri and T. obliquinervia (Standley) Standley. Recently I have had the opportunity to examine some excellent material of T. pittieri collected in Panama. In view of Standley's incomplete description I have elected to give the following diagnosis and to consider briefly the genus Tocoyena whose center of distribution appears to be in northern Brazil. The genus extends south to Paraguay.

TOCOYENA PITTIERI (Standley) Standley, Contr. Arn. Arb. 5: 151. 1933.
Posoqueria pittieri Standley, Jour, Wash. Acad. Sci. 18: 167. 1928

Trees up to 10 m high, with the branchlets often nodose, the nodes usually 2-3 cm long, terete, smooth, glabrous, the pith septate. Leaves with the petioles to 3 cm long, ca 0.25 cm wide, glabrous; lamina elliptic, widely cuneate to subrotund at the apex, short-acuminate, the acumen to 1 cm long, ultimately obtuse, cuneate toward the base, often somewhat inequilateral, up to 32 cm long, to 17 cm wide, stiffly chartaceous, black-brown when dry, glabrous except minutely pubescent beneath in the axils of the principal veins, minutely papillate under

magnification, lightly marcescent above, the principal veins ca 10, arcuate, the tertiary veins slender, irregular and open-pinnatiform, plane; stipules not seen. Inflorescence cymose-paniculate, resembling a candelabra, to 13 cm long, ca 11.5 cm wide, the flowers numerous, erect, the bracts and bracteoles triangular-subulate, 0.5-1 mm long. Flowers yellow, the pedicels 1-3 mm long, glabrous; hypanthium oblong, truncate, to 4 mm long, glabrous, the calyx cup ca 1 mm long, scarcely swollen, with the teeth 5, widely triangular-subulate, to 0.5 mm long, glabrous; corolla tube erect, to 9.5 cm long, 2-3.8 mm wide, slender, thickly carnose, occasionally dilated slightly basally, glabrous externally, glabrous within except white-villose at the base, the lobes 5, forming an ovate-rotund mass in the bud, golden-farinose on the outside, at anthesis ovate-elliptic or elliptic-rotund, to 1 cm long, ca 0.65 cm wide, glabrous; stamens 5, exserted at anthesis, the anthers sessile, elliptic, ca 6 mm long, ca 2 mm wide, attached at the apex of the throat; ovary with the wall (including the hypanthium) up to 1 mm thick, 2-locellate, the ovules flat, subrotund, ca 0.2 mm diam, the style ca 0.6 mm wide, the stigmas 2, ovate-lanceolate, crassate, ca 5 mm long, obviously wider than the style, smooth on the adaxial surface. Fruits sessile, solitary, subrotund, obtuse or rotund at the apex, 6-10 cm in diam, woody when dry, the wall thick, to 1.3 cm diam, black when dry, tan within, smooth externally except longitudinally costate, the ribs perhaps 10-15, well-spaced, slender or thick, prominent, not ridge-like, often in part evaescent along their length, the general surface often marked by well-spaced corky eruptions, the seeds flat, ovate-trapeziform, obtuse, to 2 cm long, to 1.3 cm wide, ca 0.5 cm thick, slimy to the touch, the pulp when dry blue-black.

PANAMA: Canal Zone: Barro Colorado Island, Croat 4636 (MO). Darien: La Boca de Pirre, Bristan 1246 (MO); Río Balsa nr Río Coasi, Kirkbride & Duke 1386 (MO); Río Balsa nr Cerro Campamento, S Cerro Pirre, cloud forest, Duke 15599 (MO).

Several additional collections of Tocoyena pittieri have been made on Barro Colorado Island; in fact this has been the only collection site in Panama. Bristan records that the wood is hard; the twigs have a diaphragmed pith which resembles that of our black walnut Juglans nigra L. The corolla is an attractive lemon yellow; on falling from the tree it turns a drab brown (fide Croat; Kirkbride). T. pittieri probably has as large a fruit as is found in any Tocoyena, although judging from the original descriptions, only about only about one third of the species have been described from fruit. The fruit may reach the size of a fist and is marked by distinct although irregular and often incomplete ribs varying considerably in diameter. The fruit wall is lined with a glossy, tan, thin, and hard coat, up to 0.2 mm thick. Kirkbride & Duke note that the fresh pulp is brownish-black; the dried pulp is deep purple, resembling the

dried pulp of Genipa, a relative of Tocoyena. Genipa yields the well-known cyclopentanoid monoterpenes genipin and genipic acid (cf. Tallen in Tetrahedron 20: 178-187. 1964 ; also several papers by Djerassi et al in Journ. Organic Chem., beginning with vol. 23: 2174-2177. 1960.).

Tocoyena ranges from Mexico to Paraguay. T. cubensis (Griseb.) Britton a West Indian species, perhaps would be better placed in Casasia Rich.

In Tocoyena the principal characters separating the species are: the relative size of the leaves, the number of lateral veins of the lamina, the presence or absence of hairs on most parts of the plant, especially on the leaves, the hypanthium, and the inner surface of the corolla lobes; the length of the calycine teeth, the length of the corolla tube; the size and ribbing of the fruit.

The Mexican T. tabascensis Standley is probably not a Tocoyena; the inflorescence has the flowers disposed in threes and the corolla has only 4 lobes. In T. obliquinervia Standley the flowers are much smaller than in T. pittieri and the calycine lobes are not acute but obtuse. Among the South American species T. amazonica Standley, T. brasiliensis Mart., T. brevifolia Steyermark, T. hirsuta Moric ex DC, T. mollis Krause, T. selloana (C. & S.) Schuman have much smaller leaves, measuring up to about 8 cm in width. The leaves of the Peruvian T. hispidula Standley are hispidulous. T. longiflora Aublet, the type species has glabrous foliage but has calycine squamellae and elongate calycine lobes. T. orinocensis Steyermark from Venezuela whose fruits are longitudinally ribbed is probably closely related to T. pittieri, but its corolla lobes and anthers are much larger. The Peruvian T. williamsii Standley is reported as having 6 corolla lobes while T. sprucei Standley has much smaller fruit. T. foetida P. & E., of Brazil and Colombia has much longer floral tubes as in the Venezuelan T. guianensis Steyermark, and a tomentose hypanthium as in T. stipulosa K. Schum., and presumably smaller fruit. T. cuatrecasii Steyermark from Colombia, T. hirsuta from Brazil, T. neglecta Brown, T. surinamensis Brem. from Dutch Guiana, and T. tomentosa Mor. (herbarium name?) from Brazil all differ from T. pittieri in having the leaves very pubescent. Noteworthy is the fact that the corolla lobes of T. costanensis Steyermark from Venezuela and T. cuatrecasii are pubescent within, unlike the lobes of T. surinamensis and T. pittieri. The Venezuelan T. pendulina Spruce ex Standley differs from all Tocoyena (except T. sprucei) in having the leaves widely rounded at the apex; the lamina is up to 8 cm wide with the lateral veins reduced to about 6; the corolla tube is very short, measuring up to 4.5 cm in length.

ADDITIONAL NOTES ON THE ERIOCAULACEAE. XV

Harold N. Moldenke

ERIOCAULACEAE Lindl.

Additional bibliography: Melchior in Engl., Syllabus Pfl., ed. 12, 2: 19, 20, 24, 26 & 554--556, fig. 230. 1964; M. E. S. Morrison, Journ. Ecol. [Brit.] 56: 373, fig. 5. 1968; D. Walker, Journ. Ecol. [Brit.] 56: 451. 1968; Moldenke, Phytologia 17: 372-395. 1968.

Morrison (1968) reports the finding of eriocaulaceous pollen in Uganda swamps, which he feels is not from the genera Mesanthemum or Syngonanthus, since these genera are recorded only from swamps at lower elevations.

BLASTOCAULON Ruhl.

Additional bibliography: Melchior in Engl., Syllabus Pfl., ed. 12, 2: 556. 1964; Moldenke, Phytologia 17: 373. 1968.

COMANTHERA L. B. Sm.

Additional bibliography: Melchior in Engl., Syllabus Pfl., ed. 12, 2: 556. 1964; Moldenke, Phytologia 17: 376--377. 1968.

ERIOCAULON Gron.

Additional bibliography: Melchior in Engl., Syllabus Pfl., ed. 12, 2: 555 & 556, fig. 230 A--K. 1964; M. E. S. Morrison, Journ. Ecol. [Brit.] 56: 373, fig. 5. 1968; D. Walker, Journ. Ecol. [Brit.] 56: 451. 1968; Moldenke, Phytologia 17: 377--395. 1968.

ERIOCAULON ABYSSINICUM Hochst.

Additional bibliography: Moldenke, Phytologia 17: 382--383 & 387. 1968.

ERIOCAULON ACHITON Körn.

Additional bibliography: Moldenke, Phytologia 17: 383--384 & 386. 1968.

ERIOCAULON ALPESTRE Hook. f. & Thoms.

Additional bibliography: Moldenke, Phytologia 17: 385--386 & 390. 1968.

ERIOCAULON AMBOËNSE Schinz

Additional bibliography: Moldenke, Phytologia 17: 383 & 387. 1968.

ERIOCAULON ATRUM Nakai

Additional bibliography: Moldenke, Phytologia 17: 386 & 390. 1968.

ERIOCAULON AUSTRALASICUM (F. Muell.) Körn.
Additional bibliography: Moldenke, Phytologia 17: 382 & 391. 1968.

ERIOCAULON BLUMEI Körn.
Additional bibliography: Moldenke, Phytologia 17: 395. 1968.
Additional citations: INDONESIA: GREATER SUNDA ISLANDS: Java: Backer 12567 (Ut—53018, Z), 26071 (Ut—52813); Pulle 3079 (Ut—2666, Ut—2667). Sumatra: Bünnemeyer 9728 (B).

ERIOCAULON BOMBAYANUM Ruhl.
Additional bibliography: Moldenke, Known Geogr. Distrib. Erioc. 23 & 32. 1946; Moldenke, Résumé 161 & 480. 1959.
Additional citations: INDIA: Bombay: Warburg 876 (B—type, Z—isotype).

ERIOCAULON BONGENSE Engl. & Ruhl.
Additional bibliography: Moldenke, Known Geogr. Distrib. Erioc. 20, 21, & 33. 1946; Moldenke, Résumé 133, 134, 136, 138, 146, & 480. 1959; Moldenke, Phytologia 2: 6 (1960) and 4: 6. 1962; J. & A. Raynal, Adansonia 7: 329. 1967; Berhaut, Fl. Sénégal, ed. 2, 311. 1967; Moldenke, Résumé Suppl. 16: 7. 1968; Moldenke, Phytologia 17: 385. 1968.
The Raynals found this plant growing on alluvium of the Niger River on inundated prairies, flowering in December; they report (1967) that the species is common in Gambia and Sénégal. On the label of their no. 5306 ter they claim that this specimen is identical with their no. 5230; a splendid series of drawings of the plant accompanies their no. 5306 ter collection deposited in my personal herbarium. Berhaut (1967) cites his no. 6662 from Sénégal.
Additional citations: MALI: Soudan: Jaeger 5126 (Gg); Raynal & Raynal 5306 ter (Z). CHAD: Schweinfurth 2539 (S), 2722 (B—type, Z—isotype). SÉNÉGAL: Winkoren 2 (Z). REPUBLIC OF GUINEA: Pitot s.n. [24.IV.1949] (An).

ERIOCAULON BONI H. Lecomte
Additional bibliography: Moldenke, Known Geogr. Distrib. Erioc. 26 & 61. 1946; Moldenke, Résumé 175 & 480. 1959.
Additional citations: INDOCHINA: Tonkin: Eberhardt 3834 bis (Mg).

ERIOCAULON BRACHYPEPLON Körn.
Additional bibliography: Moldenke, Known Geogr. Distrib. Erioc. 33. 1946; Moldenke, Phytologia 3: 184. 1949; Moldenke, Résumé 204 & 480. 1959.

ERIOCAULON BREVIFOLIUM Klotzsch
Additional bibliography: Moldenke, Known Geogr. Distrib. Erioc. 6 & 33. 1946; Moldenke, Phytologia 3: 322 (1950) and 4: 341. 1953; Moldenke, Résumé 75 & 480. 1959.

Gleason, in his unpublished notes for a Flora of British Guiana, describes this species as: "Leaves all basal, cespitose, 5—7 cm. long, 1.5—2.5 mm. wide, thinly pubescent toward the base; peduncles 1—4, 1—4 dm. high, straight of somewhat twisted, glabrous, the basal sheaths somewhat exceeding the leaves; heads subglobose, 5—8 mm. in diameter; bracts broadly ovate or subrhombic; subtending bracts similar in shape, acute, hirsute at the apex." He says that it inhabits savannas, and cites only the type collection (Rob. Schomburgk 107) and Appun 1538 & 2218.

An isotype, Rob. Schomburgk 107, in the Delessert Herbarium at the Conservatoire et Jardin Botaniques in Geneva, was photographed there by Macbride as his type photograph number 25158. The E. brevifolium of Martius is a synonym of E. sellowianum Kunth.

Additional citations: BRITISH GUIANA: Dirven LP.186 (Ut—283788); Rob. Schomburgk 107, in part [Macbride photos 25158] (B—type, N—isotype, W—702519—isotype, Z—photo of isotype). MOUNTED ILLUSTRATIONS: drawings & notes by Körnicke (B).

ERIOCAULON BREVIFOLIUM var. PROLIFERUM Moldenke

Additional bibliography: Moldenke, Mem. N. Y. Bot. Gard. 9: 78. 1957; Moldenke, Bull. Jard. Bot. Brux. 27: 130. 1957; Moldenke, Résumé 71 & 480. 1959.

The Vareschi & Maegedfrau 6698, distributed as E. brevifolium var. proliferum, is actually Syngonanthus xeranthemoides (Bong.) Ruhl., while their 6706 & 6717 [Herb. Nac. Venez. 42557 & 42558] are actually something in the Cyperaceae.

ERIOCAULON BREVIPEDUNCULATUM Merr.

Synonymy: Eriocaulon acaule Fosberg, Govt. Sarawak Sympos. Ecolog, Res. Humid Trop. Veg. 286. 1965 [not E. acaule Pennell, 1959].

Additional & emended bibliography: Moldenke, Known Geogr. Distrib. Erioc. 26, 27, & 61. 1946; Moldenke, Bull. Jard. Bot. Brux. 27: 130. 1957; Moldenke, Résumé 184, 192, 201, & 480. 1959; Moldenke, Résumé Suppl. 1: 14 (1959) and 8: 3. 1964; Moldenke, Biol. Abstr. 45: 5019. 1964; F. R. Fosberg, Govt. Sarawak Sympos. Ecol. Res. Humid Trop. Veg. 286. 1965; Moldenke, Résumé Suppl. 13: 7. 1966.

Recent collectors have found this plant growing in open barren country on the west side of a clay-stone plateau, in boggy meadows by pools, in wet pools, on wet and cold bare windswept granite, and in swamps surrounded by treefern grasslands, at altitudes of 8000—12,500 feet, flowering in June and November, fruiting in May and November, and called "pehndigi" and "poio" by the natives of the region. Collectors report that it is "tuft-forming", "densely cespitose", or "grows in mats". The E. acaule Pennell, referred to in the synonymy above, is a synonym of Syngonanthus peruvianus Ruhl.

Additional citations: WESTERN PACIFIC ISLANDS: PHILIPPINE ISLANDS: Mindoro: E. D. Merrill 6214 (B—isotype, N—isotype). IN-

DONESIA: GREATER SUNDA ISLANDS: Celebes: Eyma 863 (Ut--11517b). Sabah: M. S. Clemens 10504 (Ca--214441), 10611 (Ca--214439, Z); Clemens & Clemens 32336 (Ca--541311), 51120 (Ca--557560). MELANESIA: NEW GUINEA: Dutch New Guinea: Hoogland & Schodde 7031 (W--2393235). Northeastern New Guinea: M. S. Clemens 7409 (B), 9942 (B).

ERIOCAULON BREVIPEDUNCULATUM var. ANGUSTIFOLIUM Moldenke

Additional bibliography: Moldenke, Biol. Abstr. 27: 984. 1953; Moldenke, Bull. Jard. Bot. Brux. 27: 131. 1957; Moldenke, Résumé 201 & 480. 1959; Moldenke, Résumé Suppl. 1: 14. 1959.

Mrs. Clemens found this plant growing in boggy marshes and open alpine places, at 7000--9000 feet altitude.

Additional citations: MELANESIA: NEW GUINEA: Northeastern New Guinea: M. S. Clemens 5584 (B), 5655a (B), 9368 (B).

ERIOCAULON BREVIPEDUNCULATUM var. LONGIPES Moldenke

Bibliography: Moldenke, Phytologia 9: 360. 1963; Hocking, Excerpt. Bot. A.7: 455. 1964; Moldenke, Biol. Abstr. 45: 5019. 1964; Moldenke, Résumé Suppl. 8: 3. 1964.

Citations: MELANESIA: NEW GUINEA: Dutch New Guinea: Hoogland & Schodde 7647 (W--2377945--type).

ERIOCAULON BREVISCAPUM Körn.

Synonymy: Eriocaulon breviscapon Körn. ex Thanikaimoni, Pollen & Spores 7: 184. 1965.

Additional bibliography: Moldenke, Known Geogr. Distrib. Erioc. 23 & 33. 1946; Moldenke, Phytologia 3: 184. 1949; Moldenke, Résumé 161 & 480. 1959; Moldenke, Résumé Suppl. 3: 17 & 19. 1962; Thanikaimoni, Pollen & Spores 7: 184. 1965; Moldenke, Résumé Suppl. 14: 8. 1966.

Recent collectors state that this is a common herb on rocks in streams in Cambodia, the flowers being "dirty-white", blooming in February, at 1000 meters altitude.

Additional citations: INDOCHINA: Cambodia: Smitinand & Abbe 6450 (Z). MOUNTED ILLUSTRATIONS: drawings & notes by Körnicke (B).

ERIOCAULON BROMELIOIDEUM H. Lecomte

Additional bibliography: Moldenke, Known Geogr. Distrib. Erioc. 26 & 61. 1946; Moldenke, Résumé 175 & 480. 1959.

ERIOCAULON BROWNIANUM Mart.

Synonymy: Eriocaulon brownianum Wall., Numer. List 207. 1832. Eriocaulon brownianum R. Br. ex Moldenke, Résumé Suppl. 1: 16, in syn. 1959.

Additional bibliography: Moldenke, Bull. Jard. Bot. Brux. 27: 131--132. 1957; Moldenke, Résumé 159, 161, 167, 176, 286, 294, & 480. 1959; Moldenke, Résumé Suppl. 1: 11 & 16. 1959; Panigrahi & Naik, Bull. Bot. Surv. India 3: 383. 1961; Thanikaimoni, Pollen & Spores 7: 184. 1965; Moldenke, Phytologia 17: 395. 1968.

Recent collectors have found this plant growing in old fields, at altitudes of 5900—6000 feet, flowering in August and November, and fruiting in November. Chand describes it as 20 inches tall, with "grayish-white" flowers. Koorders claims that E. blumei Körn. is a synonym of this taxon, but it is glabrous!

Material has been misidentified and distributed in herbaria as E. nilagirense Steud.

Additional citations: PAKISTAN: East Bengal: De Silva 2 [Wallich 6066] (B—isotype); Griffith 5574 (S). INDIA: Assam: Chand 7993 (Mi). Khasi States: Hooker & Thomson 32 (B), s.n. [Mont. Khasia, 3-5000 ped.] (S, Ut—306). Madras: Herb. Presid. Coll. Madras 3331 (B). State undetermined: Collector undesignated 123 [Mons Pangerango] (S, S); Herb. Univ. Mich. s.n. [Mountains of India] (Mi); Wight s.n. [Ind. or.] (V—41209, V—41339). CEYLON: Børgesen s.n. [13/3/1928] (Cp); H. Saint John 24128 (Bi).

ERIOCAULON BROWNIANUM var. LATIFOLIUM Moldenke

Additional bibliography: Moldenke, Bull. Jard. Bot. Brux. 27: 132. 1957; Moldenke, Résumé 167 & 480. 1959.

Additional citations: CEYLON: Børgesen s.n. [13/3/1928] (Cp).

ERIOCAULON BRUNONIS Britten

Additional bibliography: Moldenke, Bull. Jard. Bot. Brux. 27: 132. 1957; Moldenke, Résumé 208, 286, 292, 342, & 480. 1959.

The label of Schultz 261, cited below, also bears the inscription "Rich. Schomburgk 261".

Additional citations: AUSTRALIAN REGION: AUSTRALIA: South Australia: Schultz 261 (B—isotype, Z—isotype).

ERIOCAULON BUCHANANII Ruhl.

Synonymy: Eriocaulon buchanani Ruhl. ex Moldenke, Résumé Suppl. 1: 16, in syn. 1959.

Additional bibliography: J. Hutchinson, Botanist in South. Afr. 499. 1946; H. Hess, Bericht. Schweitz. Bot. Gesell. 67: 84. 1957; Moldenke, Résumé 144, 147, 149, 418, & 480. 1959; Moldenke, Résumé Suppl. 1: 8 & 16 (1959), 4: 6 (1962), and 16: 8. 1968.

Milne-Redhead & Taylor describe this plant as an annual, the leaves "similar to those of 10885", slightly bronzy-green, with rather parallel sides; sheathes pale- or yellow-green; scapes erect, scarcely diverging or tending to spread, green or pale-green; involucral bracts pale brownish-gray or pale-brown; floral bracts brownish-gray or blackish with grayish tips, very acute; anthers blackish or greenish-black; style white; growing in damp rather deep hollows in Brachystegia-Uapaca woodlands where water has been standing, also on sandy ground in the same woodland with Lipocarpha and Naesea species and in derelict cultivated ground in riverside grassland on boggy soil. It has been collected at altitudes of 900—1320 meters, flowering in June. Hess (1957) records it from Angola, Southern Rhodesia, and Sénégal. Hutchinson (1946) cites his no. 3647. Material has been misiden-

tified and distributed in herbaria as E. plumale N. E. Br. and as E. transvaalicum N. E. Br.

Additional citations: SÉNÉGAL: J. G. Adam 17239 (Z); Raynal & Raynal 6946 bis (An). REPUBLIC OF GUINEA: Chillou 726 (An); Pitot 226 (An), s.n. [9.X.1950] (An), s.n. [16.X.1950] (An, An); Schuell 2154 (N, N--photo). TANGANYIKA: Milne-Redhead & Taylor 10886 (B), 10892 (B); Whyte s.n. [Post Hill] (B--cotype, Z--cotype). ANGOLA: Huila: H. Hess 52/2003 (B). RHODESIA: E. A. Robinson 5541 (N). MALAWI: Buchanan 1168 (B--cotype); Stolz 1344 (B, N--photo, S, Ut--64478, V--10809).

ERIOCAULON BUERGERIANUM Körn.

Synonymy: Eriocaulon pachypetalum Hayata, Icon. Pl. Formos. 10: 52, fig. 29. 1921. Eriocaulon nipponicum Körn. ex Moldenke, Résumé Suppl. 1: 17, in syn. 1959 [not E. nipponicum Maxim., 1892, nor Tatew., 1938].

Additional bibliography: Koyama, Philip. Journ. Sci. Bot. 84: 368. 1956; Moldenke, Bull. Jard. Bot. Brux. 27: 133. 1957; Moldenke, Résumé 132, 169, 172, 174, 176, 181, 290, & 480. 1959; Moldenke, Résumé Suppl. 1: 12 & 17 (1959) and 3: 17. 1962; Hatusima, Mem. South. Indust. Sci. Inst. Kagoshima Univ. 3 (2): 123. 1962; Koyama in Kitamura, Murata, & Koyama, Col. Illustr. Herb. Pl. Japan 183, pl. 48, fig. 308, text fig. 125 (2). 1964.

The plate in Koyama's (1964) work is in full color. The E. nipponicum Maxim., referred to in the synonymy above, is a valid species, while E. nipponicum Tatew. is a synonym of xE. perplexum Satake & Hara; the E. nipponicum of Körnicke is a cheironym which he placed on Savatier 1361 in the Berlin herbarium [it should be pointed out, however, that this and the other Savatier collection cited below may actually be Franchet numbers].

Eriocaulon buergerianum has been found growing in the retaining walls of rice terraces, but is said by Lau to be "rare" in Kwangtung. It has been collected in anthesis and fruit in August. Koyama (1956) gives its overall distribution as "China, Formosa, Liukiu, Japan" and cites Hayata s.n. from Tonkin, which he says is a new record for Indochina.

Material has been misidentified and distributed in herbaria under the names E. sexangulare L., E. sieboldianum Sieb. & Zucc., and E. wallichianum Mart. The Faber s.n. collection cited below is a mixture with E. cristatum Mart. On the other hand, the Kawakami 431, distributed as E. buergerianum, is actually E. pterospermum Hayata, while W. T. Tsang 535 [Herb. Lingnan Univ. 16034] is E. sinii Ruhl.

Additional citations: CHINA: Anhwei: R. C. Ching 4550 [Herb. Univ. Nanking 8939] (Ca--263593). Kwangsi: W. T. Tsang 23167 (V--8303). Kwangtung: Lau 708 (N); W. T. Tsang 20687 (B, Cp, S, V--1838, V--4618), 21681a (N). Manchuria: Bohnhof 294 (N). Yunnan: Maire 2331 (Ca--222835). Province undetermined: Faber

s.n. (N). CHINESE COASTAL ISLANDS: Hainan: Tak 535 [Herb. Lingnan Univ. 16034] (Ca—326638); W. T. Tsang 535 [Herb. Lingnan Univ. 16034] (N). WESTERN PACIFIC ISLANDS: JAPAN: Honshu: Savatier 1361 (B), 1361 bis (B).

ERIOCAULON BURCHELLII Ruhl.

Additional bibliography: Moldenke, Bull. Jard. Bot. Brux. 27: 134. 1957; Moldenke, Résumé 88 & 480. 1959; Moldenke, Résumé Suppl. 11: 4. 1964.

The type, Burchell 7812, deposited in the herbarium of the Botanisches Museum in Berlin, was photographed there by Macbride as his type photograph number 10556.

Additional citations: BRAZIL: Goiás: Burchell 7812 [Macbride photos 10556] (B—type, W—photo of type).

ERIOCAULON CAAGUAZUENSE Ruhl.

Additional bibliography: Moldenke, Bull. Jard. Bot. Brux. 27: 134. 1957; Moldenke, Résumé 116, 286, & 480. 1959.

Additional citations: PARAGUAY: Balansa 564 (P); Hassler 8885 (B—type, V—1433— isotype), 9425 (V—7011).

ERIOCAULON CABRALENSE Alv. Silv.

Synonymy: Eriocaulon cubralense Alv. Silv., Fl. Mont. pl. 5a, sphalm. 1928.

Bibliography: Alv. Silv., Archiv. Mus. Nac. Rio Jan. 23: 162, pl. 4. 1921; Alv. Silv., Fl. Mont. 17—19, pl. 5 & 5a. 1928; Moldenke, Known Geogr. Distrib. Erioc. 7 & 33. 1946; Moldenke, Résumé 88, 287, & 480. 1959.

ERIOCAULON CAESIUM Griseb.

Additional bibliography: Moldenke, Known Geogr. Distrib. Erioc. 5 & 33. 1946; Moldenke, Phytologia 3: 185. 1949; Moldenke, Résumé 63 & 480. 1959.

The W. E. Broadway 2145, distributed as E. caesium, is actually Paepalanthus lamarckii Kunth.

ERIOCAULON CANDIDUM Moldenke

Additional bibliography: Moldenke, Bull. Jard. Bot. Brux. 27: 134. 1957; Moldenke, Résumé 88 & 480. 1959.

ERIOCAULON CAPITULATUM Moldenke

Additional bibliography: Moldenke, Phytologia 2: 132—133. 1948; Moldenke, Résumé 35 & 480. 1959.

ERIOCAULON CARSONI F. Muell.

Synonymy: Eriocaulon submersum Tate, Trans. Roy. Soc. S. Austral. 23: 291. 1899 [not E. submersum Welw., 1899]. Eriocaulon tatei Ruhl. in Engl., Pflanzenreich 13 (IV, 30): 117. 1903. Eriocaulon carsonii F. Muell. ex Moldenke, Known Geogr. Distrib. Erioc. 27 & 33. 1946.

Bibliography: F. Muell., Proc. Linn. Soc. New S. Wales 5: 250. 1890; F. Muell., Bot. Centralbl. 44: 302. 1890; Moore & Betche, Handb. Fl. New S. Wales 440. 1893; Tate, Trans. Roy. Soc. S. Austral. 23: 291. 1899; Ruhl. in Engl., Pflanzenreich 13 (IV, 30): 98 & 117. 1903; Maiden & Betche, Census New S. Wales Pl. 38. 1916; Black, Fl. S. Austral., ed. 2, 1: 179. 1943; Moldenke, Known Geogr. Distrib. Erioc. 27 & 33. 1946; Moldenke, Résumé 208 & 480. 1959; O. D. Evans, Contrib. New S. Wales Nat. Herb., Fl. Ser., 27/28: 10 & 12. 1966; Moldenke, Résumé Suppl. 16: 12 & 21. 1968.

Evans (1966) describes this plant as follows: "Small, glabrous, scapigerous herb, possibly perennial. Leaves basal, tufted, lanceolate, gradually narrowed upward to an obtuse, often incurved apex, up to 6 cm. long and 0.5 cm. wide, the base enlarged and sheathing. Scapes rather robust, twice as long as the leaves or somewhat longer, angular. Flower-heads globose, up to 5 mm. diam. Involucral bracts ovate, obtuse, rounded, glabrous; fertile bracts obovate, obtuse, membranous, glabrous; central axis (receptacle) narrow-conical, up to 4 mm. long. Flowers scarcely numerous. Male flowers: outer tepals 3, spathulate- or linear-cuneate, somewhat lacerated at the apex; basal parts of the inner tepals fused into an obconical tube conspicuously longer than the lobes which are slightly fringed and each marked by a dark glandular spot. Stamens mostly 6; anthers rounded and almost black. Female flowers: outer tepals often 2 only, broad, cymbiform-conduplicate, whitish, opaque; inner tepals 3, ovate- to narrow-lanceolate, apiculate, brownish upward. Style short; stigmatic branches 3, filamentous. Fruit a membranous, turgid capsule, 3-valved. Seeds ellipsoid, shining, almost smooth, brown, ca. 0.6 mm. long." He states that the type was collected in New South Wales and that the species forms ample tufts in wet ground adjoining a somewhat saline spring, called by the aborigines Wee Watta spring, on Kallara Station, Darling River, near Louth. The type was collected by Carson in March, 1888, and is no. 66346 in the New South Wales National Herbarium. He adds "Also in South Australia where it is reported to have formed dense mats in a bog at springs between Lakes Blanche and Frome. In New South Wales it is known only from the type locality. Search is desirable at appropriate sites in the far west for further occurrence of this species. Recent endeavours to find it have been unsuccessful. The original description of E. submersum Tate is incorrect in several respects. It stated that the female flower is tetramerous, with 2 sepals, 4 petals and a 2-branched style, also that the glabrous flower-heads and the form of the bracts distinguished it from all other Australian species. Tate noticed, however, that the fourth 'petal' was distinct from the others. Careful examination of the type shows that it agrees with the description above under E. carsonii."

ERIOCAULON CAULIFERUM Mak.

Additional & emended bibliography: Moldenke, Known Geogr.

Distrib. Erioc. 25 & 61. 1946; Moldenke, Bull. Jard. Bot. Brux. 27: 134—135. 1957; Moldenke, Résumé 172 & 480. 1959; Koyama in Kitamura, Murata, & Koyama, Col. Illustr. Herb. Pl. Japan 178, text fig. 120 (2). 1964.

ERIOCAULON CEYLANICUM Körn.

Additional synonymy: Eriocaulon zeylanicum Körn. ex Moldenke, Résumé 294, in syn. 1959.

Additional & emended bibliography: Fyson, Journ. Indian Bot. 2: 310 & 312. 1921; Moldenke, Known Geogr. Distrib. Erioc. 24 & 33. 1946; Moldenke, Bull. Jard. Bot. Brux. 27: 135. 1957; Moldenke, Résumé 167, 286, 294, & 480. 1959; Thanikaimoni, Pollen & Spores 7: 184. 1965.

G. Gardner 934 appears to be the type collection of E. ceylanicum Körn. and a cotype collection of the so-called E. subcaulescens Hook. f. I therefore feel now that the latter name is not worthy of recognition and that it should be reduced, along with E. ceylanicum var. subcaulescens (Hook. f.) Fyson, to synonymy under E. ceylanicum Körn.

Saint John found this species growing in a swamp at 7500 feet altitude, flowering in November. Material has been misidentified and distributed in herbaria under the name E. argenteum Bong. Fyson (1921) is of the opinion that E. ceylanicum and E. cristatum Mart. are related.

Additional citations: CEYLON: G. Gardner 934 (B—type, B—isotype, N—isotype, N—photo of isotype); Herb. Bentham s.n. (Ut—313); H. Saint John 24154 (Bi); Uzel s.n. [1902] (V—10086).

ERIOCAULON CHINOROSSICUM Lom

Additional bibliography: Moldenke, Known Geogr. Distrib. Erioc. 61. 1946; Moldenke, Résumé 132 & 480. 1959.

ERIOCAULON CHRISTOPHERI Fyson

Additional bibliography: Moldenke, Known Geogr. Distrib. Erioc. 23 & 61. 1946; Moldenke, Résumé 161 & 480. 1959; Moldenke, Résumé Suppl. 11: 6. 1964; Thanikaimoni, Pollen & Spores 7: 184. 1965.

Thanikaimoni (1965) regards this taxon as a synonym of E. collinum Hook. f.

ERIOCAULON CILIIPETALUM H. Hess

Additional bibliography: Anon., Assoc. Etud. Tax. Fl. Afr. Trop. Index 1955: 30. 1956; Moldenke, Bull. Jard. Bot. Brux. 27: 135—136. 1957; Moldenke, Résumé 145 & 480. 1959.

ERIOCAULON CINEREUM R. Br.

Emended synonymy: Leucocephala spathacea Roxb., Hort. Beng. 68, hyponym (1814), Fl. Ind. 3: 613. 1832. Eriocaulon nitidum Buch.-Ham. ex Wall., Numer. List 207, no. 6073, hyponym. 1832. Eriocaulon tenue Buch.-Ham. ex Wall., Numer. List 207, no. 6073,

hyponym. 1832. Eriocaulon sieboldtianum Sieb. & Zucc. ex Steud., Syn. Pl. Cyp. 2: 272. 1855. Eriocaulon sexangulare var. α Körn., Linnaea 27: 613. 1856. Eriocaulon sexangulare var. β Körn., Linnaea 27: 613. 1856. Eriocaulon sexangulare var. γ Körn., Linnaea 27: 613. 1856. Eriocaulon heteranthum Benth., Fl. Hongkong 382. 1861. Eriocaulon sieboldianum Sieb. & Zucc. ex Jacks. in Hook. f. & Jacks., Ind. Kew., pr. 1, 1: 879. 1893. Eriocaulon stuhlmanni N. E. Br. in Thiselt.-Dyer, Fl. Trop. Afr. 8: 255. 1901. Eriocaulon formosanum Hayata, Icon. Pl. Formos. 10: 49, fig. 27. 1921. Eriocaulon cinereum Merr. apud Satake, Rev. Jap. Eriocaul. 11, in syn. 1940. Eriocaulon sexangulare Mart. apud Satake, Rev. Jap. Eriocaul. 11, in syn. 1940. Eriocaulon sieboldianum Steud. ex Moldenke, Phytologia 3: 181, in syn. 1949. Eriocaulon siebolotianum Sieb. & Zucc. apud Koyama, Philip. Journ. Sci. Bot. 84: 373, sphalm. 1955. Eriocaulon hexangulare Wall. ex Moldenke, Résumé 288, in syn. 1959. Eriocaulon sieboltianum Sieb. & Zucc. ex Moldenke, Résumé 292, in syn. 1959. Eriocaulon setaceum Willd. ex Moldenke, Résumé 292, in syn. 1959. Eriocaulon sexangulare Auct. ex Moldenke, Résumé 292, in syn. 1959. Eriocaulon tenue Hamilt. ex Moldenke, Résumé 293, in syn. 1959. Eriocaulon quinquangulare var. β Körn. ex Moldenke, Résumé Suppl. 1: 18, in syn. 1959. Eriocaulon quinquangulare β pusillum Körn. ex Moldenke, Résumé Suppl. 1: 18, in syn. 1959. Eriocaulon setaceum Rottler ex Moldenke, Résumé Suppl. 2: 9, in syn. 1960. Eriocaulon cinerea S. & Z. ex Moldenke, Résumé Suppl. 3: 31, in syn. 1962. Eriocaulon sieboldii S. & Z. ex Moldenke, Résumé Suppl. 3: 32, in syn. 1962. Eriocaulon siiboldianum S. & Z. ex Moldenke, Résumé Suppl. 3: 32, in syn. 1962. Eriocaulon cinereum var. sieboldianum (Sieb. & Zucc.) Murata ex Koyama in Kitamura, Murata, & Koyama, Col. Illustr. Herb. Pl. Japan 178--179, pl. 48, fig. 304, text fig. 121 (1). 1964. Eriocaulon sieboldianum Sieb. ex Sebastine & Ramamurthy, Bull. Bot. Surv. India 8: 182. 1966. Eriocaulon sieboldianum "Sieb. & Zucc. ex Steud." apud J. L. Ellis, Bull. Bot. Surv. India 8: 339. 1966.

Additional & emended bibliography: Kawakami, List Pl. Formos. 130. 1910; F. M. Bailey, Compreh. Cat. Queensl. Pl. 584. 1913; Moldenke, Known Geogr. Distrib. Erioc. 23--27, 33, 35, 38, 40, 44, & 61. 1946; Koyama, Philip. Journ. Sci. Bot. 84: 373. 1955; Masa Ikusi, Pollen Gr. Jap. 1956; E. H. Walker, Proc. 8th Pacif. Sci. Cong. 4: 406. 1957; Moldenke, Résumé 32, 144, 159--161, 165, 167, 169, 171, 172, 174, 176, 178, 181, 184, 188, 190, 207, 208, 287, 288, 290, 292, 293, 309, & 480. 1959; Moldenke, Résumé Suppl. 1: 12 & 18 (1959), 2: 9 (1960), 3: 17, 18, 21, 31, & 32 (1962), and 4: 7. 1962; G. L. Shah, Bull. Bot. Surv. India 4: 237. 1962; Hatusima, Mem. South. Indust. Sci. Inst. Kagoshima Univ. 3 (2): 123. 1962; J. Joseph, Bull. Bot. Surv. India 5: 297.

1963; Prain, Bengal Pl., ed. 2, 2: 848. 1963; Koyama in Kitamura, Murata, & Koyama, Col. Illustr. Herb. Pl. Japan 178—179, pl. 48, fig. 304, text fig. 121 (1). 1964; Bhattacharyya, Bull. Bot. Surv. India 6: 208. 1964; Panigrahi, Chowdhury, Raju, & Deka, Bull. Bot. Surv. India 6: 260—261. 1964; C. M. & D. S. Patel, Vidya 7: [58]—70, fig. 1—59. 1964; Moldenke, Résumé Suppl. 11: 6 (1964) and 12: 9. 1965; Thanikaimoni, Pollen & Spores 7: 182 & 184. 1965; J. S. Beard, Descrip. Cat. W. Austr. Pl. 9. 1965; S. V. Ramaswami, Study Flow. Pl. Bangalore (thesis) 219—221 & 1407. 1966; Subramanyam & Henry, Bull. Bot. Surv. India 8: 214. 1966; Sebastine & Ramamurthy, Bull. Bot. Surv. India 8: 182. 1966; Shinners, Sida 2: 441. 1966; Kral, Sida 2: 310—312 & 330. 1966; J. L. Ellis, Bull. Bot. Surv. India 8: 329 & 339. 1966; Moldenke, Résumé Suppl. 15: [1], 8, & 10 (1967) and 16: 9 & 21. 1968; Moldenke, Phytologia 17: 395. 1968.

Recent collectors have found this plant growing in mud of dried ponds and paddy-fields, in rice fields, in open places by the sides of fields, and in drained rice paddies after the grain is harvested, at altitudes of 200—2000 meters, flowering in January, February, and August to November, fruiting in August and September. Raizada describes it as a "small herb in damp depressions" in Bashahr; Smitinand found it "common in wet localities in savannas" in Thailand; Ellis says "marshy plants near fringes of puddles formed in rainy season of January to February" in Andhra Pradesh; Steward & Cheo say "cultivated in field" in Kwangsi, but surely they mean "in cultivated field"; Sebastine & Ramamurthy (1966) tell us that it is common in Madras, citing their no. 15644. Bhattacharyya (1964) found it to be "common in marshy areas" in Uttar Pradesh; Joseph (1963) found it "common on riverbanks" in Madhya Pradesh; and Panigrahi and his associates (1964) report it as "common" in Orissa. Prain (1963) assures us that in Bengal it is "In most of the provinces. A herb of rice-field and marshy ground". Ellis (1966) records it from Andhra Pradesh and cites no. 15788, while Subramanyam & Henry cite no. 18707 from Madhya Pradesh. Koyama (1955) cites Hayata s.n. from Annam and gives the over-all distribution of the species as "Tonkin, Cochin-china, Philippines, Formosa, Liukiu, China, Japan, Malaysia, Africa, India".

Kral (1966) describes the species as follows: "Solitary or in small tufts, the leaves narrow, linear-attenuate, to 9 cm. long, green, thin, tapering very gradually to a filiform tip. Scape of the sheath 2—4 cm. long, definitely shorter than the leaves, scarious and bifid-acute above. Mature scape filiform, 15—30 cm. long, slightly twisted, 6—8 ridged. Mature head subglobose to very broadly ovoid, about 4 mm. broad, silvery-gray, somewhat chaffy in appearance. Outer involucral bracts ranging from obovate to lanceolate, ca. 2 mm. long, scarious, pale, the tips acute, often lacerate or erose. Receptacular bractlets linear-oblong, ca. 2 mm. long, scarious, pale save for a grayish mid-region, the tips acute. Surface of the receptacle of the head with a few long, very slender, transparent, multicellular tri-

chomes. Male flower: sepals united into a single spatulate, lustrous, scarious, 3-lobed scale which is gray-translucent toward the apex, pale toward the clawed, tubular base, glabrous save for a few white, short-linear trichomes at or toward the tip. Petals 3, joined into a yellowish tubular-clavate androphore ca. 2 mm. long whose base is enveloped by the calyx tube and whose apex is divided into 3 small, scale-like, white-hairy (the hairs tapering) glanduliferous lobes. Central glands 3, white or yellowish-white. Stamens 6. Anthers broadly ellipsoidal, ca. 0.25 mm. long, yellow, on white filaments about as long as the corolla lobes. Female flowers: perianth consisting of 2 or 3 (if 3, one much narrower and shorter) linear, flat, pale, translucent scales ca. 1.5 mm. long whose margins or connivent, acute tips may bear a few multicellular clear trichomes. Gynophore at least 1 mm. long, usually somewhat longer, smooth. Gynoecium 3-carpellary; style branches 3. Seeds ovoid, slightly less than 0.5 mm. long, pale brown, reticulate, the rectangular compartments of the reticule oriented perpendicularly to the axis of the seeds."

If it can be assumed that this description has been taken from the California specimen cited by this monographer, then it should be compared carefully with descriptions of the Old World material of E. cinereum. The California plant has quite a different aspect from at least most of the Old World material and I am not at all sure that the California specimens are properly placed in this species. Kral goes on to say "Adventive in rice paddies, Stanislaus County, California. Reported as native in northern Australia and in the rice growing regions of the south Pacific. I have so far examined only one U. S. collection of this species, the citation for it being: 'Krause rice fields, Modesto. Plants submersed except for upper part of flowering stems, Stanislaus County, California, Basil G. Markos, Sept. 18, 1947'. I visited the rice areas around Modesto during the summer of 1964 but was unable to find the plants."

Vernacular names reported for the species are "hoshikusa" or "hoshi-kusa". Ruhland, on a label of Pringle 3855 in the Berlin herbarium, states that E. bilobatum Morong is probably conspecific with this taxon. In this I cannot agree with him. The plate in Koyama's (1964) work is in full color.

Material has been misidentified and distributed in herbaria under the names E. dianae Fyson, E. merrillii Ruhl., E. minimum Lam., E. parvum Körn., E. sexangulare L., and E. truncatum Hamilt., as well as "Eriocaulon sp.", "Eriocaulon affine sexangulari L." [by Miquel], and even Xyris microcephala.

On the other hand, the R. C. Ching 4550 and Herb. Univ. Nanking 8939, distributed as E. cinereum, are actually E. buergerianum Körn., while Tanaka & Shimada 13574 is E. kiusianum Maxim., Stocks, Law, &c. s.n. and Wight 2366 are E. redactum Ruhl., Clemens & Clemens 3275 and Squires 91 are E. robinsonii Moldenke, and J. S. Drummond 15053 and Saulière 71 are E. sollyanum Royle. Koelz 19398 is a mixture with E. luzulaefolium Mart., E. oryze-

torum Mart., and E. sollyanum Royle, and Dorsett & Morse 6328 is a mixture with something in the Cyperaceae.

Additional citations: CALIFORNIA: Stanislaus Co.: Markos s.n. [Modesto, Sept. 18, 1947] (Ca--754280, Gg—341592). PAKISTAN: East Bengal: "Br. 6073a" (B); Griffith 5565 (S); Hooker & Thomson s.n. [Chittagong, 0-1000 ped.] (S). INDIA: Assam: Chand 2472 (Mi). Bashahr: Raizada 19970 (Gg—398815). Bombay: Hohenacker 131bb (S, Ut—319). Kashmir: Polunin 381 (B); R. R. Stewart 3268 1/2 (Ca—322687). Madras: E. W. Erlanson 5652 (Mi); Herb. Presid. Coll. Madras 5127 (S); Herb. Roth s.n. [Trankenbar] (B); Mace s.n. [Coromandel] (B); Perrottet 1168 (V, V—96381). Mysore: S. N. Ramaswamy 2 (Ac), 3 (Ac), 14 (Rf), 15 (Rf), 31 (Ac), 1745 (Lw); G. Thomson s.n. [Maisor & Carnatic] (S). Pondichery: Lépine s.n. [Pondichery] (V—6092). Surguja: Koelz 19398, in part (Mi). West Bengal: Herb. Roth s.n. [Bengala] (B). State undetermined: Hornemann s.n. [ex Ind. orient.] (B); Rottler 17 [India orientalis] (S); Wight 2365 (B). CEYLON: Thwaites C.P.795 (B). CHINA: Fukien: H. H. Chung 2574 (Ca—232825), 2599 (Ca—232907), 3842 (Ca—288515); Han 8347 (Ws). Kiangsi: Ip 14 [Herb. Univ. Nanking 7649] (Ca—259186). Kwangsi: R. C. Ching 7263 (Ca--410041); Steward & Cheo 1097 (S). Kwangtung: E. D. Merrill 10948 (Ca—300937); Tak & Chow s.n. [Herb. Canton Chr. Coll. 14389] (Ca—319067). Kweichow: Y. Tsiang 7010 (Ca—503635), 7011a (S). CHINESE COASTAL ISLANDS: Hainan: W. Y. Chun s.n. [Herb. Univ. Nanking 5795] (Ca); S. K. Lau 3061 (Bi, S). Honam: E. D. Merrill 9846 (Ca--291647). THAILAND: Hansen, Seidenfaden, & Smitinand 10839 (Cp); Smitinand 5018 [Herb. Roy. Forest Dept. 13585] (Gg); Vesterdal 465 (Cp). INDOCHINA: Annam: Clemens & Clemens 3652 (Ca—339257). Vietnam: E. H. Walker 8019 (W—2395270). KOREA: Dorsett & Morse 6328, in part (Mi, S). WESTERN PACIFIC ISLANDS: JAPAN: Honshu: Collector undesignated s.n. [Tokyo] (S); Furuse s.n. [27 Sept. 1955] (S), s.n. [2 July 1956] (S), s.n. [8 Oct. 1959] (S); Hashimoto 1624 (Go, N, S); Ito & Koyama 826 (B, Ca—55778, Go, Mg, N, S); Maximowicz s.n. [Yokohama, 1862] (S); Murata 8342 (Ws), 12194 (Ut—89477b); Sugimoto s.n. [25/IX/1927] (B); Suzuki UG.489 (Ca--928743); Wichura 709 (B). FORMOSA: Faurie 796 (V—8309), s.n. [22.6.09] (S); Herb. Govt. Formosa 21620 (Ca—344141); Simada 430 (Ca—344948). PHILIPPINE ISLANDS: Luzon: Loher 13901 (Ca—242826); E. D. Merrill 293 (Ut—22491); M. Ramos s.n. [Herb. Philip. Bur. Sci. 24089] (Bi, Bi); Reillo 1276 (N). Island undetermined: Cuming 670 (V). INDONESIA: GREATER SUNDA ISLANDS: Java: Herb. Galathea Exped. s.n. [Buitenzorg] (Cp); Möller s.n. [Goenoeng Pautjar, 6.1897] (S, S).

ERIOCAULON CIPOENSE Alv. Silv.

Additional bibliography: Moldenke, Résumé 88 & 480. 1959.

Additional citations: BRAZIL: Minas Gerais: Silveira 343 (B--isotype, Z--isotype).

ERIOCAULON COERULEUM Van Royen

Bibliography: Van Royen, Blumea 10: 128. 1960; G. Taylor, Ind. Kew. Suppl. 13: 52. 1966.

This species is said by Van Royen (1960) to be endemic to the island of Celebes.

ERIOCAULON COLLETTII Hook. f.

Additional bibliography: Moldenke, Bull. Jard. Bot. Brux. 27: 139. 1957; Moldenke, Résumé 165 & 480. 1959; Thanikaimoni, Pollen & Spores 7: 184. 1965.

ERIOCAULON COLLINUM Hook. f.

Additional synonymy: Eriocaulon luzulifolium Thwaites ex Moldenke, Résumé Suppl. 1: 17, in syn. 1959. Eriocaulon collinium Hook. ex Thanikaimoni, Pollen & Spores 7: 184, sphalm. 1965.

Additional & emended bibliography: Moldenke, Known Geogr. Distrib. Erioc. 23, 24, 33, & 34. 1946; Moldenke, Bull. Jard. Bot. Brux. 27: 139--140. 1957; Moldenke, Résumé 161, 167, 287, 290, & 480. 1959; Moldenke, Résumé Suppl. 1: 17 (1959) and 3: 17. 1962; Thanikaimoni, Pollen & Spores 7: 184. 1965; Moldenke, Résumé Suppl. 14: 8. 1966; Subramanyam & Henry, Bull. Bot. Surv. India 8: 214. 1966; Moldenke, Résumé Suppl. 16: 9. 1968.

Thanikaimoni (1965) regards E. christopheri Fyson and E. oliveri Fyson as synonyms of E. collinum. The name, E. luzulifolium Thwaites, is apparently based on Thwaites C.P.796 in the Berlin herbarium.

Eriocaulon collinum has been found growing in meadows and old fields, at 6000 feet altitude, flowering in July and August. Chand describes it as 7 inches tall, while Koelz remarks "black, opening white" [for the floral heads?]. Subramanyam & Henry record it from Madhya Pradesh and cite no. 12123.

Material has been misidentified and distributed in herbaria under the names E. quinquangulare Mart., E. trilobum Ham., and E. 5-angulare L.

Additional citations: INDIA: Assam: Chand 7991 (Mi); Koelz 23078 (Mi). Madras: Herb. Presid. Coll. Madras 7083 (S); Kofoed s.n. [Ootacamund, Oct. 1903] (Cp). State undetermined: N. E. H. Bang 6 [9] (S); Wight s.n. [Ind. or.] (V--41324, V--41345, V--41351, V--41353). CEYLON: G. Gardner 935 (B); Thwaites C.P.796 (B, B); Walker 12 (B). MOUNTED LITERATURE: Ruhl. in Engl., Pflanzenreich (B).

ERIOCAULON COMPRESSUM Lam.

Additional synonymy: Eriocaulon gnaphalodes Beauv. ex Moldenke, Résumé Suppl. 1: 17, in syn. 1959. Eriocaulon compressum

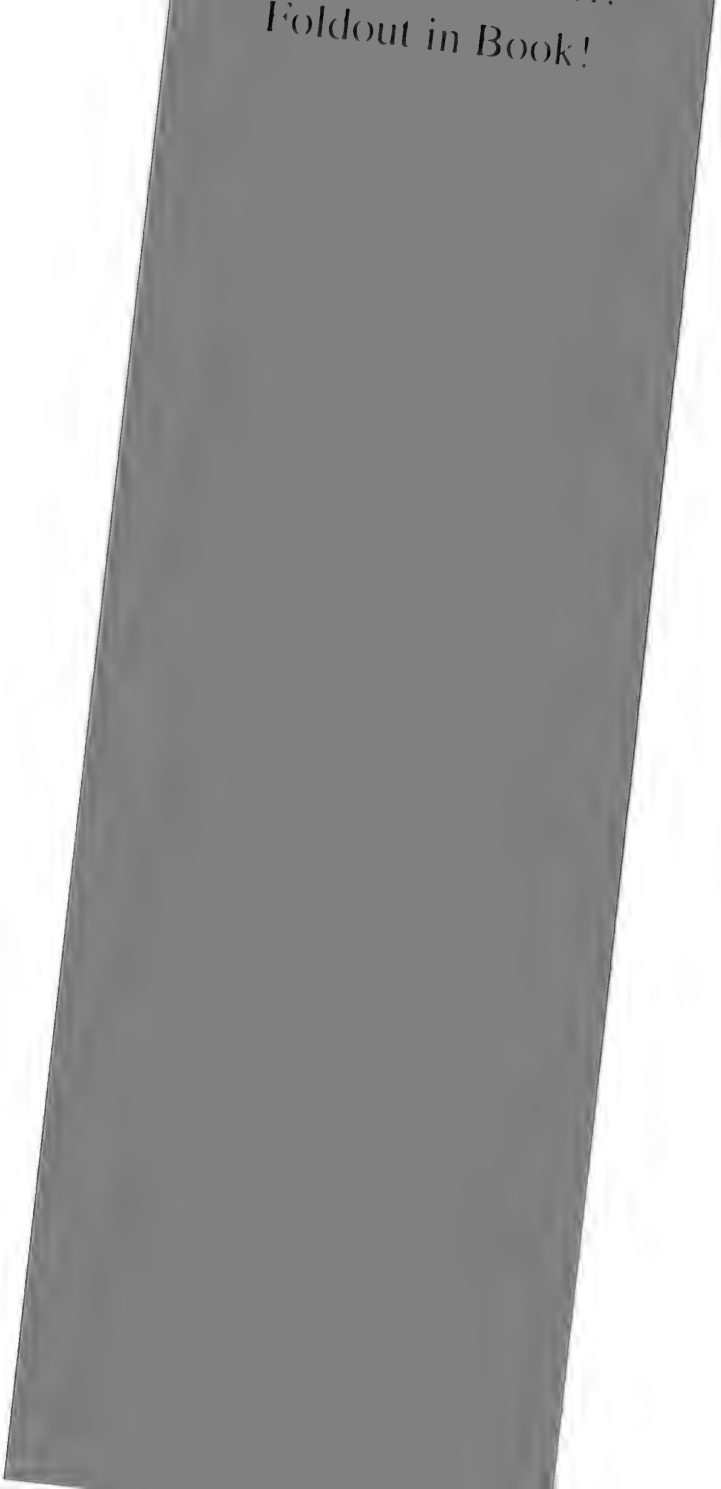
(Huds.) Morong ex Moldenke, Résumé Suppl. 2: 9, in syn. 1960.

Additional & emended bibliography: Britton & Br., Ill. Fl., ed. 1, 1: 372 & 602, fig. 900 (1896) and 3: 537. 1896; R. M. Harper, Ann. N. Y. Acad. Sci. 17: 267. 1906; Robins. & Fern. in A. Gray, New Man. Bot., ed. 7, 261 & 898. 1908; M. A. Day, Check List 39. 1908; W. H. Br., Contrib. U. S. Nat. Herb. 13: 323. 1911; Uphof in Karst. & Schenck, Vegetationsbild. 21 (1-2): n.p. 1930; Moldenke, N. Am. Fl. 19: 18 & 22—23. 1937; Wells, Bot. Rev. 8: 537. 1942; R. R. Tatnall, Fl. Del. 75. 1946; Moldenke, Known Geogr. Distrib. Erioc. [1]—3, 33, 35, & 56. 1946; Moldenke, Bull. Jard. Bot. Brux. 27: 140. 1957; Moldenke, Résumé 7—12, 14, 23, 27, 288, 320, 345, & 480. 1959; Moldenke, Résumé Suppl. 1: 2 & 17 (1959) and 2: 2 & 9. 1960; Fables, Bartonia 32: 9. 1961; Moldenke, Résumé Suppl. 3: 2, 3, & 7 (1962) and 4: [1]—3. 1962; Gleason & Cronquist, Man. Vasc. Pl. 184. 1963; Montgomery & Fairbrothers, Bull. Torrey Bot. Club 90: 92 & 96. 1963; Melchior in Engl., Syllabus Pfl., ed. 12, 2: 556, fig. 230 i & k. 1964; Kral, Sida 2: 299—302 & 331. 1966; Shinners, Sida 2: 441. 1966; Moldenke, Résumé Suppl. 14: [1]. 1966; R. M. Harper, Castanea 32: 17. 1967; Rickett, Wild Fls. U. S. 2 (1): 135 (1967) and 2 (2): 659. 1967; L. S. Thomas, Pine Barrens 23. 1967; Justice & Bell, Wild Fls. N. C. 13 & 209. 1968; Moldenke, Résumé Suppl. 16: 1. 1968.

Additional illustrations: Melchior in Engl., Syllabus Pfl., ed. 12, 2: fig. 230 i & k. 1964; Kral, Sida 2: 300. 1966; Justice & Bell, Wild Fls. N. C. 13 [in color]. 1968.

Recent collectors have found this plant growing in shallow peaty ephemeral bogs or ponds, cypress ponds in the pinebarrens, small cypress swamps, savannas, low pine savannas, swamps, creek edges, marshy borders of ponds, river bottoms, dry white sandy loblolly pine areas, bogs, pools, boggy savannas, pinebarrens, acid bogs in pinelands, sandy open bogs, Sarracenia sledgei bogs, cranberry bogs, sphagnous bogs, and cypress ponds. Redfearn & Kral say that it is "frequent in shallow water of cypress swamps" and "frequent in shallow water of ponds" in Florida. Tatnall (1946) records it from the pinebarrens of Sussex and Wicomica Counties on the Delmarva Peninsula, flowering there from May to August. Harper says that it occupies the Lower Oligocene and the Altamaha Grit formations on the coastal plain of Georgia and records it from Berrien, Coffee, Irwin, Screven, Tattnall, and Wilcox Counties in that state. Fables (1961) states that it blooms earlier than E. decangulare L. in the New Jersey pinebarren bogs and swamps.

Harper (1967) avers that he and Berry in the autumn of 1910 found this species in bloom at the mouth of the Yellow River in western Florida. It was high water at the time and the plants were submerged, with only the flower-heads above the water. He notes that this was surprising to him because he had thought that the species blooms only in the spring. Several years later, at time of low water, Godfrey found many of the basal leaf-rosettes at the spot, but no flowers. Brown (1911) shows that the texture of the substratum is more important to this species than water depth.



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INDEX THELYPTERIDIS

Supplement I

Clyde F. Reed*

Shortly after the manuscript to INDEX THELYPTERIDIS had been sent to be published, several papers arrived from Dr. Kunio Iwatsuki which were not available to the author while preparing the index. Therefore, a few corrections are necessary and few more new combinations are to be made.

Thelypteris crinipes (Hook.) K. Iwats., Journ. Jap. Bot., 38(10): 315. 1963; Reed, Phytologia, 17(4): 269. 1968. Himalayas, SW China to N Thailand; Malacca.

Th. cyrtomioides (C.Chr.) Reed, comb. nov. Basionym: Dryopteris stegnogramma var. cyrtomioides C.Chr., Acta Hort. Gothob., 1: 56. 1924; Stegnogramma cyrtomioides (C.Chr.) Ching, Sinensia, 7: 95. 1936; Icon. Fil. Sin., 5: pl. 231. 1958 (1959). South and Western China (Szechwan).

Th. dictyoclinoides (Ching) Reed, comb. nov. Basionym: Stegnogramma dictyoclinoides Ching, Sinensia, 7: 92. 1936. Yunnan, Annam, Taiwan.

Th. evoluta (Clarke) Tagawa et K. Iwats., Acta. Phytotax. Geobot., 22(4-6): 101. 1967; (Bedd.) Reed, Phytologia, 17(4): 276. 1968. Basionym: Nephrodium amboinense var. evolutum Clarke, Journ. Linn. Soc., 24: 417. 1888; N. evolutum Bedd., Handb. Ferns Brit. India, Suppl., 76. 1892. Assam and North Thailand.

Th. exsculpta (Baker) K.Iwats., Acta Phytotax. Geobot., 21(5-6): 170. 1965. Basionym: Acrostichum exsculptum Baker, Journ. Bot., 26: 326. 1888. Borneo, Brunei.

Th. griffithii (Moore) Reed, Phytologia, 17(4): 280. 1968. Synonym: Stegnogramma griffithii (Moore) K.Iwats., Acta Phytotax. Geobot., 19(4-6):117. 1963.

Th. hirtisora (C.Chr.) K.Iwats., Journ. Jap. Bot., 38(10): 314. 1963; Reed, Phytologia, 17(4): 283. 1968. Add: Upper Burma, Indochina.

Th. interrupta (Willd.) K.Iwats., Journ. Jap. Bot., 38(10): 314. 1963; Stone, Micronesica, 2: 3. 1966. Add: Thailand.

Th. kingii Reed, nom. nov. Based on Stegnogramma leptogrammoides K.Iwats., Acta Phytotax. Geobot., 19(4-6): 119, f. 17-18. 1963. Sikkim.

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Thelypteris prolifera (Retz.) Reed, Phytologia, 17(4): 306. 1968. Add: Thailand.

Th. rubra (Ching) K.Iwats., Journ. Jap. Bot., 38: 315. 1963. Add: Thailand.

Th. rubra var. hirsuta (Ching) Tagawa et K.Iwats., The Southeast Asian Studies, 5(1): 70. 1967. Basionym: Abacopteris rubra var. hirsuta Ching, Bull. Fan Mem. Inst. Biol., 8: 248. 1938. China (Kwangtung) to Burma and northern Thailand.

Th. siamensis Tagawa et K.Iwats., Acta Phytotax. Geobot., 22(4-6): 101-102, f. 5. 1967. Thailand (Loey).

Th. stegnogramma (Blume) Reed, comb. nov. Basionym: Gymnogramma stegnogramma Blume, Fl. Jav. Fil., 98, t. 44. 1829. Synonym: Gymnogramma aspidioides Hook. et Bauer, Gen. Fil., t. 120B. 1841, non Kaulf. 1824, nec Desv. 1827, nec Blume 1828. Java, Borneo, Sumatra and Ceylon.

Th. stegnogrammopsis Reed, nom. nov. Based on Dryopteris stegnogramma var. asplenioides C.Chr., Acta Hort. Gothob., 1: 56. 1924; Stegnogramma asplenioides J.Smith ex Ching, Sinensia, 7: 94. 1936; Icon. Fil. Sin., 5: pl. 232. 1958 (1959). Khasia, Sikkim, China (Szechwan), Assam.

Th. subelata (Baker) K.Iwats., Journ. Jap. Bot., 39(10): 315. 1963; Reed, Phytologia, 17(4): 317. 1968. Add: Thailand and Upper Burma.

Th. sumatrana (v.A.v.R.) Tagawa et K.Iwats., Acta Phytotax. Geobot., 22(4-6): 101. 1967; Reed, Phytologia, 17(4): 318. 1968.

Th. valida (Christ) Tagawa et K.Iwats., Acta Phytotax. Geobot., 22(4-6): 101. 1967; Reed, Phytologia, 17(4): 323. 1968. Basionym: Dryopteris valida Christ, Journ. de Bot., 21e Annee, 261. 1908. Add: Tonkin and northern Thailand.

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---- An American Species of Stegnogramma. Amer. Fern Journ., 54(3): 141-143. 1964.

---- On Hypodematium Kunze. Acta Phytotax. Geobot., 21(1-2): 43-54, 5 figs. 1964.

---- Ferns of Borneo, collected by M. Hirano and M. Hotta. 2. Thelypteris group. Acta Phytotax. Geobot., 21(5-6): 165-172. 1965.

Reed, Clyde F. Index Thelypteridis. Phytologia, 17(4): 249-328. Oct. 18, 1968.

Tagawa, Motozi and Kunio Iwatsuki Ferns of Borneo, Collected by M. Hirano and M. Hotta, 4. Acta Phytotax. Geobot., 22(3): 87-94. 1966.

---- and ---- New or Interesting Ferns from Thailand, I. Acta Phytotax. Geobot., 22(4-6): 97-103, f. 1-5. 1967.

---- and ---- Enumeration of Thai Pteridophytes collected during 1965-1966. The Southeast Asian Studies, 5(1): 23-120. 1967.

STRUVEOPSIS, A NEW GENUS OF GREEN ALGAE

Charles F. Rhyne & Harold Robinson

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A new green algal genus, Struveopsis, is described to include two species with small stipitate fronds and retarded branch septation, S. chagoensis, a new species from the central Indian Ocean, and Cladophoropsis robusta from El Salvador and the Gulf of California.

Attempts to determine recent collections from the island of Diego Garcia, Chagos Archipelago, have resulted in the discovery of a new species of Siphonocladalian algae having a long stipe cell, an upper blade-like portion branching in one plane, delayed division at the bases of branches, and no interconnecting tenaculae. The same combination of characters has been seen in a species from the west coast of Mexico, Cladophoropsis robusta. Comparison with related groups indicates that the two species are best placed in a new genus, Struveopsis.

The taxonomic problem lies in a group of genera belonging by most recent treatments to the three families, Anadyomenaceae, Siphonocladaceae, and Boodleaceae, most of which have either a stipitate or blade-like branching structure. Two such genera, Willeella Børg., 1930, in the Anadyomenaceae, and Ernodesmis Børg., 1912, in the Siphonocladaceae, are readily distinguished by their lack of delayed division at the bases of branches, the smallest observable branches showing already a distinct cell wall separating them from the subtending cell. The latter genus, Ernodesmis, is also distinct by its branching being in no way restricted to one plane. Struvea Sonder, 1845, and Boodlea Murray & DeToni, 1889, both of the Boodleaceae, and Cladophoropsis Børg., 1905, and Apjohnia Harvey, 1855, both of the Siphonocladaceae, all have a type of branching where the lateral branches are usually long delayed in laying down basal dividing walls and where such walls are often formed somewhat out of place. Of these, Struvea and Boodlea are distinguished by having tenaculae that attach adjacent parts of the plant to each other. The mature parts of these two genera always show, to some extent, interconnections or anastomoses caused by these tenaculae. Most of these genera are reviewed in some detail by Egerod (1952).

The genus Apjohnia possesses several characters in common with Struveopsis such as distal younger branches laying in one plane with retarded branch septation and a distinct stipe cell.

Though branching in Apjohnia is largely in one plane, the branching at the apex of the stipe cell is clearly verticillate. Marked annular constrictions are also a distinctive feature of Apjohnia. Harvey (1855, 1858), Agardh (1887), and DeToni (1889) all related Apjohnia to Chamaedoris because of the evident annular constrictions in the stipe. DeToni combined the two in a tribe Apjohnieae of his family Cladophoraceae, subfamily Valonieae. The basic verticillate manner of branching in the initial phases of Apjohnia is reminiscent of the cup-shaped capitulum development in Chamaedoris.

The genus Cladophoropsis serves as an interesting comparison of a less organized plant. Careful observation of Cladophoropsis membranacea, the type of the genus, indicates some organization of mature plants, but far short of the blade-like form seen in Struveopsis. Plants of C. membranacea often exhibit long areas without cell walls, but these are not differentiated as distinct stipe cells. There are branches formed in a comb-like series, but these are only one branch per cell, and they tend to lie slightly out of plane. In the best developed material the branches seem to alternate in lying in two planes slightly offset from each other. Whenever branching of a second order occurs, there is not necessarily any correlation with the branching plane of the first order. On the basis of the type species, Cladophoropsis can be distinguished from Struveopsis by the lack of a stipe cell, of a distinct blade-like structure, and by the lack of pairs of branches from individual cells. Though we have seen no material, an illustration (Womersley, 1955) shows a few paired branches in C. magnus. Still, the plant seems comparatively unorganized in its structure and to be related to C. membranacea.

The characters and composition of Struveopsis are as follows.

Struveopsis Rhyne & H. Robinson, gen. nov.
Siphonocladaceae

Plantae frondosae parvae; frondibus laxe subpinnatis, stipitatis, haud tenaculatis; rami plerumque bini, non plus numerosi; septis basilaribus ramorum retardatis; cellulae non annulatae.

Including two species of which Struveopsis chagoensis n. sp. is type.

The delayed formation of cell walls at the bases of branches seems to be usually associated with the phenomenon called segregative division. In segregative division the protoplasts divide and separate and then grow together again forming a wall. The rounded units of protoplasm seen in Struveopsis chagoensis (fig. 3) seem to agree with those illustrated by Børgesen (1913, p. 44, fig. 29) and to represent true segregative division.

Key to the species of Struveopsis

Apical cells rather pointed; cells of main axes often with bulbose enlargements near the upper ends, branching angle ca. 30° (Central Indian Ocean) . . . . . S. chagoensis

Apical cells with broadly rounded tips; cells of main axes without bulbose enlargements, branching angle 45° or more (Pacific coast of Mexico and Central America) . . . S. robusta

Struveopsis chagoensis Rhyne & H. Robinson, sp. nov.

Plantae frondosae parvae; frondibus laxe subpinnatis, stipitatis, haud tenaculatis; septis basilaribus ramorum retardatis; cellulis veterioribus interdum in parte superiore inflatis.

Plants frondose, laxly bipinnate, to 2.75 cm high; basal portion of creeping rhizoids with occasional septations; stipe cell erect, rather clavate, 0.7-1.0 cm long, to 275 μ diam. near the base, to 450 μ diam. just below the first branches; branches in one plane, regularly pinnate, forming open blade-like structure, branches usually arising at angles of less than 30°, ultimate branches up to 2.5 mm long, 200-275 μ diam., with apices very narrowly rounded, larger branches up to 325 μ diam.; larger cells often with distinct swollen rather bulbose enlargements near upper ends immediately below branch origin or rarely in cells that lack branches.

Specimens examined: Central Indian Ocean: Diego Garcia atoll, lagoon side of West Island, in shallow Cymodocea bed in 0.3-0.7 m of water, epiphytic upon Cymodocea, 16 June 1967, Rhyne 421, with wet material (holotype-US); same habitat, infrequent as epiphyte, 22 June 1967, Rhyne 450 (US).

The enlargements seen in some cells of the plant seem quite distinctive, and they are in no way comparable to the annulations in Apjohnia. The former are actual enlargements that are located near the upper ends of the cells, while the latter seem to be the result of constrictions and are located in the lower ends of the cells. There were small rhomboid crystals observed in the center of some of the enlargements, but the significance of these is not known.

The plants of S. chagoensis have a strong superficial resemblance to various species of Struvea, especially some material seen of S. orientalis Gepp & Gepp from the island of Aldabra. The latter material was relatively immature and had less highly developed tenaculae, however, with careful examination, some tenaculae could be demonstrated in all parts of the plant.

Struveopsis robusta (Setchell & Gardner) Rhyne & H. Robinson, comb. nov.

Cladophoropsis robusta Setchell & Gardner, Calif. Acad. Sci., Proc. IV. 12: 714, pl. 13, fig. 16. 1924.
Willeella mexicana Dawson, Amer. Jour. Bot. 37: 151, fig. 11. 1950.

Plants with small fronds arising in dense tufts, up to 2.5 cm long, 350-500 μ diam. near upper end, sparsely forked at base and attached by numerous rhizoidal filaments, branching above into a small pinnate to bipinnate blade-like structure; branches usually in pairs, usually diverging at 45° or more, 250-400 μ diam.; apical cells with broadly rounded tips.

Specimens examined: Mexico: Gulf of California, Punta Aguja, Bahia Conception, 26 March 1949, Dawson 7102 (US); Puerto Escondido, 18 March 1949, Dawson 7148 (US). El Salvador: Gulfo de Fonseca, Meanguera Island, 7 September 1960, Dawson 21898a, with wet material (US).

The species was originally distinguished in the genus Cladophoropsis by the large diameter (up to 1.1 mm in dry material) and the great length of segments between the branches (Setchell and Gardner, 1924). Dawson (1950) described Willeella mexicana from material showing much more highly developed blade structure. Later, Dawson (1959) recognized the identity of his collections as more mature specimens of Cladophoropsis robusta.

We wish to acknowledge the many important suggestions of Dr. Max H. Hommersand of the University of North Carolina, and we appreciate the cooperation of Dr. C. J. Dawes of the University of South Florida in furnishing wet material of Apjohnia laetevirens and indicating some significant results of his investigations.

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Fig. 1-3: Struveopsis chagoensis, new species; 1: Habit. 2: Detail of branching. 3: Detail showing segregative division.

ADDITIONAL NOTES ON THE ERIOCAULACEAE. XVI

Harold N. Moldenke

A considerable quantity of notes and herbarium material has come to my attention since the previous installments in this series were prepared. It seems worthwhile to place this information on record in these series of notes for the benefit of future workers on this group.

ERIOCAULACEAE Lindl.

Additional & emended bibliography: Petiv., Gaz. Nat. 10, pl. 6, fig. 2. 1702; J. E. Sm. in Rees, Cycl. 13. 1809; S. Ell., Sketch Bot. 2: 564—567. 1824; Desv., Ann. Sci. Nat. Paris, sér. 1, 13: 45—47, pl. 5. 1828; Raf., Atl. Journ., pr. 1, 121. 1832; Colla, Herb. Pedem. 483—484. 1836; Raf., Autikon Bot., pr. 1, 188—189. 1840; Benth., Pl. Hartw. 28. 1840; Steud., Nom. Bot., ed. 2, 1: 585. 1840; G. Gardn. in Hook. f., Icon. Pl. 6 [new ser., 2]: pl. 525. 1843; Schlecht., Linnaea 18: 434—436. 1844; W. Griff., Notul. 3: 112—122, pl. 159. 1851; D. Dietr., Syn. Pl. 5: 259—268. 1852; Steud., Syn. Pl. Glum. 2 (Cyp.): 261, 267—283, 332—334, 340, 342, & 347. 1855; F. Muell., Fragm. 1: 92—96. 1859; Körn. in Mart., Fl. Bras. 3 (1): [271]—508, pl. 38—62. 1863; Griseb., Fl. Brit. W. Ind., pr. 1, 526. 1864; Sauv., Fl. Cub. 162. 1868; J. G. Baker, Journ. Linn. Soc. Lond. Bot. 20: 277—279. 1883; S. Wats., Proc. Am. Acad. 22: 420. 1887; Wawra, Itin. Princ. S. Coburg 2: 96. 1888; F. Muell., Proc. Linn. Soc. New S. Wales, ser. 2, 5: 250. 1890; Engl., Abh. Preuss. Akad. Wiss. 1891: 154. 1892; Sessé & Moc., Fl. Mex., ed. 1 [La Naturaleza, ser. 2, 2: App. 2], 17. 1893; Engl., Abh. Preuss. Akad. Wiss. 1894: 14. 1894; Jacks. in Hook. f. & Jacks., Ind. Kew., pr. 1, 2: 681 & 1283. 1895; Engl., Pflanzenw. Ost-Afr. C: 133. 1895; Schinz, Bull. Herb. Boiss., ser. 1, 4, App. 3: 35. 1896; N. E. Br. in Thisel.-Dyer, Fl. Cap. 7: 54—55. 1897; Schinz, Mém. Herb. Boiss. 10: 76. 1900; Britten, Journ. Bot. 38: 481—483. 1900; Pilg. in Engl., Bot. Jahrb. 30: 146—147. 1901; Durand & Jacks., Ind. Kew. Suppl. 1, pr. 1, 158. 1902; Thiselt.-Dyer, Ind. Kew. Suppl. 2: 70 & 203. 1904; Rendle, Journ. Linn. Soc. Lond. 37: 475. 1906; Beauverd, Bull. Herb. Boiss., sér. 2, 8: 283, fig. 9A. 1908; H. Lecomte, Journ. de Bot. 21: 89 & [101]—109. 1908; Alv. Silv., Fl. Serr. Min. 33—34. 1908; H. Lecomte, Bull. Soc. Bot. France 55: 571—573 (1908) and 55: 643—648. 1909; Druce, Pharm. Journ. 29: 700. 1909; Beauverd, Bull. Herb. Boiss., sér. 2, 8: 986—988. 1909; E. D. Merr., Philip. Journ. Sci. Bot. 5: 336. 1910; Nakai in Fedde, Repert. Sp. Nov. 9: 466. 1911; A. Chiov., Ann. Bot. Roma 9: 148. 1911; Nakai, Bull. Géogr. Bot. 21: 139. 1911; H. Lecomte, Not. Syst. 2: 215. 1912; Prain, Ind. Kew. Suppl. 4, pr. 1, 82. 1913; H. Lecomte, Not. Syst. 2: 380. 1913; Nakai in Matsumura, Icon. Pl. Koisikav. 1: 157, pl. 79 (1913) and 2: 35—47, pl. 102—108. 1914; Koidz., Bot. Mag. Tokyo 28:

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Jackson (1893) consistently cites Körnicke's monograph of this group in Linnaea, volume 27, as "1854", but the evidence seems to indicate that it was not issued until April, 1856.

ERIOCAULON Gron.

Additional & emended bibliography: Petiv., Gaz. Nat. 10, pl. 6, fig. 2. 1702; J. E. Sm. in Rees, Cycl. 13. 1809; S. Ell., Sketch Bot. 2: 564—567. 1824; Desv., Ann. Sci. Nat. Paris, sér. 1, 13: 45—47, pl. 5. 1828; Colla, Herb. Pedem. 483—484. 1836; Raf., Autikon Bot., pr. 1, 188—189. 1840; Benth., Pl. Hartw. 28. 1840; G. Gardn. in Hook. f., Icon. Pl. 6 [new ser., 2]: pl. 525. 1843; Schlecht., Linnaea 18: 434—436. 1844; W. Griff., Notul. 3: 112—122, pl. 159. 1851; D. Dietr., Syn. Pl. 5: 259—268. 1852; Steud., Syn. Pl. Glum. 2 (Cyp.): 261, 268—283, 332—334, & 342. 1855; F. Muell., Fragm. 1: 92—96. 1859; Griseb., Fl. Brit. W. Ind., pr. 1, 526. 1864; Sauv., Fl. Cub. 162. 1868; J. G. Baker, Journ. Linn. Soc. Lond. Bot. 20: 277—278. 1883; S. Wats., Proc. Am. Acad. 22: 420. 1887; Wawra, Itin. Princ. S. Coburg 2: 96. 1888; Engl., Abh. Preuss. Akad. Wiss. 1891: 154. 1892; F. Muell., Proc. Linn. Soc. New S. Wales, ser. 2, 5: 250. 1890; Sessé & Moc., Fl. Mex., ed. 1 [La Naturaleza, ser. 2, 2: App. 2], 17. 1893; Engl., Abh. Preuss. Akad. Wiss. 1894: 14. 1894; Jacks. in Hook. f. & Jacks., Ind. Kew., pr. 1, 2: 681 & 1283. 1895; Engl., Pflanzenw. Ost-Afr. C: 133. 1895; Schinz, Bull. Herb. Boiss., sér. 1, 4, App. 3: 35. 1896; N. E. Br. in Thiselt.-Dyer, Fl. Cap. 7: 54—55. 1897; Britten, Journ. Bot. 38: 481—483. 1900; Schinz, Mém. Herb. Boiss. 10: 76. 1900; Pilg. in Engl., Bot. Jahrb. 30: 146—147. 1901; Durand & Jacks., Ind. Kew. Suppl. 1, pr. 1, 158. 1902; Thiselt.-Dyer, Ind. Kew. Suppl. 2: 70 & 203. 1904; Rendle, Journ. Linn. Soc. Lond. Bot. 37: 475. 1906; Beauverd, Bull. Herb. Boiss., sér. 2, 8: 283, fig. 9A. 1908; H. Lecomte, Journ. de Bot. 21: 89 & [101]—109. 1908; Alv. Silv., Fl. Serr. Min. 33—34. 1908; H. Lecomte, Bull. Soc. Bot. France 55: 571—573 (1908) and 55: 643—648. 1909; Prain, Ind. Kew. Suppl. 3: 69—70. 1908; Druce, Pharm. Journ. 29: 700. 1909; Beauverd, Bull. Herb. Boiss., sér. 2, 8: 986—988. 1909; E. D. Merr., Philip. Journ. Sci. Bot. 5: 336. 1910; Nakai in Fedde, Repert. Sp. Nov. 9: 466. 1911; A. Chiov., Ann. Bot. Roma 9: 148. 1911; Nakai, Bull. Géogr. Bot. 21: 139. 1911; H. Lecomte, Not. Syst. 2: 215. 1912; Prain, Ind. Kew. Suppl. 4, pr. 1, 82. 1913; H. Lecomte, Not. Syst. 2: 380. 1913; Nakai in Matsumura, Icon. Pl.

Koisikav. 1: 157, pl. 79 (1913) and 2: 35—47, pl. 102—108. 1914; Koidz., Bot. Mag. Tokyo 28: 171. 1914; Guillaumin & Beauvis., Ann. Soc. Bot. Lyon 38: 40. 1914; Fyson, Kew Bull. Misc. Inf. 1914: 330—331. 1914; E. D. Merr., Philip. Journ. Sci. Bot. 10: 290. 1915; H. N. Ridl., Journ. Fed. Malay States Mus. 6: 191. 1915; Komarov, Bull. Jard. Bot. Pétersb. 16: 156. 1916; H. N. Ridl., Trans. Linn. Soc. Lond. Bot. 9: 240. 1916; R. E. Fries, Wiss. Ergebn. Schwed. Rhod.-Kongo-Exped. 1911-12 1: 218. 1916; Ewart & Cookson in Ewart & Davies, Fl. N. Terr. 67. 1917; Nakai, Bot. Mag. Tokyo 31: 97. 1917; N. L. Britton, Bull. Torrey Bot. Club 44: 31—32. 1917; C. H. Wright, Kew Bull. Misc. Inf. 1919: 264. 1919; H. N. Ridl., Journ. Fed. Malay States Mus. 10: 155. 1920; Hand.-Mazz., Anz. Akad. Wiss. Wien 57: 238. 1920; Prain, Ind. Kew. Suppl. 5, pr. 2, 97. 1921; Rendle, Journ. Linn. Soc. Lond. Bot. 45: 259. 1921; Dinter in Fedde, Repert. Sp. Nov. 17: 260. 1921; Haines, Bot. Bihar & Orissa 6: 1066—1071. 1924; Herzog in Fedde, Repert. Sp. Nov. 20: 82—88. 1924; Ruhl. in Fedde, Repert. Sp. Nov. 22: 29—35. 1925; Kudo, Jap. Journ. Bot. 2: 248. 1925; Mak., Journ. Jap. Bot. 3: 26. 1926; A. W. Hill, Ind. Kew. Suppl. 6: 78—79. 1926; Miyabe & Nakai, Bot. Mag. Tokyo 42: 479. 1928; Honda, Bot. Mag. Tokyo 42: 507. 1928; A. W. Hill, Ind. Kew. Suppl. 7: 88—89. 1929; C. E. C. Fischer, Kew Bull. Misc. Inf. 1930: 159—161. 1930; Markötter, Ann. Univ. Stellenb. 8A (1): 10. 1930; Ohwi, Bot. Mag. Tokyo 44: 566—567 (1930) and 45: 196 & 389. 1931; Honda, Bot. Mag. Tokyo 45: 299. 1931; C. E. C. Fischer, Kew Bull. Misc. Inf. 1931: 261. 1931; Herzog in Fedde, Repert. Sp. Nov. 29: 202—213. 1931; C. E. C. Fischer in Gamble, Fl. Presid. Madras 9: 1607—1619. 1931; Bullock, Kew Bull. Misc. Inf. 1932: 507. 1932; A. W. Hill, Ind. Kew. Suppl. 8: 87. 1933; Arwidsson, Bot. Notiser 1934: 83—87. 1934; Wang & Tang, Contrib. Inst. Bot. Nat. Acad. Peiping 2: 133. 1934; Herter, Rev. Sudam. Bot. 2: 125. 1935; C. E. C. Fischer, Kew Bull. Misc. Inf. 1935: 159. 1935; Malme, Arkiv Bot. Stockh. 26A, 9: 8. 1935; Hand.-Mazz., Symb. Sin. 7: 1246. 1936; P. C. Standl., Field Mus. Publ. Bot. 12: 90. 1936; Hand.-Mazz., Sinensia 7: 619. 1936; Prain, Ind. Kew. Suppl. 4, pr. 2, 82. 1938; Satake in Nakai, Icon. Fl. As. Orient. 2: 175. 1938; Satake & Hara, Bot. Mag. Tokyo 52: 400. 1938; A. W. Hill, Ind. Kew. Suppl. 9: 105. 1938; Milne-Redhead in Hook., Icon. Pl. 34: pl. 3388 & 3389. 1939; Satake, Bull. Tokyo Sci. Mus. 4: [Rev. Jap. Erioc.] 1—[74], pl. 1—12. 1940; Durand & Jacks., Ind. Kew. Suppl. 1, pr. 2, 158. 1941; Miyabe & Satake, Acta Phytotax. & Geobot. Kyoto 13: 280. 1943; Masamune, Trans. Nat. Hist. Soc. Taiwan 33: 13 & 25—26. 1943; Castell. in Descole, Gen. & Sp. Pl. Argent. 3: 83—88, pl. 17. 1945; León, Fl. Cuba 1: 279—281. 1946; Abbiatti, Revist. Mus. La Plata, new ser., Bot. 6: 323—341, pl. 2 (1), fig. 4 (d) & 6. 1946; Jacks. in Hook. f. & Jacks., Ind. Kew., pr. 2, 1: 877—880 (1946) and 2: 681 & 1283. 1946; Hill & Salisb., Ind. Kew. Suppl. 10: 86. 1947; Meikle, Kew Bull. Misc. Inf. 1948: 472 (1949) and 1950: 231. 1950; Suesseng. & Heine, Mitt. Bot. Staatssamml. München 2: 57. 1950; E. J. Salisb., Ind. Kew. Suppl. 11: 88. 1953; Koyama, Philip. Journ. Sci. Bot. 84: 369—371. 1956;

J. N. Mishra, Mycologia 48: 407—409, fig. 1 d—f. 1956; Bourdu, Bull. Soc. Bot. France 104: 156. 1957; H. Hess, Bericht. Schweitz. Bot. Gesell. 67: 84. 1957; Durand & Jacks., Ind. Kew. Suppl. 1, pr. 3, 158. 1959; G. Taylor, Ind. Kew. Suppl. 12: 55. 1959; Jacks. in Hook. f. & Jacks., Ind. Kew., pr. 3, 1: 877—880 (1960) and 2: 681 & 1283. 1960; Prain, Ind. Kew. Suppl. 5, pr. 2, 97. 1960; Griseb., Fl. Brit. W. Ind., pr. 2, 526. 1963; G. Taylor, Ind. Kew. Suppl. 13: 52. 1966; L. O. Williams, Fieldiana Bot. 31: 255-256. 1967; Moldenke, Phytologia 17: 450—464. 1968; D. Walker, Journ. Ecol. [Brit.] 56: 451. 1968.

Jackson (1893) consistently cites Körnicke's monograph of this genus in Linnaea, volume 27, as "1854", but the evidence seems to indicate that it was not issued until April of 1856.

ERIOCAULON ABYSSINICUM Hochst.

Additional bibliography: Hochst., Flora 28: 341. 1845; Jacks. in Hook. f. & Jacks., Ind. Kew., pr. 1, 1: 877. 1893; Ruhl. in Engl., Pflanzenreich 13 (4-30): 281, 282, & 284. 1903; Jacks. in Hook. f. & Jacks., Ind. Kew., pr. 2, 1: 877 (1946) and pr. 3, 1: 877. 1960; Moldenke, Phytologia 17: 450. 1968.

ERIOCAULON ACANTHOCEPHALUM Griff.

Synonymy: Eriocaulon acanthocephalus Griff., Notul. 3: 118, sphalm. 1851.

Bibliography: W. Griff., Notul. 3: 116—118. 1851.

Nothing is known to me about this taxon except the detached characters mentioned by Griffith. The binomial has never been recorded in the Index Kewensis or any of its supplements to date.

ERIOCAULON ACHITON Körn.

Additional bibliography: Körn., Linnaea 27: 630. 1854; Jacks. in Hook. f. & Jacks., Ind. Kew., pr. 1, 1: 877. 1893; Ruhl. in Engl., Pflanzenreich 13 (4-30): 13, 103, 111, & 284. 1903; H. Lecomte, Journ. de Bot. 21: 108. 1908; Haines, Bot. Bihar & Orissa 6: 1067 & 1070—1071. 1924; Jacks. in Hook. f. & Jacks., Ind. Kew., pr. 2, 1: 877 (1946) and pr. 3, 1: 877. 1960; Moldenke, Phytologia 17: 450. 1968.

Jackson (1893) reduces this taxon to synonymy under E. nigricans R. Br., but the latter is now itself reduced to synonymy under E. pygmaeum Soland. The specific epithet of E. achiton is sometimes written with its initial letter uppercased for no valid reason. The C. B. Clarke 16101, distributed as E. achiton, is actually E. gregatum Körn.

ERIOCAULON ADAMESII Meikle

Additional bibliography: Meikle, Kew Bull. Misc. Inf. 1948: 472. 1949; E. J. Salisb., Ind. Kew. Suppl. 11: 88. 1953; Moldenke, Phytologia 17: 384. 1968.

ERIOCAULON AEQUINOCTIALE Ruhl.

Additional bibliography: Ruhl. in Engl., Pflanzenreich 13 (4-

30): 42, 47, & 284. 1903; Prain, Ind. Kew. Suppl. 3: 69. 1908; Moldenke, Phytologia 17: 384. 1968.

ERIOCAULON AFRICANUM Hochst.

Additional bibliography: Hochst., Flora 28: 340. 1845; Jacks. in Hook. f. & Jacks., Ind. Kew., pr. 1, 1: 877. 1893; Ruhl. in Engl., Pflanzenreich 13 (4-30): 61, 69, & 284. 1903; Jacks. in Hook. f. & Jacks., Ind. Kew., pr. 2, 1: 877 (1946) and pr. 3, 1: 877. 1960; Moldenke, Phytologia 17: 384. 1968.

ERIOCAULON AFZELIANUM Wikstr.

Emended synonymy: Eriocaulon kouroussense H. Lecomte, Bull. Soc. Bot. France 55: 644. 1909.

Additional bibliography: Körn., Linnaea 27: 680. 1856; Jacks. in Hook. f. & Jacks., Ind. Kew., pr. 1, 1: 877. 1893; Ruhl. in Engl., Pflanzenreich 13 (4-30): 63, 83, & 284. 1903; H. Lecomte, Bull. Soc. Bot. France 55: 644—645. 1909; Prain, Ind. Kew. Suppl. 4, pr. 1, 82 (1913) and pr. 2, 82. 1938; Jacks. in Hook. f. & Jacks., Ind. Kew., pr. 2, 1: 877 (1946) and pr. 3, 1: 877. 1960; Moldenke, Phytologia 17: 384--385. 1968.

ERIOCAULON ALATUM H. Lecomte

Additional bibliography: H. Lecomte, Journ. de Bot. 21: 102 & 104—105, fig. 2. 1908; Prain, Ind. Kew. Suppl. 4, pr. 1, 82 (1913) and pr. 2, 82. 1938; Moldenke, Phytologia 17: 385. 1968.

Illustrations: H. Lecomte, Journ. de Bot. 21: 105, fig. 2. 1908.

ERIOCAULON ALLEIZETTEI Moldenke

Additional bibliography: G. Taylor, Ind. Kew. Suppl. 12: 55. 1959; Moldenke, Phytologia 17: 385. 1968.

ERIOCAULON ALPESTRE Hook. f. & Thoms.

Additional & emended bibliography: Jacks. in Hook. f. & Jacks., Ind. Kew., pr. 1, 1: 877. 1893; Durand & Jacks., Ind. Kew. Suppl. 1, pr. 1, 158. 1902; Ruhl. in Engl., Pflanzenreich 13 (4-30): 65, 95—96, & 284. 1903; Durand & Jacks., Ind. Kew. Suppl. 1, pr. 2, 158. 1941; Jacks. in Hook. f. & Jacks., Ind. Kew., pr. 2, 1: 877. 1946; Durand & Jacks., Ind. Kew. Suppl. 1, pr. 3, 158. 1959; Jacks. in Hook. f. & Jacks., Ind. Kew., pr. 3, 1: 877. 1960; Moldenke, Phytologia 17: 450. 1968.

ERIOCAULON ALPINUM Van Royen

Bibliography: D. Walker, Journ. Ecol. [Brit.] 56: 451. 1968.

Nothing is known to me about this taxon.

ERIOCAULON ALTOGIBBOSUM Ruhl.

Synonymy: Eriocaulon alto-gibbosum Ruhl. in Engl., Pflanzenreich 13 (4-30): 18, 54, & 284. 1903.

Additional bibliography: Pilg. in Engl., Bot. Jahrb. 30: 146. 1901; Ruhl. in Engl., Pflanzenreich 13 (4-30): 18, 43, 54, & 284.

1903; Prain, Ind. Kew. Suppl. 3: 69. 1908; Moldenke, Phytologia 17: 386—387. 1968.

The index to Ruhland's monograph (1903) cites this species to page "64" instead of to 54. Consultation of the original publication reveals that I have been in error in writing the specific epithet of this taxon with a hyphen in my previous publications and annotation of specimens. It was originally proposed without the hyphen.

ERIOCAULON AMANOANUM Koyama

Additional bibliography: G. Taylor, Ind. Kew. Suppl. 13: 52. 1966; Moldenke, Phytologia 17: 387. 1968.

ERIOCAULON AMBOËNSE Schinz

Additional & emended bibliography: Schinz, Bull. Herb. Boiss., sér. 1, 4, app. 3: 35. 1896; Ruhl. in Engl., Pflanzenreich 13 (4-30): 112 & 284. 1903; Thiselt.-Dyer, Ind. Kew. Suppl. 2: 70. 1904; H. Hess, Bericht. Schweitz. Bot. Gesell. 65: 160—161, fig. 1, & 176—178, pl. 9, fig. 3. 1955; Moldenke, Phytologia 17: 450. 1968.

Illustrations: H. Hess, Bericht. Schweitz. Bot. Gesell. 65: 160, fig. 1, & pl. 9, fig. 3. 1955.

Hess (1955) tells us, among other things, that this species often grows in association with E. gilgianum Ruhl. The type is Schinz 859.

ERIOCAULON AMPHIBIUM Rendle

Additional bibliography: Prain, Ind. Kew. Suppl. 4, pr. 1, 82 (1913) and pr. 2, 82. 1938; Moldenke, Phytologia 17: 387. 1968.

ERIOCAULON ANDONGENSE Welw.

Additional bibliography: Rendle, Cat. Welw. Afr. Pl. 2: 100. 1899; Ruhl. in Engl., Pflanzenreich 13 (4-30): 66, 101, & 284. 1903; Thiselton-Dyer, Ind. Kew. Suppl. 2: 70. 1904; H. Lecomte, Bull. Soc. Bot. France 55: 647. 1909; Moldenke, Phytologia 17: 387. 1968.

ERIOCAULON ANGUSTIFOLIUM Körn.

Additional bibliography: Körn. in Mart., Fl. Bras. 3 (1): 494—496. 1863; Jacks. in Hook. f. & Jacks., Ind. Kew., pr. 1, 1: 877. 1893; Ruhl. in Engl., Pflanzenreich 13 (4-30): 42, 49, 57, & 284. 1903; Jacks. in Hook. f. & Jacks., Ind. Kew., pr. 2, 1: 877 (1946) and pr. 3, 1: 877. 1960; Moldenke, Phytologia 17: 387—388. 1968.

ERIOCAULON ANGUSTISEPALUM H. Hess

Additional & emended bibliography: H. Hess, Bericht. Schweitz. Bot. Gesell. 65: 160, fig. 7 & 8, & 170—174, pl. 9, fig. 2, 6, & 7. 1955; G. Taylor, Ind. Kew. Suppl. 12: 55. 1959; Moldenke, Phytologia 17: 388. 1968.

Illustrations: H. Hess, Bericht. Schweitz. Bot. Gesell. 65:

160, fig. 7 & 8, & pl. 9, fig. 2, 6, & 7. 1955.

ERIOCAULON ANNAMENSE H. Lecomte
Additional bibliography: H. Lecomte, Not. Syst. 2: 215. 1912; Prain, Ind. Kew. Suppl. 5, pr. 1, 97 (1921) and pr. 2, 97. 1960; Moldenke, Phytologia 17: 388. 1968.

ERIOCAULON ANNUUM Milne-Redhead
Additional bibliography: Milne-Redhead in Hook., Icon. Pl. 34: pl. 3389. 1939; Hall & Salisb., Ind. Kew. Suppl. 10: 86. 1947; Moldenke, Phytologia 17: 388. 1968.

ERIOCAULON ANTUNESII Engl. & Ruhl.
Additional bibliography: Ruhl. in Engl., Bot. Jahrb. 27: 76. 1899; Ruhl. in Engl., Pflanzenreich 13 (4-30): 61, 69, 70, & 284. 1903; Thiselt.-Dyer, Ind. Kew. Suppl. 2: 70. 1904; Moldenke, Phytologia 17: 388. 1968.

ERIOCAULON APICULATUM H. Lecomte
Synonymy: Eriocaulon apiculatum H. Lecomte & Moldenke ex Moldenke, Phytologia 3: 410—411. 1951.
Additional bibliography: H. Lecomte, Bull. Soc. Bot. France 55: 571 & 572. 1908; Prain, Ind. Kew. Suppl. 4, pr. 1, 82 (1913) and pr. 2, 82. 1938; G. Taylor, Ind. Kew. Suppl. 12: 55. 1959; Moldenke, Phytologia 17: 388. 1968.
Through an unfortunate oversight, I was not aware until now that Lecomte had actually validly published the binomial name which he had proposed and written on herbarium material of the type collection, Bernier 79, from Madagascar. The name must, therefore be accredited solely to him!

ERIOCAULON AQUATILE Körn.
Emended synonymy: Paepalanthus aquatilis Mart. ex Körn. in Mart., Fl. Bras. 3 (1): 495, in syn. 1863.
Additional bibliography: Körn., Linnaea 27: 60. 1856; Körn. in Mart., Fl. Bras. 3 (1): 495--496. 1863; Jacks. in Hook. f. & Jacks., Ind. Kew., pr. 1, 1: 877. 1893; Ruhl. in Engl., Pflanzenreich 13 (4-30): 42, 49, 57, & 284. 1903; Jacks. in Hook. f. & Jacks., Ind. Kew., pr. 2, 1: 877 (1946) and pr. 3, 1: 877. 1960; Moldenke, Phytologia 17: 388--389. 1968.

ERIOCAULON ARECHAVALETAE Herter
Additional bibliography: Arech., Anal. Mus. Montevid. 4 (1): 21. 1902; Prain, Ind. Kew. Suppl. 3: 69. 1908; Herter, Rev. Sudam. Bot. 2: 125. 1935; Hill & Salisb., Ind. Kew. Suppl. 10: 86. 1947; E. J. Salisb., Ind. Kew. Suppl. 11: 88. 1953; Moldenke, Phytologia 17: 389. 1968.

ERIOCAULON ARENICOLA Britton & Small
Additional bibliography: N. L. Britton, Bull. Torrey Bot. Club 44: 31. 1917; A. W. Hill, Ind. Kew. Suppl. 6: 78. 1926; León,

Fl. Cuba 1: 280. 1946; Moldenke, Phytologia 17: 389. 1968.

ERIOCAULON ARISTATUM H. Hess

Additional & emended bibliography: H. Hess, Bericht. Schweitz. Bot. Gesell. 65: 160, fig. 11 & 12, & 162--164, pl. 9, fig. 5. 1955; G. Taylor, Ind. Kew. Suppl. 12: 55. 1959; Moldenke, Phytologia 17: 389. 1968.

Illustrations: H. Hess, Bericht. Schweitz. Bot. Gesell. 65: 160, fig. 11 & 12, & pl. 9, fig. 5. 1955.

ERIOCAULON ATABAPENSE Moldenke

Additional bibliography: E. J. Salisb., Ind. Kew. Suppl. 11: 88. 1953: Moldenke, Phytologia 17: 389. 1968.

ERIOCAULON ATRATUM Körn.

Additional bibliography: Körn., Linnaea 27: 610. 1856; Jacks. in Hook. f. & Jacks., Ind. Kew., pr. 1, 1: 877. 1893; Ruhl. in Engl., Pflanzenreich 13 (4-30): 61, 69, & 284. 1903; Jacks. in Hook. f. & Jacks., Ind. Kew., pr. 2, 1: 877 (1946) and pr. 3, 1: 877. 1960; Moldenke, Phytologia 17: 389--390. 1968.

ERIOCAULON ATRATUM var. MAJOR Thwaites

Synonymy: Eriocaulon caulescens Hook. f. & Thoms. ex Thwaites, Pl. Zeyl. 341. 1864 [not E. caulescens Poir., 1813, nor Willd., 1863]. Eriocaulon philippo-coburgi Szyszyl. ex Wawra, Itin. Princ. S. Coburg 2: 96. 1888.

Additional bibliography: Wawra, Itin. Princ. S. Coburg 2: 96. 1888; Durand & Jacks., Ind. Kew. Suppl. 1, pr. 1, 158. 1902; Ruhl. in Engl., Pflanzenreich 13 (4-30): 68, 69, 284, & 285. 1903; Durand & Jacks., Ind. Kew. Suppl. 1, pr. 2, 158 (1941) and pr. 3, 158. 1959; Moldenke, Phytologia 17: 390. 1968.

The E. caulescens of Poiret is Syngonanthus caulescens (Poir.) Ruhl., while that accredited to Willdenow is Paepalanthus pilosus (H.B.K.) Kunth.

ERIOCAULON ATROIDES Satake

Additional & emended bibliography: Satake in Nakai, Icon. Pl. As. Orient. 2: 175, pl. 65. 1938; Hill & Salisb., Ind. Kew. Suppl. 10: 86. 1947; Moldenke, Phytologia 17: 390. 1968.

Illustrations: Satake in Nakai, Icon. Pl. As. Orient. 2: pl. 65. 1938.

ERIOCAULON ATRUM Nakai

Additional bibliography: Nakai in Fedde, Repert. Sp. Nov. 9: 466. 1911; Prain, Ind. Kew. Suppl. 5, pr. 1, 97. 1921; Masamune, Prel. Rep. Veg. Yakus. 51. 1929; Satake, Bull. Tokyo Sci. Mus. 4: [Rev. Jap. Erioc.] 57. 1940; Prain, Ind. Kew. Suppl. 5, pr. 2, 97. 1960; Moldenke, Phytologia 17: 450. 1968.

The E. atrum accredited to Masamune is E. hananoegoense Masamune.

ERIOCAULON AUSTRALASICUM (F. Muell.) Körn.
Additional synonymy: Eriocaulon australasicum Körn. in Mart., Fl. Bras. 3 (1): 475. 1863.
Additional bibliography: Körn. in Mart., Fl. Bras. 3 (1): 475. 1863; Jacks. in Hook. f. & Jacks., Ind. Kew., pr. 1, 1: 877 & 878. 1893; Ruhl. in Engl., Pflanzenreich 13 (4-30): 13, 104, 114, 284, & 285. 1903; Jacks. in Hook. f. & Jacks., Ind. Kew., pr. 2, 1: 877 & 878 (1946) and pr. 3, 1: 877 & 878. 1960; Moldenke, Phytologia 17: 451. 1968.

ERIOCAULON AUSTRALE R. Br.
Additional bibliography: F. Muell., Fragm. 1: 92. 1859; Jacks. in Hook. f. & Jacks., Ind. Kew., pr. 1, 1: 877. 1893; Ruhl. in Engl., Pflanzenreich 13 (4-30): 60, 62, 66, 281, & 284. 1903; Jacks. in Hook. f. & Jacks., Ind. Kew., pr. 2, 1: 877 (1946) and pr. 3, 1: 877. 1960; Moldenke, Phytologia 17: 391—393. 1968.

ERIOCAULON BANANI H. Lecomte
Bibliography: H. Lecomte, Bull. Soc. Bot. France 55: 645. 1909; Prain, Ind. Kew. Suppl. 4, pr. 1, 82 (1913) and pr. 2, 82. 1938.
The type of this species is A. Chevalier 524 from Soudan in Mali.

ERIOCAULON BARBA-CAPRAE Fyson
Additional & emended bibliography: Fyson, Journ. Indian Bot. 1: 50 (1919) and 2: 197. 1921; A. W. Hill, Ind. Kew. Suppl. 6: 78 (1926) and 7: 88. 1929; Moldenke, Phytologia 17: 393. 1968.

ERIOCAULON BARBEYANUM Ruhl.
Additional bibliography: Ruhl. in Engl., Pflanzenreich 13 (4-30): 61, 73, & 284. 1903; Prain, Ind. Kew. Suppl. 3: 69. 1908; Moldenke, Phytologia 17: 393. 1968.

ERIOCAULON BASSACENSE Moldenke
Additional bibliography: E. J. Salisb., Ind. Kew. Suppl. 11: 88. 1953; Moldenke, Phytologia 17: 393. 1968.

ERIOCAULON BAURI N. E. Br.
Synonymy: Eriocaulon baurii N. E. Br. apud Ruhl. in Engl., Pflanzenreich 13 (4-30): 63, 79, & 284. 1903.
Additional bibliography: N. E. Br. in Thiselt.-Dyer, Fl. Cap. 7: 54—55. 1897; Ruhl. in Engl., Pflanzenreich 13 (4-30): 63, 79, & 284. 1903; Thiselt.-Dyer, Ind. Kew. Suppl. 2: 70. 1904; Moldenke, Phytologia 17: 393. 1968.
Consultation of the original publication shows that Brown there proposed this binomial with only a single "i" in the specific portion. I see no valid reason for changing his spelling.

ERIOCAULON BEAUVERDI Moldenke
Synonymy: Eriocaulon helichrysoides var. giganteum Beauverd,

Bull. Herb. Boiss., sér. 2, 8: 283, fig. 9A. 1908. Eriocaulon giganteum Beauverd, Bull. Herb. Boiss., sér. 2, 8: 987. 1909. Eriocaulon giganteum (Beauverd) Beauverd ex Moldenke, Phytologia 3: 183, in syn. 1949.

Additional bibliography: Beauverd, Bull. Herb. Boiss., sér. 2, 8: 283, fig. 9A. 1908; Prain, Ind. Kew. Suppl. 4, pr. 1, 82 (1913) and pr. 2, 82. 1938; E. J. Salisb., Ind. Kew. Suppl. 11: 88. 1953; Moldenke, Phytologia 17: 393. 1968.

Illustrations: Beauverd, Bull. Herb. Boiss., sér. 2, 8: 283, fig. 9A. 1908.

ERIOCAULON BENTHAMI Kunth

Additional & emended bibliography: Benth., Pl. Hartw. 28. 1840; Schlecht., Linnaea 18: 434. 1844; Seem., Bot. Voy. Herald 221. 1854; Körn. in Mart., Fl. Bras. 3 (1): 490—492. 1963; Hemsl., Biol. Cent. Am. Bot. 3: 443. 1885; Jacks. in Hook. f. & Jacks., Ind. Kew., pr. 1, 1: 877. 1893; Ruhl. in Engl., Pflanzenreich 13 (4-30): 42, 48, 49, & 284. 1903; Moldenke, Phytologia 1: 311 & 316. 1939; Jacks. in Hook. f. & Jacks., Ind. Kew., pr. 2, 1: 877 (1946) and pr. 3, 1: 877. 1960; Moldenke, Phytologia 17: 393—394. 1968.

This taxon was first noted as "Eriocauli spec. nova?" by Bentham (1840). The Aschenborn 531, distributed as E. benthami, is actually a cotype collection of E. ehrenbergianum Klotzsch.

ERIOCAULON BIFISTULOSUM Van Heurck & Muell.-Arg.

Emended synonymy: Eriocaulon fluitans J. G. Baker, Journ. Linn. Soc. Lond. Bot. 20: 277—278. 1883.

Additional & emended bibliography: J. G. Baker, Journ. Linn. Soc. Lond. Bot. 20: 277-278. 1883; Jacks. in Hook. f. & Jacks., Ind. Kew., pr. 1, 1: 877 & 878. 1893; Ruhl. in Engl., Pflanzenreich 13 (4-30): 18, 64, 90, 284, 285, & 286. 1903; Thiselt.-Dyer, Ind. Kew. Suppl. 2: 70. 1904; H. Lecomte, Bull. Soc. Bot. France 55: 571 (1908) and 55: 647. 1909; A. W. Hill, Ind. Kew. Suppl. 8: 87. 1933; Jacks. in Hook. f. & Jacks., Ind. Kew., pr. 2, 1: 877 & 878 (1946) and pr. 3, 1: 877 & 878. 1960; Moldenke, Phytologia 17: 394—395. 1968.

Jackson (1893) regards E. fluitans J. G. Baker as conspecific with E. melanocephalum Kunth; the date "1893" given by me in some of my previous publications for this binomial is erroneous.

ERIOCAULON BILOBATUM Morong

Additional bibliography: Durand & Jacks., Ind. Kew. Suppl. 1, pr. 1, 158. 1902; Ruhl. in Engl., Pflanzenreich 13 (4-30): 21, 56, 113, 284, & 286. 1903; Durand & Jacks., Ind. Kew. Suppl. 1, pr. 2, 158 (1941) and pr. 3, 158. 1959; Moldenke, Phytologia 17: 395. 1968.

ERIOCAULON BLUMEI Körn.

Additional bibliography: Körn. in Miq., Ann. Mus. Bot. Lugd.

Bat. 3: 240. 1867; Jacks. in Hook. f. & Jacks., Ind. Kew., pr. 1, 1: 877. 1893; Ruhl. in Engl., Pflanzenreich 13 (4-30): 114 & 284. 1903; Jacks. in Hook. f. & Jacks., Ind. Kew., pr. 2, 1: 877 (1946) and pr. 3, 1: 877. 1960; Moldenke, Phytologia 17: 451 & 455. 1968.

It is of interest to note that Ruhland (1903) seems to recognize this taxon as valid in his text, but as invalid in his index.

ERIOCAULON BOMBAYANUM Ruhl.

Additional bibliography: Ruhl. in Engl., Pflanzenreich 13 (4-30): 102, 104, & 284. 1903; Prain, Ind. Kew. Suppl. 3: 69. 1908; Moldenke, Phytologia 17: 451. 1968.

ERIOCAULON BONGENSE Engl. & Ruhl.

Additional bibliography: Ruhl. in Engl., Bot. Jahrb. 27: 75. 1899; Ruhl. in Engl., Pflanzenreich 13 (4-30): 66, 100, & 284. 1903; Thiselt.-Dyer, Ind. Kew. Suppl. 2: 70. 1904; H. Lecomte, Bull. Soc. Bot. France 55: 647. 1909; Moldenke, Phytologia 17: 451. 1968.

ERIOCAULON BONI H. Lecomte

Additional bibliography: H. Lecomte, Journ. de Bot. 21: 89 & 108. 1908; Prain, Ind. Kew. Suppl. 4, pr. 1, 82 (1913) and pr. 2, 82. 1938; Moldenke, Phytologia 17: 451. 1968.

ERIOCAULON BRACHYPEPLON Körn.

Additional bibliography: Körn., Linnaea 27: 665. 1854; Jacks. in Hook. f. & Jacks., Ind. Kew., pr. 1, 1: 877. 1893; Ruhl. in Engl., Pflanzenreich 13 (4-30): 281 & 285. 1903; Jacks. in Hook. f. & Jacks., Ind. Kew., pr. 2, 1: 877 (1946) and pr. 3, 1: 877. 1960; Moldenke, Phytologia 17: 451. 1968.

ERIOCAULON BREVIFOLIUM Klotzsch

Additional bibliography: Klotzsch in Schomb., Faun. & Fl. Brit. Guian. 1116. 1848; Körn. in Mart., Fl. Bras. 3 (1): 496—497. 1863; Jacks. in Hook. f. & Jacks., Ind. Kew., pr. 1, 1: 877. 1893; Ruhl. in Engl., Pflanzenreich 13 (4-30): 42, 50, & 285. 1903; Jacks. in Hook. f. & Jacks., Ind. Kew., pr. 2, 1: 877 (1946) and pr. 3, 1: 877. 1960; Moldenke, Phytologia 17: 451—452. 1968.

The name hitherto employed for this taxon is invalid because of the Eriocaulon brevifolium Raf., Autikon Bot., pr. 1, 189 (1840), published validly 8 years before Klotzsch published his homonym. I, therefore, hereby propose the substitute name, Eriocaulon klotzschii Moldenke, for this taxon, honoring Johann Friedrich Klotzsch (1805—1860), who contributed considerably to our knowledge of this group of plants. The var. proliferum Moldenke, Mem. N. Y. Bot. Gard. 9: 278 (1957) will have to receive the new name, Eriocaulon klotzschii var. proliferum (Moldenke) Moldenke.

Lest there be any doubt about the legality of Rafinesque's binomial, I quote his original description of Eriocaulon brevi-

folium Raf. herewith, taken from his Autikon Bot., pr. 1, 189 (1840), reprinted without change in 1843 and listed in E. J. Salisb., Ind. Kew. Suppl. 11: 88 (1953): "fol. subul. brevissimis acutis, scapo gracilis contorto sulcato, basi vaginato, capit. globosis, bract. ovat. acut. glabris fulvis — South New Jersey and Texas, leaves uncial or less, scape 5 to 8 inches few ribs, heads small, fl. gray". The exact identity of Rafinesque's plant will be discussed by me later in this series of notes.

ERIOCAULON BREVIPEDUNCULATUM Merr.

Additional bibliography: Prain, Ind. Kew. Suppl. 4, pr. 1, 82 (1913) and pr. 2, 82. 1938; Moldenke, Phytologia 17: 452—453. 1968.

ERIOCAULON BREVISCAPUM Körn.

Additional bibliography: Körn., Linnaea 27: 676. 1856; Jacks. in Hook. f. & Jacks., Ind. Kew., pr. 1, 1: 877. 1893; Ruhl. in Engl., Pflanzenreich 13 (4-30): 61, 70, & 285. 1903; H. Lecomte, Bull. Soc. Bot. France 55: 646. 1909; Jacks. in Hook. f. & Jacks., Ind. Kew., pr. 2, 1: 877 (1946) and pr. 3, 1: 877. 1960; Moldenke, Phytologia 17: 453. 1968.

ERIOCAULON BROMELIOIDEUM H. Lecomte

Synonymy: Eriocaulon bromelloideum H. Lecomte ex Moldenke, Known Geogr. Distrib. Erioc. 26 & 61, sphalm. 1946.

Additional bibliography: H. Lecomte, Journ. de Bot. 21: 107. 1908; Prain, Ind. Kew. Suppl. 4, pr. 1, 82 (1913) and pr. 2, 82. 1938; Moldenke, Phytologia 17: 453. 1968.

Unfortunately, due to an early typographic error, I have been misspelling the specific epithet of this species up until now. Consultation of the original publication has brought to light the correct spelling.

ERIOCAULON BROWNIANUM Mart.

Additional bibliography: Jacks. in Hook. f. & Jacks., Ind. Kew., pr. 1, 1: 877. 1893; Ruhl. in Engl., Pflanzenreich 13 (4-30): 63, 84, 114, & 285. 1903; Jacks. in Hook. f. & Jacks., Ind. Kew., pr. 2, 1: 877 (1946) and pr. 3, 1: 877. 1960; Moldenke, Phytologia 17: 453—454. 1968.

ERIOCAULON BRUNONIS Britten

Additional bibliography: Britten, Journ. Bot. 38: 482. 1900; Ruhl. in Engl., Pflanzenreich 13 (4-30): 32, 38, & 285. 1903; Thiselt.-Dyer, Ind. Kew. Suppl. 2: 70. 1904; Moldenke, Phytologia 17: 454. 1968.

ERIOCAULON BUCHANANII Ruhl.

Additional & emended bibliography: Ruhl. in Thiselt.-Dyer, Fl. Cap. 7: 83. 1897; Ruhl. in Engl., Pflanzenreich 13 (4-30): 66, 101, & 285. 1903; Thiselt.-Dyer, Ind. Kew. Suppl. 2: 70. 1904; H. Lecomte, Bull. Soc. Bot. France 55: 647. 1909; H. Hess, Bericht.

Schweitz. Bot. Gesell. 65: 138, fig. 5 & 6, 145—147, & 161, pl. 8, fig. 7—9. 1955; Moldenke, Phytologia 17: 454—455. 1968.

Illustrations: H. Hess, Bericht. Schweitz. Bot. Gesell. 65: 138, fig. 5 & 6, & pl. 8, fig. 7—9. 1955.

Hess (1955) informs us that this species often grows in close association with E. gilgianum Ruhl.

ERIOCAULON BUERGERIANUM Körn.

Additional bibliography: Jacks. in Hook. f. & Jacks., Ind. Kew., pr. 1, 1: 877. 1893; Ruhl. in Engl., Pflanzenreich 13 (4-30): 65, 94, & 285. 1903; A. W. Hill, Ind. Kew. Suppl. 7: 89. 1929; Jacks. in Hook. f. & Jacks., Ind. Kew., pr. 2, 1: 877 (1946) and pr. 3, 1: 877. 1960; Moldenke, Phytologia 17: 455—456. 1968.

ERIOCAULON BURCHELLII Ruhl.

Additional bibliography: Ruhl. in Engl., Pflanzenreich 13 (4-30): 42, 50, & 285. 1903; Prain, Ind. Kew. Suppl. 3: 69. 1908; Moldenke, Phytologia 17: 456. 1968.

ERIOCAULON CAAGUAZUENSE Ruhl.

Additional & emended bibliography: Prain, Ind. Kew. Suppl. 4, pr. 1, 82 (1913) and pr. 2, 82. 1938; Moldenke, Phytologia 17: 456. 1968.

ERIOCAULON CABRALENSE Alv. Silv.

Additional bibliography: Alv. Silv., Arch. Mus. Nac. Rio Jan. 23: 162. 1921; A. W. Hill, Ind. Kew. Suppl. 7: 88. 1929; Moldenke, Phytologia 17: 456. 1968.

ERIOCAULON CAESIUM Griseb.

Additional bibliography: Griseb., Fl. Brit. W. Ind., pr. 1, 526. 1864; Jacks. in Hook. f. & Jacks., Ind. Kew., pr. 1, 1: 877. 1893; Ruhl. in Engl., Pflanzenreich 13 (4-30): 18, 64, 88, & 285. 1903; Jacks. in Hook. f. & Jacks., Ind. Kew., pr. 2, 1: 877 (1946) and pr. 3, 1: 877. 1960; Griseb., Fl. Brit. W. Ind., pr. 2, 526. 1963; Moldenke, Phytologia 17: 456. 1968.

ERIOCAULON CALLOSUM Raf.

Bibliography: Raf., Autikon Bot., pr. 1, 188 (1840) and pr. 2, 188. 1943; E. J. Salisb., Ind. Kew. Suppl. 11: 88. 1953.

Rafinesque's original description (1840) of this taxon is: "fol. gramineis semipedalibus latiusculis apice obt. callosis, scapis fol. longior basi vaginatis contortis sulcatis, capit. depressis, bract. subrot. acutis vel obt. fulvis glabris, fl. cinereis — Alabama, leaves broader at base, scape ultrapedal, heads small, fl. cinereous".

Of the probable identity of Rafinesque's plant more will be said by me later in this series of notes.

ERIOCAULON CANDIDUM Moldenke

Additional bibliography: E. J. Salisb., Ind. Kew. Suppl. 11:

88. 1953; Moldenke, Phytologia 17: 456. 1968.

ERIOCAULON CAPITULATUM Moldenke

Additional bibliography: E. J. Salisb., Ind. Kew. Suppl. 11: 88. 1953; Moldenke, Phytologia 17: 456. 1968.

ERIOCAULON CARSONI F. Muell.

Additional & emended bibliography: F. Muell., Proc. Linn. Soc. New S. Wales, ser. 2, 5: 250. 1890; Durand & Jacks., Ind. Kew. Suppl. 1, pr. 1, 158. 1902; Ruhl. in Engl., Pflanzenreich 13 (4-30): 65, 98, 281, & 285. 1903; Thiselt.-Dyer, Ind. Kew. Suppl. 2: 70. 1904; Prain, Ind. Kew. Suppl. 3: 70. 1908; Durand & Jacks., Ind. Kew. Suppl. 1, pr. 2, 158 (1941) and pr. 3, 158. 1959; Moldenke, Phytologia 17: 456--457. 1968.

ERIOCAULON CAULIFERUM Mak.

Additional bibliography: Prain, Ind. Kew. Suppl. 4, pr. 1, 82 (1913) and pr. 2, 82. 1938; Moldenke, Phytologia 17: 457--458. 1968.

ERIOCAULON CELEBICUM Van Royen

Bibliography: Van Royen, Blumea 10: 127. 1960; G. Taylor, Ind. Kew. Suppl. 13: 52. 1966.

Nothing is known to me about this taxon except what is given in the bibliography above. It is supposedly endemic to Celebes.

ERIOCAULON CEYLANICUM Körn.

Additional synonymy: Eriocaulon subcaulescens Hook. f., Fl. Brit. Ind. 6: 573. 1893. Eriocaulon subacaulescens Hook. ex Moldenke, Résumé 293, in syn. sphalm. 1959.

Additional bibliography: Körn., Linnaea 27: 667. 1856; Jacks. in Hook. f. & Jacks., Ind. Kew., pr. 1, 1: 877. 1893; Durand & Jacks., Ind. Kew. Suppl. 1, pr. 1, 158. 1902; Ruhl. in Engl., Pflanzenreich 13 (4-30): 64, 68, 87, & 285. 1903; Durand & Jacks., Ind. Kew. Suppl. 1, pr. 2, 158. 1941; Jacks. in Hook. f. & Jacks., Ind. Kew., pr. 2, 1: 877. 1946; Durand & Jacks., Ind. Kew. Suppl. 1, pr. 3, 158. 1959; Jacks. in Hook. f & Jacks., Ind. Kew., pr. 3, 1: 877. 1960; Moldenke, Phytologia 17: 458. 1968.

ERIOCAULON CHINOROSSICUM Komarov

Synonymy: Eriocaulon chinorossicum Lom ex Moldenke, Known Geogr. Distrib. Erioc. 61, sphalm. 1946.

Additional bibliography: Komarov, Bull. Jard. Bot. Pétersb. 16: 156. 1916; A. W. Hill, Ind. Kew. Suppl. 6: 78. 1926; Moldenke, Phytologia 17: 458. 1968.

Lamentably, due to a typographic error in 1946, I have been misaccrediting this binomial until now!

ERIOCAULON CHRISTOPHERI Fyson

Additional bibliography: Fyson, Kew Bull. Misc. Inf. 1914: 330. 1914; Prain, Ind. Kew. Suppl. 5, pr. 1, 97 (1921) and pr.

2, 97. 1960; Moldenke, Phytologia 17: 458 & 463. 1968.

ERIOCAULON CILIIPETALUM H. Hess

Additional bibliography: G. Taylor, Ind. Kew. Suppl. 12: 55. 1959; Moldenke, Phytologia 17: 458. 1968.

ERIOCAULON CINEREUM R. Br.

Additional synonymy: Eriocaulon ciliiflorum F. Muell., Fragm. 1: 95—96. 1859. Eriocaulon sieboldianum Sieb. & Zucc. ex H. Lecomte, Bull. Soc. Bot. France 55: 648, sphalm. 1909.

Additional & emended bibliography: R. Br., Prodr. Fl. Nov. Holl. 1: 254. 1810; Kunth, Enum. Pl. 3: 552 & 571. 1841; Jacks. in Hook. f. & Jacks., Ind. Kew., pr. 1, 1: 877—879. 1893; N. E. Br. in Thiselt.-Dyer, Fl. Trop. Afr. 8: 259. 1901; Ruhl. in Engl., Pflanzenreich 13 (4-30): 111, 285, & 286, fig. 112. 1903; Prain, Ind. Kew. Suppl. 3: 70. 1908; H. Lecomte, Bull. Soc. Bot. France 55: 648. 1909; Fyson, Journ. Indian Bot. 2: 313. 1921; Haines, Bot. Bihar & Orissa 6: 1066 & 1068. 1924; S. Sasaki, List Pl. Formos. 99. 1928; A. W. Hill, Ind. Kew. Suppl. 7: 89. 1929; C. E. C. Fischer in Gamble, Fl. Presid. Madras 9: 1611 & 1619. 1931; Jacks. in Hook. f. & Jacks., Ind. Kew., pr. 2, 1: 877—879. 1946; Moldenke, Phytologia 3: 325. 1950; Jacks. in Hook. f. & Jacks., Ind. Kew., pr. 3, 1: 877—879. 1960; Moldenke, Phytologia 17: 454 & 458—462. 1968.

Another vernacular name recorded for this plant is "takasago-hosikusa".

The E. nitidum Buch.-Ham., cited in the synonymy of this taxon previously, is erroneously reduced to E. sexangulare L. by Jackson (1893). The E. nitidum of Bongard is Syngonanthus nitidus (Bong.) Ruhl., while the E. cinereum Buch.-Ham., also cited as E. cinereum Hamilt., is E. hamiltonianum Mart.

Additional & emended citations: CHINA: Kwangtung: Samson 256 [127] (D—824275). FORMOSA: Tanaka & Shimada 13574 (D—697328).

ERIOCAULON CIPOENSE Alv. Silv.

Additional bibliography: Alv. Silv., Fl. Serr. Min. 33. 1908; A. W. Hill, Ind. Kew. Suppl. 8: 87. 1933; Moldenke, Phytologia 17: 463. 1968.

ERIOCAULON COLLETTII Hook. f.

Additional bibliography: Hook. f., Fl. Brit. Ind. 6: 275. 1893; Durand & Jacks., Ind. Kew. Suppl. 1, pr. 1, 158. 1902; Ruhl. in Engl., Pflanzenreich 13 (4-30): 114 & 285. 1903; Durand & Jacks., Ind. Kew. Suppl. 1, pr. 2, 158 (1941) and pr. 3, 158. 1959; Moldenke, Phytologia 17: 463. 1968.

ERIOCAULON COLLINUM Hook. f.

Synonymy: Eriocaulon dianae var. triloboides Fyson, Journ. Indian Bot. 2: 260. 1921. Eriocaulon luzulifolium f. nigrescens Ruhl. ex Moldenke, Bull. Jard. Bot. Brux. 27: 139, in syn. 1957.

Additional bibliography: Hook. f., Fl. Brit. Ind. 6: 584. 1893; Durand & Jacks., Ind. Kew. Suppl. 1, pr. 1, 158. 1902; Ruhl. in Engl., Pflanzenreich 13 (4-30): 64, 87, & 285. 1903; Haines, Bot. Bihar & Orissa 6: 1066 & 1069. 1924; C. E. C. Fischer, Kew Bull. Misc. Inf. 1931: 261. 1931; C. E. C. Fischer in Gamble, Fl. Presid. Madras 9: 1615--1616 & 1620. 1931; Durand & Jacks., Ind. Kew. Suppl. 1, pr. 2, 158. 1941; Koyama, Philip. Journ. Sci. Bot. 84: 370. 1956; Durand & Jacks., Ind. Kew. Suppl. 1, pr. 3, 158. 1959; Moldenke, Phytologia 17: 458 & 463. 1968.

Fyson's original description (1921) of his E. dianae var. triloboides is "Capitula nigra aut nigrescentia globoba. Plate 15. Khandala to Wynaad. Leaves as in var. a [=typica]. Heads globose, dark almost black, distinguishable only by the third female sepal being linear from E. trilobum Ham. This variety has in consequence frequently been identified as that species. See p. 139, fig. 3, which is this plant, but wrongly named E. trilobum on p. 150, also see p. 206."

Koyama (1956) says that E. hayatanum Koyama, from Annam, "is distinguishable from E. collinum by completely free sepals of male flowers, female sepals emarginate at apex and much longer sheaths at the base of peduncles".

The Gopalaswamy s.n. [Castle Rock, 7-10-51], distributed as E. collinum, is actually E. dianae var. longibracteatum Fyson.

ERIOCAULON COMPRESSUM Lam.

Additional & emended synonymy: Eriocaulon filiformis Raf., Atl. Journ., pr. 1, 21. 1832 [not E. filiforme Bong., 1831]. Eriocaulon gnaphaloides Schlecht., Linnaea 18: 435. 1844. Eriocaulon cephalotes Poir. apud Jacks. in Hook. f. & Jacks., Ind. Kew., pr. 1, 1: 877, in syn. 1893. Eriocaulon filiforme Raf. apud Jacks. in Hook. f. & Jacks., Ind. Kew., pr. 1, 1: 878. 1893. Eriocaulon gnaphaloides Michx. ex Moldenke, Phytologia 3: 186, in syn. 1949.

Additional bibliography: Raf., Atl. Journ., pr. 1, 121. 1832; Raf., Autikon Bot., pr. 1, 189. 1840; Jacks. in Hook. f. & Jacks., Ind. Kew., pr. 1, 1: 877 & 878. 1893; Ruhl. in Engl., Pflanzenreich 13 (4-30): 13, 31, 34, 35, & 285. 1903; Raf., Autikon Bot., pr. 2, 189. 1943; Raf., Atl. Journ., pr. 2, 121. 1946; Jacks. in Hook. f. & Jacks., Ind. Kew., pr. 2, 1: 877 & 878 (1946) and pr. 2, 877 & 878. 1960; Moldenke, Phytologia 17: 463--464, fig. 2. 1968.

On pure sand this species is a common pioneer, but may frequently be seen where the water is a few inches or to 30 inches deep. Eventually accumulation of organic matter changes the bottom substratum. Rooted aquatics and then marsh plants move in and eliminate the Eriocaulon.

Cooley & Monachino found the plant growing on a wet prairie, in water 0.5 m. deep, describing the heads as white, the petals each with a black spot, and the sepals black with a fringe of white,

blooming in March. Cooley & Eaton found it in a wet ditch of a hammock, and describe the bracts as blackish, the flowers white-bearded, sometimes ciliate.

The R. M. Harper 2146, cited below, was erroneously cited as E. lineare Small by me in a previous installment of these notes. The Jansson s.n. [Aug. 26, 1950], also cited below, is a mixture with E. decangulare L. mounted in such a way that the E. decangulare flowering scapes appear to be issuing from an E. compressum leaf-rosette!

It should be noted here that the E. filiforme Bong., cited in the synonymy above, is a synonym of Syngonanthus nitens (Bong.) Ruhl.

Kral (1966) gives the following very interesting notes about this species: "Sands or sandy peats of shallow pineland ponds, lakeshores, seepage bogs, savannas, ditches or low flatwoods, coastal plain, eastern Texas, e. to Florida and n. to New Jersey. Type. South Carolina, Fraser. (At P?). In stature and habit E. compressum somewhat resembles E. decangulare, a tall summer and fall flowering Eriocaulon, but differs from it in having a more spongy foliage, softer heads, a less-hairy receptacle, and darker coloured bracts the tips of which are acute or rounded rather than acuminate. In fact, it is closest in appearance to a shorter plant, E. lineare, which also has soft, white, usually hemisphaerical heads, but differs from that species in having larger, often unisexual (rather than bisexual) heads, the receptacular surfaces of which have at least sparse hairs (those of E. lineare are smooth). Also, the surface of the seed of E. compressum is smoothish while that of the seed of E. lineare is indistinctly cancellate, sometimes papillate. This is perhaps the showiest of all the Eriocaulaceae of the southeastern United States, in springtime so abundantly decorating the shallow waters of pinelands as to appear like a shower of white confetti."

Material has been abundantly misidentified and distributed in herbaria as E. decangulare L., E. lineare Small, E. septangulare With., E. texense Körn., and Lachnocaulon glabrum Körn. On the other hand, the Demaree 28664, R. K. Godfrey 53139, Jacob 1278, and Kral & Godfrey 2342, distributed as E. compressum, are actually E. compressum var. harperi Moldenke, A. A. Heller 181, Morong s.n. [Aug. 11, 1873], W. F. Rhoades s.n. [Abbeeville, July & Aug. 1925], and P. O. Schallert s.n. [Nakina, 6/25/34] are E. decangulare L., W. M. Canby s.n. [Magnolia, April 1858], R. K. Godfrey 53684, and S. Taylor 127 are E. lineare Small, Hueske s. n. [White Lake, 5/24/47] is E. pellucidum Michx., and M. O. Helms 1011 and Olds s.n. [Montgomery, 3.20.94] are Lachnocaulon anceps (Walt.) Morong.

Additional citations: NEW JERSEY: Atlantic Co.: G. W. Bassett s.n. [Hammonton, May 27, 1923] (Mi, Ws); C. A. Gross s.n. [Cedar Lake, June 3, 1891] (Dt); H. N. Moldenke 22273 (Ac); Williamson

s.n. [Aug. 1905] (S). Burlington Co.: Herb. Durand s.n. (Ms--15473); F. J. Hermann 4478 (Mi, Ok--14318); M. A. Johnson s.n. [Chatsworth, 5 June 1934] (S); Lawrence & Dress 273 (Ca--805289); G. B. Rossbach s.n. [6/18/48] (We). Ocean Co.: Ewer 1066 (Ms--43547); Jansson s.n. [Aug. 26, 1950] (Go); MacElwee 658 (S). County undetermined: C. F. Austin s.n. [Oct. 1862] (N); W. M. Canby s.n. [Damp pine barrens, 1859] (Ws); Treat s.n. [Pine barrens] (Dt). NORTH CAROLINA: Bladen Co.: C. L. Rodgers 155c (Hi--34475). Brunswick Co.: Bell & Kim 281 (Hi--199268). Columbus Co.: Godfrey & White 7104 (Ca--741130, Mi, S); A. E. Radford 4215 (Hi--48380). Harnett Co.: A. E. Radford 4014 (Hi--48379). New Hanover Co.: W. M. Canby s.n. [prope Wilmington, 1873] (Ca--405216); Godfrey & White 7083 (Ca--741350, Mi, S); A. E. Radford 4279 (Hi--48381), 4377 (Hi--48383), 5155 (Hi--50212). Onslow Co.: Ashe s.n. [May 20, 1899] (Hi); Radford & Stewart 1213 (Hi--23656). Robeson Co.: Ahles & Ramseur 23819 (Hi--97212). Scotland Co.: Ahles & Hammond 24763 (Hi--97213), 24942 (Hi--119267); Radford & Stewart 328 (Hi--16761). SOUTH CAROLINA: Allendale Co.: C. R. Bell 2643 (Hi--97210). Barnwell Co.: Batson & Kelley s.n. [Apr 13, 1952] (Hi--140166), s.n. [Apr. 20, 1953] (Hi--140167, Hi--140168, Hi--140169, Hi--140170). Charleston Co.: Cabanis s.n. [around Pinebarren Ponds near Charleston] (B). Darlington Co.: W. C. Coker s.n. [4/3/1910] (Hi--77049), s.n. [5/7/10] (Hi), s.n. [June 27, 1931] (Hi--21487); J. B. Norton s.n. [Apr. 9, 1921] (Hi, Hi); B. E. Smith s.n. [April 21, 1932] (Hi--21442). Dorchester Co.: C. G. Du Bois s.n. [Apr. 11, 1889] (Ws). Georgetown Co.: Radford & Stewart 1030 (Ca--978012, Hi--23497). Marion Co.: C. R. Bell 7870 (Hi--97211). Williamsburg Co.: A. E. Radford 21268 (Hi--97167). County undetermined: L'Herminier s.n. [Carolina meridionale] (B). GEORGIA: Early Co.: R. F. Thorne 3294 (N), 3477 (Mi, Vi); Thorne & Muenscher 2467 (We). Miller Co.: Thorne & Harper 3171 (Ca--906391). Montgomery Co.: R. M. Harper 2146 (Ms--15476, N). Sumter Co.: R. M. Harper 2219 (Ms--15477), 2279 (B). Ware Co.: Ward, Ward, & Godfrey 1307 (Hi--181986). Sapelo Island [McIntosh Co.]: Adams, Connell, & Duncan 20000 (Mi). FLORIDA: Alachua Co.: "B. T. Y." 421 (Hi--203783). Collier Co.: A. R. Moldenke 1379 (Ac, Rf, Ws). Dade Co.: A. A. Eaton 485 (Rf). Duval Co.: Curtiss 3017 (Ca--2412, Ms--15466, Ms--15468, Vi), 4585 (Ca--115168, Mm--7961), 6126 (Hi--77051, S), s.n. [Jacksonville] (Ws); Ruth s.n. [May 1893] (Ut--798b). Escambia Co.: Fassett 21142 (Ws); R. K. Godfrey 54595 (N); Goodale s.n. [24 March 1933] (Ms--69827), s.n. [31 March 1933] (Ms--69824). Gulf Co.: A. W. Chapman s.n. [Wewahhitchka] (Dt). Hillsborough Co.: Cooley & Eaton 5781 (N). Holmes Co.: R. K. Godfrey

56395 (Ca—112969); Kral & Redfearn 2895 (Hi—111832). Jackson Co.: R. K. Godfrey 54530 (Hi—157560, N). Lake Co.: G. V. Nash 92 (Ca—115165, Mm—7963, Ms—15469). Lee Co.: R. K. Godfrey 53104 (Hi—157559); H. N. Moldenke 689a (S). Leon Co.: R. K. Godfrey 53104 (N). Liberty Co.: A. R. Moldenke 281 (S); Reese 1141 (Hi—193468). Martin Co.: W. F. Buchanan s.n. [Stuart, March 23, 1938] (Ok). Okeechobee Co.: J. A. Harris C.17908 (Ca—610047). Orange Co.: A. S. Hitchcock s.n. [Winter Park] (Dt); A. M. Huger 9 (S). Osceola Co.: G. Een s.n. [25.3.1951] (S). Palm Beach Co.: A. R. Moldenke 1379 (B); Small, DeWinkeler, & Rane 9815 (S). Pasco Co.: Cooley & Monachino 5585 (N). Pinellas Co.: M. S. Bebb s.n. [Clearwater, 1894] (Ok). Polk Co.: McFarlin 4280 (Mi), 4322 (Mi), 4491 (Mi); Topping 2611 (Mi). Saint Johns Co.: J. D. Smith s.n. [Mch. 4, 1882] (Ca—189386). Santa Rosa Co.: Fassett 21136 (Ws). Seminole Co.: H. C. Beardslee s.n. [Near Altemonte Springs, April 1939] (Ca—841785). Volusia Co.: H. C. Beardslee 1 (Ca—841784). Wakulla Co.: R. K. Godfrey 53134 (Hi—157558, N); Redfearn & Kral 2443 (N). Walton Co.: Kral 19844 (N). Robert's Island [Dade Co.]: J. K. Small 7386 (S). County undetermined: Chickering s.n. (Ca—2444); Curtiss s.n. [Pine barren swamps, July 188-] (Hi—77043), s.n. (Mm—7962); Goodale 69827 [Ensley] (Ok); Herb. Amherst Coll. s.n. (Ms—15473). ALABAMA: Escambia Co.: Ahles 7255 (Ur). Mobile Co.: Herb. Jewett 3007 (Dt); Kell & Dittman s.n. [29 April 1951] (Ac). MISSISSIPPI: George Co.: Ahles & Bell 7688 (Ur). County undetermined: Hilgard s.n. [seacoast, May 1859] (Dt). LOUISIANA: Saint Tammany Par.: Kral 16508 (N). TEXAS: Austin Co.: Tharp s.n. [Bellville, 5/4/40] (Ca—841806). Hardin Co.: R. L. Crockett 6697 (Ld); E. J. Palmer 9563 (S). Henderson Co.: O. Sanders 132 (Mi, Rf). Houston Co.: E. J. Palmer 13185 (Ws). LOCALITY OF COLLECTION UNDETERMINED: Boott s.n. (Ws); Hooker s.n. [S. States] (B); Palisot de Beauvois s.n. [America septentr.] (B).

ERIOCAULON COMPRESSUM var. HARPERI Moldenke

Additional bibliography: Moldenke, Bull. Jard. Bot. Brux. 27: 141. 1957; Moldenke, Résumé 11, 12, 14, 23, & 480. 1959; Moldenke, Résumé Suppl. 3: 2 (1962) and 16: 1 & 2. 1968.

Recent collectors have found this variety growing in pinebarrens, open white gravel bogs, moist shallow broad ditches, sphagnous peat of hillside bogs, sphagnous sandy peaty soil of flatwoods areas, longleaf pine hills, heavy sandy peaty clay of hillside bogs, and Sarracenia bogs. Kral reports it "very abundant in sphagnous Sarracenia type boggy areas in flatwoods", while Kral & Godfrey report it "common on moist open sands of savanna". They have collected it in flower and fruit in April and August. Kral describes the heads as "snowy white".

Material has been misidentified and distributed in herbaria as E. compressum Lam. and E. decangulare L. The Lighthipe s.n. [Tom's River, Sept. 1, 1890] is actually a mixture with E. decangulare L.

Additional citations: NEW JERSEY: Ocean Co.: Lighthipe s.n. [Tom's River, Sept. 1, 1890] (Ca--841790). MARYLAND: Prince Georges Co.: S. F. Blake 10665 (Ws). GEORGIA: R. M. Harper 1395 (B). FLORIDA: Bay Co.: Kral 19800 (N). Escambia Co.: Kral 19876 (N), 19880 (N). Franklin Co.: R. K. Godfrey 53139 (Hi--157557, N). Lee Co.: H. N. Moldenke 689 (S). Wakulla Co.: Kral & Godfrey 2342 (Hi--193978, N); H. N. Moldenke 1123 (S). Walton Co.: Kral 19808 (N). ALABAMA: Mobile Co.: Kral 26526 (N). MISSISSIPPI: George Co.: Kral 19854 (N). Jackson Co.: Demaree 28664 (Ok, St); Jacob 1278 (Hi--196310). LOCALITY OF COLLECTION UNDETERMINED: Herb. Soc. Nat. Hist. Boston s.n. (Dt).

ERIOCAULON COMPTONII Rendle

Additional bibliography: Rendle, Journ. Linn. Soc. Lond. Bot. 45: 259. 1921; A. W. Hill, Ind. Kew. Suppl. 7: 88. 1929; Moldenke, Known Geogr. Distrib. Erioc. 27 & 61. 1946; Moldenke, Résumé 205 & 480. 1959.

ERIOCAULON CONCRETUM F. Muell.

Additional bibliography: F. Muell., Fragm. 1: 92--93. 1859; Jacks. in Hook. f. & Jacks., Ind. Kew., pr. 1, 1: 878. 1893; Ruhl. in Engl., Pflanzenreich 13 (4-30): 114 & 285. 1903; Moldenke, Known Geogr. Distrib. Erioc. 27 & 33. 1946; Jacks. in Hook. f. & Jacks., Ind. Kew., pr. 2, 1: 878 (1946) and pr. 3, 1: 878. 1960; Moldenke, Résumé 208 & 480. 1959.

ERIOCAULON CONGOLENSE Moldenke

Additional bibliography: Moldenke, Résumé Suppl. 4: 7. 1962; Moldenke, Phytologia 8: 386. 1962; Hocking, Excerpt. Bot. A.6: 455. 1963; Moldenke, Biol. Abstr. 42: 1517. 1963; Anon., Assoc. Etud. Tax. Fl. Afr. Trop. Index 1962: 29. 1963.

Citations: CONGO LEOPOLDVILLE: Monod 11642 (An--type, Z--isotype).

ERIOCAULON CONICUM (Fyson) C. E. C. Fischer

Synonymy: Eriocaulon dianae var. conica Fyson, Journ. Indian Bot. Soc. 2: 260. 1921. Eriocaulon conicum Fisch. apud Razi, Journ. Mysore Univ. 7 (4): 77. 1946. Eriocaulon conicum Hook. f. ex Razi, Proc. Nat. Inst. Sci. India 21 B (2): 82. 1955.

Bibliography: Fyson, Journ. Indian Bot. Soc. 2: 260. 1921; C. E. C. Fischer, Kew Bull. Misc. Inf. 1931: 261. 1931; C. E. C. Fischer in Gamble, Fl. Presid. Madras 9: 1616--1617 & 1620. 1931; A. W. Hill, Ind. Kew. Suppl. 9: 105. 1938; Razi, Journ. Mysore Univ. 7 (4): 77. 1946; Moldenke, Known Geogr. Distrib. Erioc. 23 & 61. 1946; Moldenke, Phytologia 3: 189 (1949) and 3: 322. 1950;

Razi, Journ. Mysore Univ. B 14 (10): 460. 1955; Razi, Contrib. Bot. 40: 92. 1955; Razi, Proc. Nat. Inst. Sci. India 21 B (2): 82. 1955; Moldenke, Résumé 161, 287, & 480. 1959; Razi, Rec. Bot. Surv. India 18: 19. 1959; Moldenke, Résumé Suppl. 3: 17 & 31. 1962; Thanikaimoni, Pollen & Spores 7: 184. 1965.

Fyson's original description of this taxon is "Capitula conica, basi truncata, folia linearia. Mysore to Wyanaad. Heads conical with horizontal base, very black, because nearly glabrous: clearly connected with var. f. This plant is possibly E. Rousciamum Steud." Razi (1959) cites Gamble's Fl. Madras, cited by me in the bibliography above. He records the species from Andhra, Madras, and Mysore.

The Ramaswamy 1042 & 2267, distributed as E. conicum, actually are E. odoratum Dalz., while Ramaswamy 2108 is E. oliveri Fyson and his 1830 is E. hamiltonianum var. minimum Fyson

ERIOCAULON CONIFERUM Herzog

Additional bibliography: Lützelburg, Estud. Bot. Nordéste 3: 147 & 150. 1923; Herzog in Fedde, Repert. Sp. Nov. 20: 82. 1924; A. W. Hill, Ind. Kew. Suppl. 7: 88. 1929; Moldenke, Known Geogr. Distrib. Erioc. 7 & 33. 1946; Moldenke, Phytologia 3: 322. 1950; Moldenke, Résumé 88 & 480. 1959.

Additional citations: BRAZIL: Goiás: Lützelburg 455 [Macbride photos 18685] (N--photo of cotype, W--photo of cotype).

ERIOCAULON CRASSISCAPUM Bong.

Synonymy: Eriocaulon molle Mart. ex Körn. in Mart., Fl. Bras. 3 (1): 487, in syn. 1863 [not E. molle Steud., 1855]. Eriocaulon crassiscapum Bonz. ex Rennó, Levant. Herb. Inst. Agron. 68, sphalm. 1960.

Bibliography: Bong., Mém. Acad. Imp. Sci. St.-Pétersb., sér. 6, 1: 628, pl. 44. 1831; Kunth, Enum. Pl. 3: 574 & 575. 1841; Steud., Syn. Pl. Glum. 2 (Cyp.) 2: 269. 1855; Körn. in Mart., Fl. Bras. 3 (1): 486--487. 1863; Jacks. in Hook. f. & Jacks., Ind. Kew., pr. 1, 1: 878. 1893; Ruhl. in Engl., Pflanzenreich 13 (4-30): 7, 8, 17, 42, 52, 285, & 286, fig. 2 E—G, & 7. 1903; Ruhl. in Engl. & Prantl, Nat. Pflanzenfam., ed. 2, 15a: fig. 17. 1930; Castell. in Descole, Gen. Sp. Pl. Argent. 3: 87, pl. 17. 1945; Abbiatti, Revist. Mus. La Plata Bot. 6 (26): 329—330, pl. 2 (1), fig. 4 (d) & 6. 1946; Jacks. in Hook. f. & Jacks., Ind. Kew., pr. 2, 1: 878. 1946; Moldenke, Known Geogr. Distrib. Erioc. 7, 33, & 37. 1946; Moldenke, Phytologia 3: 189 (1949) and 3: 322. 1950; Angely, Fl. Paran. 10: 14. 1957; Moldenke, Résumé 88, 123, & 290. 1959; Angely, Fl. Paran. 16: 51. 1960; Rennó, Levant. Herb. Inst. Agron. 68. 1960; Jacks. in Hook. f. & Jacks., Ind. Kew., pr. 3, 1: 878. 1960; Angely, Fl. Paran. 17: 24. 1961; Moldenke, Résumé Suppl. 3: 31. 1962.

Illustrations: Ruhl. in Engl., Pflanzenreich 13 (4-30): 7 & 52, fig. 2 E--g & 7. 1903; Ruhl. in Engl. & Prantl, Nat. Pflanzenfam., ed. 2, 15a: fig. 17. 1930; Castell. in Descole, Gen.

Sp. Pl. Argent. 3: pl. 17. 1945; Abbiatti, Revist. Mus. La Plata Bot. 6 (26): 330, pl. 2 (1), fig. 4 (d) & 6. 1946.

The E. molle Steud., referred to in the bibliography above, is a synonym of Paepalanthus plumosus (Bong.) Körn. It should be noted that E. molle Mart. is based on Luschnath 40 [Martius 890] from Caxoeiro do Campo, Minas Gerais, Brazil.

Kunth (1841) describes E. crassiscapum as follows: "acaule; foliis vagina brevioribus, lanceolatis, acuminatis, reticulatis, glabris; pedunculo crassiusculo, fistuloso, glabro; vagina laxa, bifida. Bong. -- In paludibus inter as Prados et Barbacena." He tells us that the "pl. 44" of Bongard's work (1831) was never published. I have personally verified that it does not occur in the New York Botanical Garden's copy of the work. It is, of course, possible that the original drawings are preserved in Leningrad.

Our plant has been collected in marshes, flowering in February. Material has been misidentified and distributed in herbaria under the name E. flagellare Guill. The Riedel 1038, cited below, is a mixture with Leiothrix curvifolia (Bong.) Ruhl. and was identified by Pulle as L. curvifolia var. lanuginosa (Bong.) Ruhl.

Abbiatti (1946) thinks that the Löfgren collection, cited below as from São Paulo, may actually have come from Minas Gerais [the locality of collection is "Corrego Alegre"]. She cites also Muniez s.n. [Loreto, Sept. 1919] from Misiones, Argentina, and the following specimens from São Paulo, Brazil: Brade 5536 [Herb. Inst. Bot. S. Paulo 6581], Duarte 37 [Herb. Inst. Bot. S. Paulo 10176], F. C. Hoehne s.n. [Butantan, 27-VII-1917; Herb. Inst. Bot. S. Paulo 368], and Collector undesignated s.n. [Cantareira, 8-IV-1901; Herb. Com. Geogr. & Geol. 74; Herb. Inst. Bot. S. Paulo 10177].

Additional citations: BRAZIL: Minas Gerais: Burchell 5701 (Br); P. Clausen 8 (Br), 17 (P), 1180 (E), s.n. (Br); Lindberg 570 (Br, S); Luschnath 40 [Martius 890] (Br, M, N--photo, Z--photo), s.n. [Campos Bravos, Julio 1833] (Br); Magalhães Gomes 4301 [Herb. Jard. Bot. Belo Horiz. 26714] (N); Mosén 1738 (S); Regnell III. 1269 [22/11/1864] (S, S, W--200762), III.1269 [26/11/1864] (S); L. Riedel 1038, in part (Ut--336). Paraná: Dusén 10493 (S, S); Hatschbach 2861 (N). São Paulo: Brade 5536 (S); Eiten & Eiten 1749 (N); Löfgren s.n. [Herb. Inst. Bot. S. Paulo 10175; Herb. Com. Geogr. & Geol. 3576] (N); L. Riedel 1481 (S, Ut--328). State undetermined: Glaziou 17344 (Br).

ERIOCAULON CRISTATUM Mart.

Bibliography: Wall., Plant. As. Rar. 3: 28. 1832; Wall., Numer. List 207. 1832; Kunth, Enum. Pl. 3: 559--560. 1841; Körn., Linnaea 27: 607. 1856; Hook. f., Fl. Brit. Ind. 6: 574. 1893; Jacks. in Hook. f. & Jacks., Ind. Kew., pr. 1, 1: 878. 1893; Ruhl. in Engl., Pflanzenreich 13 (4-30): 63, 84, & 285. 1903; Fyson, Journ. Indian

Bot. Soc. 2: 312, pl. 31. 1921; Satake, Bull. Tokyo Sci. Mus. 4: [Rev. Jap. Erioc.] 64. 1940; Moldenke, Known Geogr. Distrib. Erioc. 23, 25, 26, 33, & 61. 1946; Jacks. in Hook. f. & Jacks., Ind. Kew., pr. 2, 1: 878. 1946; Moldenke, Phytologia 3: 189. 1949; Moldenke, Résumé 159, 162, 169, 173, 174, 180, 287, 291, & 480. 1959; Moldenke, Résumé Suppl. 1: 11. 1959; Jacks. in Hook. f. & Jacks., Ind. Kew., pr. 3, 1: 878. 1960; Thanikaimoni, Pollen & Spores 7: 183 & 184, tab. 1. 1965; Moldenke, Résumé Suppl. 15: 8. 1967; Moldenke, Phytologia 17: 454. 1968.

Illustrations: Fyson, Journ. Indian Bot. Soc. 2: pl. 31. 1921; Thanikaimoni, Pollen & Spores 7: 183, tab. 1. 1965.

Fyson (1921) describes this species as follows: "Stem short or up to 1 in. Leaves linear to 6 in. by 1/6 in., many nerved, not much enlarged at the base. Scapes 6—15 in. Heads 1/3 in. Involucre black or white. Floral bracts deltoid. Receptacle not very hairy." He gives its distribution as "Assam; Khasia; Bengal" and comments that "Some of the heads have a fringe of protruding male petals as in E. longicuspis, but because of the broad leaf-bases I am inclined to regard this as more nearly related to E. ceylanicum."

The E. cristatum Mart., noted in Körn., Linnaea 27: 607 (1856), is actually E. miserum Körn.

It appears that the W. Griffith 5568, cited by me as from West Bengal, India, in a previous installment of these notes, is actually from East Bengal, Pakistan. Chand describes E. cristatum as "5 in. tall, gray" and found it growing in a meadow in Assam, flowering in June. It has been collected at altitudes of 4000 to 6000 feet. Material has been misidentified and distributed in herbaria as E. depauperatum Merr.

Additional citations: PAKISTAN: East Bengal: H. Bruce 9 (Br—cotype); W. Griffith 5568 (Br, C, S), 5578 (S); Hamilton s.n. [Silhet] (Br, N—photo, Z—photo); F. de Silva 8 (Br—cotype, N—photo of cotype, Z—photo of cotype); Wallich 6070 (B). INDIA: Assam: Chand 7814 (Mi). Bombay: J. Fernandez s.n. [Arn. Arb. 443] (Xa), s.n. [Arn. Arb. 888] (Xa); Santapau 10906 (Xa), 11738 (Xa). Khasi States: Hooker & Thomson s.n. [Mont. Khasia, 4-5000 ped.] (B, Br, M, S, Ut—307). Madras: S. N. Ramaswamy 17 (Z). Mysore: S. N. Ramaswamy 28 (Ac). State undetermined: Ritchie 1248 (T).

ERIOCAULON CRISTATUM var. MACKII Hook. f.

Bibliography: Hook. f., Fl. Brit. Ind. 6: 574. 1893; Ruhl. in Engl., Pflanzenreich 13 (4-30): 84 & 285. 1903; Moldenke, Known Geogr. Distrib. Erioc. 23 & 33. 1946; Moldenke, Résumé 162 & 480. 1959.

Hooker (1893) describes this variety as follows: "leaves broader, receptacle densely villous. Assam (probably Khasia). Mrs. Mack. Probably a different species." It is to be noted that if he intended to honor Mrs. Mack, rather than her husband, he did not spell the varietal epithet in the proper manner.

ERIOCAULON CUBENSE Ruhl.

Additional bibliography: Ruhl. in Fedde, Repert. Sp. Nov. 22: 29. 1925; A. W. Hill, Ind. Kew. Suppl. 7: 88. 1929; Moldenke, N. Am. Fl. 19: 18 & 20. 1937; Moldenke, Phytologia 1: 313. 1939; Moldenke, Known Geogr. Distrib. Erioc. 4 & 33. 1946; León, Fl. Cuba 1: 280. 1946; Moldenke, Résumé 53 & 480. 1959.

Additional citations: ISLA DE PINOS: Ekman 12065 (Ca--491274--isotype, N--photo of type, S--type, Z--photo of type).

ERIOCAULON CUSPIDATUM Dalz.

Additional bibliography: Dalz. in Hook., Kew Journ. 3: 281. 1851; Jacks. in Hook. f. & Jacks., Ind. Kew., pr. 1, 1: 878. 1893; Hook. f., Fl. Brit. Ind. 6: 581. 1894; Ruhl. in Engl., Pflanzenreich 13 (4-30): 102, 104, 168, & 285. 1903; Fyson, Journ. Indian Bot. Soc. 2: 317--318, pl. 38. 1921; C. E. C. Fischer in Gamble, Fl. Presid. Madras 9: 1606 & 1618. 1931; Moldenke, Known Geogr. Distrib. Erioc. 23 & 33. 1946; Razi, Journ. Mysore Univ. 7 (4): 77. 1946; Jacks. in Hook. f. & Jacks., Ind. Kew., pr. 2, 1: 878. 1946; Moldenke, Phytologia 3: 189 (1949) and 3: 322. 1950; Razi, Journ. Mysore Univ. 11 (1): 6 & 16. 1950; Moldenke, Résumé 162, 165, & 480. 1959; Jacks. in Hook. f. & Jacks., Ind. Kew., pr. 3, 1: 878. 1960; Thanikaimoni, Pollen & Spores 7: 184. 1965.

Illustrations: Fyson, Journ. Indian Bot. Soc. 2: pl. 38. 1921.

Fyson (1921) describes this species as follows: "Stem disciform. Leaves 1--4 in. by 1/6--1/4 in. exactly oblong up to the round and apiculate or cuspidate apex above 7 nerved. Scapes several 8--15 in. Head 1/4 in. diam., globose, white. Floral bracts cuneate, obovate, hairy. Sepals of both sexes 2 only (F.B.I. has '3, one flat') female sepals deeply boatshaped and enlarged down the back. Seeds oblong, quite smooth. Petals 3, linear-lanceolate, unequal." He gives its distribution as "Peninsular India; N. Mysore; Kanara, at sea-level, Malabar and Concan" and comments that "The leaves make this a very distinct species." He cites Dalziel 138 in the Calcutta herbarium. Razi (1950) also records the species from Mysore.

Additional citations: INDIA: Bombay: Sedgwick & Bell 7016 (Xa, Z). Kerala: Stocks, Law, &c. 20 (B), s.n. [Concan] (S). Mysore: Herb. Presid. Coll. Madras s.n. [21 October '26] (S); E. K. Janaki 327 (Mi).

ERIOCAULON CUSPIDATUM var. BRACTEATUM Fyson

Synonymy: Eriocaulon cuspidatum var. bracteata Fyson, Journ. Indian Bot. Soc. 2: 318. 1921.

Bibliography: Fyson, Journ. Indian Bot. Soc. 2: 318. 1921.

ERIOCAULON DALZELLII Körn.

Synonymy: Eriocaulon rivulare Dalz. in Hook., Kew Journ. 3: 280. 1851 [not E. rivulare G. Don, 1849].

Bibliography: Hook., Kew Journ. 3: 280. 1851; Körn., Linnaea 27: 605. 1856; Jacks. in Hook. f. & Jacks., Ind. Kew., pr. 1, 1:

878 & 879. 1893; Ruhl. in Engl., Pflanzenreich 13 (4-30): 91 & 285. 1903; H. Lecomte, Not. Syst. 2: 215. 1912; Haines, Bot. Bihar & Orissa 6: 1066--1068. 1924; Jacks. in Hook. f. & Jacks., Ind. Kew., pr. 2, 1: 878 & 879. 1946; Moldenke, Known Geogr. Distrib. Erioc. 23, 33, & 39. 1946; Moldenke, Phytologia 3: 189--190. 1949; Razi, Journ. Mysore Univ. 11 (1): 16. 1950; Moldenke, Résumé 159, 162, 167, 291, & 480. 1959; Jacks. in Hook. f. & Jacks., Ind. Kew., pr. 3, 1: 878 & 879. 1960; Thanikaimoni, Pollen & Spores 7: 185. 1965.

The E. rivulare of Don, mentioned in the synonymy above, is a synonym of E. latifolium J. Sm.

Lecomte (1912) states that E. dalzellii differs from E. eberhardtii H. Lecomte in having its scapes 10- (not 6-) costate and its anthers white (not black).

The W. Griffith 5563 and Herb. R. Wight 2855, cited by me as E. dalzellii in a previous installment of these notes, prove to be E. odoratum Dalz. instead. The Herb. Roy. Forest Dept. 18174, distributed as E. dalzellii, also is actually E. odoratum. Razi (1950) records E. dalzellii from Mysore.

Additional citations: INDIA: Bombay: Santapau 17667 (Xa). Kerala: Stocks, Law, &c. s.n. [Malabar, Concan, &c.] (B, M, S, Ut--314). Mysore: Dhanvantari s.n. [Castle Rocks, 7-10-51] (Bn--3206). State undetermined: Dalzell 1494 (T).

ERIOCAULON DAMAZIANUM Beauverd

Additional bibliography: Beauverd, Bull. Herb. Boiss., sér. 2, 8: 986. 1909; Prain, Ind. Kew. Suppl. 4, pr. 1, 82 (1913) and pr. 2, 82. 1938; Moldenke, Known Geogr. Distrib. Erioc. 7 & 33. 1946; Moacyr Lisboa, Cent. Nascim. Leon. Bot. Damazio [2]. 1954; Moldenke, Résumé 88 & 480. 1959.

ERIOCAULON DECANGULARE L.

Additional & emended synonymy: Randalia mariana procerior Petiv., Gaz. Nat. 10, pl. 6, fig. 2. 1702. Eriocaulon decanqulare L. ex S. Ell., Sketch Bot. 2: 565, sphalm. 1824. Randalia decangulare Desv., Ann. Sci. Nat. Paris, sér. 1, 13: 47, pl. 5, fig. 2, 1828. Randalia americana Petiv. apud Kunth, Enum. Pl. 3: 543, in syn. 1841. Randalia decangularis Beauv. ex Kunth, Enum. Pl. 3: 543. 1841. Paepalanthus decangularis L. ex Körn. in Mart., Fl. Bras. 3 (1): 491 [as "Paepalantho decangulari"]. 1863. Eriocaulon gnaphalodes Ell. apud Jacks. in Hook. f. & Jacks., Ind. Kew., pr. 1: 878, in syn. 1893 [not E. gnaphalodes Beauv., 1959, nor Michx., 1803, nor C. Wright, 1900]. Eriocaulon decemangulare L. ex Moldenke, Résumé 287, in syn. 1959. Eriocaulon decangulare Michx. ex Moldenke, Résumé Suppl. 1: 17, in syn. 1959. Eriocaulon gnaphalodes Bernhardi ex Moldenke, Résumé Suppl. 1: 17, in syn. 1959. Eriocaulon decandulare L. ex Moldenke, Résumé Suppl. 3:

31, in syn. 1962. Eriocaulon decangular L. ex Kral, Sida 2: 305, sphalm. 1966.

Additional & emended bibliography: Petiv., Gaz. Nat. 10, pl. 6, fig. 2. 1702; L., Sp. Pl., ed. 1, 87 & 129. 1753; Crantz, Inst. 1: 360. 1766; Pluk., Alm. pl. 409, fig. 5. 1769; Walt., Fl. Carol. 83. 1788; Lam., Encycl. Méth. Bot. 3: 276. 1789; Willd. in L., Sp. Pl., ed. 4, 1: 486. 1797; Michx., Fl. Bor.-am. 2: 165. 1803; Pursh, Fl. Am. Sept. 1: 91. 1814; Roem. & Schult. in L., Syst. Veg., ed. 15 nova, 2: 864. 1817; Nutt., Gen. 1: 90. 1818; S. Ell., Sketch Bot. 2: 565—566. 1824; Desv., Ann. Sci. Nat. Paris, sér. 1, 13: 47—48, pl. 5, fig. 2 & 3. 1828; Beck, Bot. 370. 1833; Raf., Autikon Bot., pr. 1, 188—189. 1840; Kunth, Enum. Pl. 3: 543—544, 563, & 580. 1841; Schlecht., Linnaea 18: 435. 1844; W. Griff., Notul. 3: 118. 1851; Körn. in Mart., Fl. Bras. 3 (1): 474, 476, 491, & 497. 1863; Morong, Bull. Torrey Bot. Club 18: 354. 1891; Jacks. in Hook. f. & Jacks., Ind. Kew., pr. 1, 1: 878. 1893; Coult., Contrib. U. S. Nat. Herb. 2: 459. 1894; Jacks. in Hook. f. & Jacks., Ind. Kew., pr. 1, 2: 681. 1895; Britton & Br., Illustr. Fl., ed. 1, 1: 372 & 602, fig. 901 (1896) and 3: 537. 1896; J. K. Small, Fl. Southeast. U. S., ed. 1, 236. 1903; Ruhl. in Engl., Pflanzenreich 13 (4-30): 1, 31, 33, 35, & 285. 1903; R. M. Harper, Ann. N. Y. Acad. Sci. 17: 267, pl. 24, fig. 1. 1906; M. A. Day, Check List 39. 1908; Robins. & Fern. in A. Gray, New Man. Bot., ed. 7, 261 & 898. 1908; Ann. Rep. N. J. State Mus. 1910: pl. 28, fig. 2. 1912; Britton & Br., Illustr. Fl., ed. 2, 1: 455, fig. 1143. 1913; J. K. Small, Fl. Southeast. U. S., ed. 2, 236. 1913; Uphof in Karst. & Schenck, Vegetationsbild. 21 (1-2): n.p. 1930; J. K. Small, Man. Southeast. Fl. 258. 1933; Cory, Texas Agr. Exp. Sta. Bull. 550: 29. 1937; Moldenke, N. Am. Fl. 19: 18 & 21. 1937; Moldenke, Phytologia 1: 314—316. 1939; Moldenke in Lundell, Fl. Texas 3 (1): 4—5. 1942; Raf., Autikon Bot., pr. 2, 188—189. 1943; Moldenke, Phytologia 2: 124. 1944; R. R. Tatnall, Fl. Del. 75. 1946; Fern., Rhodora 48: iv & 58. 1946; Jacks. in Hook. f. & Jacks., Ind. Kew., pr. 2, 1: 878 (1946) and 2: 681. 1946; Moldenke, Known Geogr. Distrib. Erioc. [1]—3, 34, 40, & 56. 1946; Moldenke, Phytologia 2: 153 (1948), 3: 190—192 (1949), 3: 383—385 (1950), and 3: 468. 1951; Thorne, Am. Midl. Nat. 52: 281. 1954; Angely, Pl. Paran. 10: 4. 1957; Moldenke, Résumé 7—12, 14, 23, 27, 287, 288, 292, 293, 342, 350, 414, & 480. 1959; Moldenke, Résumé Suppl. 1: 2, 3, 17, & 23 (1959) and 2: 2. 1960; Jacks. in Hook. f. & Jacks., Ind. Kew., pr. 3, 1: 878 (1960) and 2: 681. 1960; Fables, Bartonia 32: 9. 1961; Moldenke, Résumé Suppl. 3: 2—5, 7, & 31 (1962), 4: [1]—3 (1962), 5: 2 (1962), and 6: [1]. 1963; Gleason & Cronquist, Man. Vasc. Pl. 184. 1963; Batson, Wild Fls. S. C. 28. 1964; Moldenke, Résumé Suppl. 11: [1] (1964) and 12: [1]. 1965; Shinners, Sida 2: 441. 1966; Kral, Sida 2: 302—305 & 330. 1966; Rickett, Wild Fls. U. S. 2 (1): 135 (1967) and 2 (2): 659. 1967; Moldenke, Résumé Suppl. 15: [1] (1967) and 16: [1] & 2. 1968; Moldenke, Phytologia 17: 382. 1968.

Additional illustrations: Petiv., Gaz. Nat. pl. 6, fig. 2.

1702; Batson, Wild Fls. S. C. 28 [in color]. 1964.

It is perhaps worth pointing out here that the homonymous designations, E. decangulare Hill and E. decangulare Muds., are synonyms of the Old World E. septangulare With., E. decangulare Lightf. is the New World E. pellucidum Michx., E. decangulare Willd. is E. humboldtii Kunth, E. gnaphalodes Beauv. and E. gnaphalodes Michx. are E. compressum Lam., and E. gnaphalodes C. Wright is E. pseudocompressum Ruhl. Although Jackson (1893) accredits the homonym, E. gnaphalodes Ell., to S. Ell., Sketch Bot. 2: 565 (1824), the binomial is there plainly attributed to Michaux. The initial letter of the specific epithet is often uppercased.

Eriocaulon decangulare L. is the type species of the genus Eriocaulon. It is worth noting the comments of Kunth (1841) regarding Symphachne xyroides Beauv. & Desv.: "Endlicher cum ? ad Philodicen ducit. Planta a cel. Beauvois sub nomine Symphachnis xyroidis accepta nil nisi specimen valde juvenile Eriocauli decangularis esse videtur; florem structuram enucleare mihi haud licuit." The same author, under E. wightianum Mart., comments that "Huic speciei pro aliis habitu accedit E. decangulare Linn."

Kral (1966) says for E. decangulare: "Sandy or peaty lakeshores, pine flatwood, ditches, margins of cypress domes, or savannas, primarily in the coastal plain, Florida north to New Jersey, west to eastern Texas. Type. In swamps, North America. Not seen by this writer. This is the most robust of the Eriocaulons of the southern United States and it is certainly one of the more conspicuous floral elements in the midsummer and fall savannas, its white 'buttons' providing a pleasing contrast in a sea of grass and sedge. It is also to be distinguished from sympatric Eriocaulons by its narrowly acute to acuminate receptacular bractlets, the pale tips of which are noticeably exserted from the heads, and by the firmer character of its foliage and inflorescences. The stature, leaf length and breadth, and the head size of E. decangulare all tend to be less as one travels west toward Texas or north along the Atlantic coastal plain. The largest examples of this species are to be found in northwest Florida (E. decangular L. var. latifolium Chapm. ex Moldenke)."

Recent collectors have found this plant growing in a great variety of habitats, which they describe as follows: moist or pine savannas, flatwoods, low pinebarrens, low savannas with few scattered pines, boggy pinelands, pinebarren bogs and swamps, bogs in longleaf pine hills, hillside and mountain bogs, pineland swales, shrub bogs and Sarracenia bogs, on gravel in seepage bogs, in sandy clay peat or sandy peat in flatwood bogs, in sandy soil along brooks in cutover longleaf pine country, in pastured pine savannas, in boggy sandy margins and adjacent woods near ponds, burned-over shrub savannas, roadside or acid roadside ditches, in pocosins and pocosin borders, low woodland borders, muddy Sphagnum holes in shaded swamps, exsiccated cypress ponds, in barely emersed Sphagnum, swamp and shallow lake areas in oak

woods, and among severely cutover longleaf pine 'crayfish flats' with much myrtle and sweetgum shrubbery. It ascends to 2500 feet in western North Carolina.

Thorne (1951) states that the species is "common" in moist pinelands, cypress ponds, and bogs; Novosad reports it "abundant in acid bogs, full sun" in Texas; Rock found it "abundant in ditch bordering a Muhlenbergia-Arundinaria grass savannah with pine not yet in aspect dominance; some Clethra and Cyrilla present" in North Carolina; while Webster & Wilbur report it "common in low moist areas in woods of longleaf pine and some hardwoods", also in Texas. Correll & Johnston note that the plants form "large clumps". Lakela found it in "sandy mucky soil and shallow open water; drier soil with forbs and grasses" in Collier County, Florida.

In spite of the statement that it is normally a late-bloomer, specimens have been collected in anthesis from April to September and in November, in fruit both in June and in September and November. Fables (1961) emphasizes that in New Jersey it blooms later than E. compressum Lam. Tatnall (1946) avers that on the Delmarva Peninsula it occurs mostly in Sussex County pinebarrens, flowering from July to September. The Lundells say for their no. 11902 "perennial herb, corolla yellow, anthers orange", but surely this must be a case of faulty transcription when the labels were made.

Arsène 11030 in the Berlin herbarium has a printed label reading "PL. du MEXIQUE", but a longhand inscription "Covington"; no. 11786 has a similar printed label and the inscription "Covington-Fairview". Obviously the specimens are from Louisiana, not Mexico.

The Palisot de Beauvois s.n., cited below, is the type collection of Symphachne xyrioides Beauv. & Desv., but the labels are inscribed "Symphachne xyroides Beauv." and "S. xyroides Palis."

Ahles & Leisner 31896 and Ray, Lakela, & Patman 10062 exhibit binary flower-heads! C. R. Bell s.n. [Sept. 10, 1958] exhibits 3 flower-heads with large foliaceous-proliferated involucral bractlets. Mikula 3056 has very soft compressed heads; J. T. Baldwin Jr. 14824 is from the same locality and is very immature but doubtless conspecific. Possibly this may represent a hybrid with E. compressum Lam. Godfrey 48489 and B. W. Wells s.n. [July 14, 1949] have very narrow leaves; similarly, B. W. Wells s.n. [Burgaw, 6/23/1945] has very narrow and not very firm leaves, but its heads are still very immature. Perhaps these may also represent this hybrid.

The F. A. Barkley 13543, cited by Kral as typical E. decangulare, is the type collection of var. minor Moldenke, and Kral 17208 also represents that variety. Lighthipe s.n. [Tom's River, Sept. 1, 1890] is a mixture with E. compressum var. harperi Moldenke. The Jansson s.n. [Aug. 26, 1950] specimen, cited below, is a mixture with E. compressum Lam. and is so mounted that the E.

decangulare scape appears to be issuing from an E. compressum basal leaf-rosette!

Material has been misidentified and distributed in herbaria under the names E. anceps Walt., E. articulatum (Huds.) Morong., E. compressum Lam., E. septangulare With., E. texense Körn., Lachnocaulon sp., and even Phalaris arundinacea L.

On the other hand, the Bell & Kim 281, W. M. Canby s.n. [Damp Pine Barrens, 1859], R. L. Crockett 6697, Curtiss s.n. [Jacksonville] & s.n. [Pine barren swamps, July 188-], and Radford & Stewart 328, distributed as E. decangulare, are all E. compressum Lam.; S. F. Blake 10665 is E. compressum var. harperi Moldenke; Tharp, Turner, & Johnston 54954 is E. texense Körn.; and B. E. Smith s.n. [5/25/32] is Lachnocaulon anceps (Walt.) Morong. According to Kral, the F. A. Barkley 13543 & 13556, Painter & Barkley 13540, Rowell 8050 & 8136, and Tharp 4434, 44344, & 443446, all cited by me as E. texense, are actually E. decangulare; Novosad 80, distributed as E. texense, is also E. decangulare. Actually, I regard F. A. Barkley 13543 as the type collection of E. decangulare var. minor Moldenke, and Kral 17208, distributed as E. decangulare, also represents that variety.

Additional citations: NEW JERSEY: Atlantic Co.: Diffenbaugh 3016 (Dt); C. A. Gross s.n. [Weymouth Paper Works, Aug. 15, 1883] (Ca—67329), s.n. [Aug. 29, 1883] (Ca—67330), s.n. [July 1891] (Dt); Killip 13290 (S). Burlington Co.: R. C. Alexander s.n. [Batsto, 24 Jul. '69] (Ca—379006); J. A. Allen s.n. [Atsion, Aug. 14, 1879] (Ca—2410); Brinton s.n. [Quaker Bridge, June 22, 1880] (Ca—67586); Chrysler & Johnson s.n. [Aug. 11, 1936] (B); Commons s.n. [Oct. 1, 1872] (Ms—15467); Dautun s.n. [Sept. 20, 1907] (B); E. H. Eames 23387 (Ws), s.n. [Chatsworth, Sept. 15, 1896] (S), s.n. [Chatsworth, Sept. 15, 1897] (Hi—77052); Ewer 1104 (Ms—43549); Fogg 4542 (S); Johnson & Ewer 914 (Ms—43550); Lawrence & Dress 575 (Ca—805354); W. H. Leggett s.n. [Quaker Bridge, Aug. 8th, 1864] (N); O. Reed s.n. [Quaker Bridge, July 22, 1950] (We); W. R. Taylor T.588 (Mi). Camden Co.: J. W. Adams 49-358 (Hi—56425); G. W. Bassett s.n. [Atco, July 19, 1923] (S, Ws); Buckheister 901 (Dt), s.n. [Cedar Brook, 31 July '99] (Dt). Cape May Co.: G. W. Bassett s.n. [Cold Spring, July 16, 1917] (S). Ocean Co.: E. J. Alexander s.n. [Forked River, Sept. 18, 1932] (N); N. L. Britton s.n. [Manchester, Aug. 28, 1879] (N), s.n. [Forked River, Aug. 17, 1889] (Ca—2409); E. H. Day s.n. [Island Heights, 1.9.82] (N); Eggleston 4894 (Dt); Heuser s.n. [3 Sept. 1896] (B); Jansson s.n. [Aug. 26, 1950] (Go); F. C. Lane 1870 (Ur); Lighthipe s.n. [Tom's River, Sept. 1, 1890] (Ca—841790); Mackenzie 4257 (S). County undetermined: W. M. Canby s.n. [Pine barrens, Aug. 1861] (Ws), s.n. [July 1864] (Ms—15472);

W. R. Taylor T.1073 [Davenport] (Mi); J. Torrey 22 (S); Tweedy s. n. [Pine barrens, Sept. 1881] (Ca--173634). PENNSYLVANIA: Philadelphia Co.: G. Watson s.n. [Philadelphia] (Ca--379005). County undetermined: Herb. Braun s.n. (B). DELAWARE: Sussex Co.: H. R. Baker s.n. [1 Sept. 1930] (Ws); Goodale 62518 [Herb. Piper 1203] (Ok), s.n. [10 Sept. 1931] (Ms--62518). County undetermined: Bernhardi s.n. (B). MARYLAND: Baltimore Co.: Morong s.n. [Aug. 11, 1873] (Bc). Prince Georges Co.: S. F. Blake 7989 (Ca--841791), 10665 (S); E. H. Walker 4160 (N). DISTRICT OF COLUMBIA: M. S. Bebb s.n. [Herb. Umbach 17933] (Ws); T. Holm s.n. [22/7/1888] (S, S), s.n. [7-1888] (B); F. H. Sargent 6374 (Ok, St); C. S. Sheldon 8371 (Ca--189377); Steele s.n. [July 1912] (S). VIRGINIA: James City Co.: J. T. Baldwin Jr. 14824 (N); Mikula 3056 (N); H. N. Moldenke 21357 (Le). Norfolk Co.: Fernald & Long 13908 (We); Hubricht B.2508 (E--1284021). NORTH CAROLINA: Alexander Co.: Radford & Stewart 1657 (Hi--22656). Alleghany Co.: A. E. Radford 38341 (Hi--119248). Beaufort Co.: Davis & Davis 10511 (We). Bladen Co.: Ahles 458/48 (Ur); Ahles & Haesloop 29110 (Hi--119257); Fox & Godfrey 2653 (N). Brunswick Co.: R. K. Godfrey 48396 (N); B. W. Wells s.n. [July 14, 1949] (No--19791); Wood & Clement 7067 (Hi--51189). Buncombe Co.: Biltmore Herb. 3867a (Hi--77040), 3867d (S). Carteret Co.: Blomquist 15262 (Ca--946493); A. E. Radford 4705 (Hi--48384); C. E. Wood 6407 (Hi--51167). Catawba Co.: Small & Heller s.n. [June 25-26, 1891] (Ms--15470). Clay Co.: Radford & Duke 6445 (Hi--53842), 6453 (Hi--53752). Columbus Co.: C. R. Bell 12710 (Hi--119263); R. K. Godfrey 48489 (No--16392); P. O. Schallert s.n. [Nakina, 6/25/34] (Ca--540128). Craven Co.: A. E. Radford 37513 (Hi--119262); B. W. Wells s.n. [July 14, 1923] (No--2625). Cumberland Co.: Ahles & Leisner 33488 (Hi--119264). Dare Co.: P. O. Schallert s.n. [July 12, 1941] (Ca--841787, Hi--30287, Ok, Ur), s.n. [July 13, 1941] (Ca--841786); B. W. Wells s.n. [July 7, 1923] (No--2623). Duplin Co.: Ahles & Haesloop 28499 (Hi--119254). Harnett Co.: H. Laing 1439 (Hi--97154). Henderson Co.: Barksdale s.n. [8/10/37] (Hi); Singletary s.n. [Gier 365] (Je--6551). Hoke Co.: Ahles & Haesloop 29454 (Hi--119266). Iredell Co.: M. E. Hyams s.n. [Statesville] (Dt); A. E. Radford 2679 (Hi--47998); Radford & Radford 2637 (Hi--30729); Veerhoff s.n. [7/30/1934] (No--2624). Johnston Co.: Deans s.n. [Aug. 1932] (Hi--77036). Jones Co.: A. E. Radford 37120 (Hi--119247). Lenoir Co.: A. E. Radford 25772 (Hi--97159). Lincoln Co.: C. R. Bell s.n. [Sept. 10, 1958] (Hi--134743, Hi--134744). Moore Co.: Ashe s.n. [June 20, 1897] (Hi--24869); Blankinship s.n. [Southern Pines, July 18, 1895] (Lb--20643); Matthews & Holland s.n. [Oct. 26, 1929] (Hi--77037, Hi--77039). New Hanover Co.:

Biltmore Herb. 38676 (Hi—77041). Onslow Co.: C. E. Wood 6520 (Hi—51165, N). Pamlico Co.: A. E. Radford 35963 (Hi—119261). Pender Co.: Ahles & Leisner 32349 (Hi—119260); Barksdale s.n. [7/13/37] (Hi—77035); R. K. Godfrey 4740 (No—2630); Herb. North Carolina State Coll. 2628 (No); H. F. L. Rock 631 (St); B. W. Wells s.n. [July 2nd, 1924] (No—2626), s.n. [Burgaw, 6/23/1945] (No—2619, No—2635). Richmond Co.: A. E. Radford 14458 (Hi—97161). Robeson Co.: Ahles & Haesloop 29038 (Hi—119251). Rowan Co.: A. A. Heller 180 (Ca—2408), 181 (Ca—2413). Sampson Co.: Ahles & Leisner 33690 (Hi—119255). Scotland Co.: Ahles & Haesloop 28610 (Hi—119256, St). Tyrrell Co.: A. E. Radford 39234 (Hi—119249). Roanoke Island [Dare Co.]: A. E. Radford 4644 (Hi—48382); Radford & Stewart 907 (Ca—841788, Hi—15046); P. O. Schallert 535 (B). County undetermined: G. McCarthy s.n. [Julius 1884] (Hi—77038), s.n. [Julio 1885] (Hi—24868). SOUTH CAROLINA: Allendale Co.: C. R. Bell 3983 (Hi—97168). Bamberg Co.: Ahles & Haesloop 30487 (Hi—119259). Beaufort Co.: Ahles & Bell 12381 (Hi—97169). Berkeley Co.: Ahles & Haesloop 26429 (Hi—97170), 30671 (Hi—119258); Godfrey & Tryon 603 (Ca—957175); R. F. Martin 1187 (N). Charleston Co.: M. Haas s.n. [June 28, 1930] (Go). Chesterfield Co.: A. E. Radford 12455 (Hi—97172). Clarendon Co.: A. E. Radford 24605 (Hi—97171). Colleton Co.: C. R. Bell 4583 (Hi—97173). Darlington Co.: W. C. Coker s.n. [8/15/1908] (Hi—77047), s.n. [July 5, 1909] (Hi—77048); J. B. Norton s.n. [July 12, 1920] (Hi—77045); Radford & Stewart 397 (Hi—15712). Dillon Co.: Ahles & Haesloop 27862 (Hi—119252). Dorchester Co.: Ahles & Haesloop 26181 (Hi—97174); Ahles & Leisner 31896 (Hi—119253). Florence Co.: C. R. Bell 7553 (Hi—97175). Georgetown Co.: Godfrey & Tryon 343 (Ca—957181, Mi); P. O. Schallert s.n. [9/1/40] (Ws). Hampton Co.: C. R. Bell 3891 (Hi—97176); Wilbur & Webster 2833 (N). Horry Co.: C. R. Bell 7785 (Hi—97189). Jasper Co.: C. R. Bell 4937 (Hi—97190). Kershaw Co.: H. D. House 2691 (E); A. E. Radford 27640 (Hi—97155). Lee Co.: A. E. Radford 27382 (Hi—97191). Marlboro Co.: Houten & Schoenmakers 1021 (Ut—52773a); A. E. Radford 15565 (Hi—97160). Orangeburg Co.: Ahles & Leisner 31792 (Hi—119250). Sumter Co.: A. E. Radford 24007 (Hi—97162). Williamsburg Co.: Godfrey & Tryon 509 (Ca—957174); A. E. Radford 24753 (Hi—97163). GEORGIA: Bacon Co.: A. R. Moldenke 348 (Fg). Ben Hill Co.: W. H. Rhoades s.n. [Fitzgerald, Aug. 1926] (Ws). Bleckley Co.: A. R. Moldenke 380 (Fg). Chatham Co.: Herb. Mt. Holyoke Sem. s.n. [Savannah] (Dt). Clinch Co.: A. R. Moldenke 333 (Fg, S). Dodge Co.: A. R. Moldenke 418 (Fg). Dooly Co.: J. T. Curtis s.n. [Aug. 3, 1939] (Ws). Douglas Co.: Cronquist 5425 (Ca—777560, N).

Grady Co.: A. R. Moldenke 302(Fg). Jeff Davis Co.: A. R. Moldenke 349 (Fg). Lee Co.: Thorne & Muenscher 8308 (Vi). Lowndes Co.: A. R. Moldenke 316 (Fg). McIntosh Co.: Harmer 618 (S). Screven Co.: A. R. Moldenke 417 (Fg). Telfair Co.: A. R. Moldenke 361 (Fg). Thomas Co.: Mrs. Taylor s.n. [Thomasville, Aug. 4, 1903] (Rf). Ware Co.: A. R. Moldenke 338 (Fg, S); P. O. Schallert 3961, in part (B, Je--7056). Wilcox Co.: W. F. Rhoades s.n. [Abbeeville, July & Aug. 1925] (Ws). Worth Co.: Svenson 6930 (Ca--599919). Blackbeard Island: W. H. Duncan 20365 (Lb--42829). Sapelo Island: W. H. Duncan 20365, in part (Hi--106043, Ws). County undetermined: Beyrich s.n. [Georgia] (B, B). FLORIDA: Bay Co.: Farmer s.n. [July 25, 1959] (Hi--210975); Perdue 1643 (Ca--49708, Rf, Ur, Ut--61167b). Brevard Co.: Melvin s.n. [July 4, 1957] (Hi-119265); H. N. Moldenke 233 (S). Collier Co.: Lakela 30322 (N). Duval Co.: Curtiss 3016 (Ca--2411, Ms--15471), 5690 [June 24] (Ca--142521, Dt), 5690 [Aug. 21] (Ca--142521, Dt); Lighthipe 475 [Herb. Umbach 10991] (Ws). Escambia Co.: M. Morgan P.1 (Ca--841789); Redfearn & Kral 2718 (Hi--111828). Franklin Co.: R. Kral 2813 (N); Redfearn 2665 (N). Hernando Co.: R. A. Howard 12953 (B, B, B, Ca--48674, N, Ok, S, St, Ur, Ut--69634b, Vi, We). Highlands Co.: C. C. Deam 64210 (No--21316). Hillsborough Co.: Ray, Lakela, & Patman 10062 (Hi--201768). Jefferson Co.: Godfrey & Kral 54896 (N). Lake Co.: Nash 847 (Ca--115166, Mm--7960), 1722 (Ca--115169, Mm--7959), s.n. [August 10, 1894] (N). Levy Co.: Kral & Kral 6920 (N). Liberty Co.: A. R. Moldenke 279 (Fg), 283 (Fg); Redfearn 2626 (N). Manatee Co.: Perdue 1757 (Ca--27825, Rf, Ut--61229b); S. M. Tracy 7587 (Ws). Orange Co.: Barrows s.n. [Winter Park, 1894] (Dt). Palm Beach Co.: Fennell & Jones 972 (Ca--841792); W. B. Fox s.n.[Apr. 2, 1945] (No--15827). Pinellas Co.: R. F. Thorne 1353 (Ca--907023). Polk Co.: McFarlin 3418 (Mi), 6213 (Mi), 6216 (Ca--593592, Mi). Putnam Co.: P. O. Schallert 3961 (Hi--56323). Saint Lucie Co.: H. N. Moldenke 21487 (Hk, Sm, Ss). Santa Rosa Co.: E. S. Ford 5416 (Hi--158855); Kral & Redfearn 2932 (Hi--111311); A. R. Moldenke 266 (Fg). Seminole Co.: P. O. Schallert 3961, in part (Je--8731, S, Ur). Volusia Co.: P. O. Schallert 3961, in part (Ws). Wakulla Co.: Kral & Godfrey 2342 (Ms--44728). Walton Co.: A. R. Moldenke 268 (Fg). County undetermined: Herb. Chapman s.n. [Florida] (Ok, Ok). ALABAMA: Baldwin Co.: Demaree 35929 (Ss); Dress & Read 7498 (Go); A. R. Moldenke 265 (Fg); S. M. Tracy 8043 (Ws); W. Wolf s.n. [Elberta, Aug. 21, 1925] (Ca--841793). Cherokee Co.: R. M. Harper 3996 (N). Mobile Co.: C. F. Baker s.n. [Mobile, 7/20/1897] (Hi--77044); Bush 71 (S). Washington Co.: S. B. Jones s.n. [31 Aug. 1960] (Hi--210913). County undetermined: Buckley 132 (Ws), s.n. [Alabama, July 1820] (Br).

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Figure 3. Distribution of Eriocaulon decangulare

Herbarium curators who have material of this species from additional counties are asked to send it to the author for verification and record, so that future editions of this map may be more complete

Mapping by counties done by Andrew R. Moldenke