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# THREE NEW SPECIES OF DICOTYLEDONEAE FROM ST. LUCIA, WEST INDIES

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New species of Acalypha, Bernardia (Euphorbiaceae), and Calliandra (Leguminosae) are described at this time for inclusion in volume four of the Flora of the Lesser Antilles, now in press.

Acalypha elizabethae Howard, sp. nov.

Frutex monoicus; folia ovata 15-20 x 10-12 cm. dentata, hirsuta, glandulis in sinu basali aggregatis, sessilibus, setaceis; inflorescentia axillaris, spicata ad 20 cm, ovariis verrucoso-glandulosis.

Shrub to 3 m, hirsute with long, stiff, occasionally clustered hairs. Stipules broadly lanceolate to 1.5 x 0.5 cm; blades broadly ovate, 15-20 x 10-12 cm, base cordate, apex acuminate, membranous, strongly 5 or more palmately veined at base, with 3 to 5 setaceous sessile glands in the sinus, some to 4 mm long, margin sharply dentate, teeth lanceolate when young, each toothed on the sides, becoming broader and entire on maturity, all parts hirsute with single or clustered stiff hairs. Inflorescences spicate, axillary; staminate 7-10 cm long, densely flowered, imbricated bracts several at base, ovate to 1 mm; pistillate inflorescences at different nodes, spicate, tenuous, 15-20 cm long, basal bracts clustered, ovate, to 1 mm, flowers in clusters of 2 or 3, the units separated, each subtended by an ovate bract to 2 mm, hirsute, ovary verrucose-glandular, styles laciniate from base, red. Capsule 2 mm dia., verrucose-glandular, mature seeds not seen.

St. Lucia: Gros Piton, Soufrière, May 3, 1950, R. A. Howard 11492 (holotype, A); Petit Piton, Soufrière, May 2, 1985, L. L. Jn.-Pierre 141 (A).

This species differs in its spicate inflorescences, broadly lanceolate stipules and ovate dentate leaves from Acalypha vincentina Urban, which has ovate-elliptic and crenate leaves, setaceous stipules, paniculate inflorescences and pedicellate flowers.

Acalypha elizabethae is named in tribute to Elizabeth S. Howard, my wife of many years, who explored the Lesser Antilles with me on the first of many trips in 1950, when the holotype was collected. As indicated, the species has been collected again on the summit of Petit Piton, an adjacent peak.

Bernardia laurentii Howard, sp. nov.

Frutex dioicus, totus dense strigoso pubescens; stamina 10-11; pistillum 3-carpellatum, styli crassi, recurvati, basi separati, persistentes in fructibus rigide recurvati.

Dioecious shrub to 1.5 m, compact and densely branched, all parts densely covered with a strigose pubescence. Stipules setaceous, 2 mm, caducous. Petioles stout, 3-4 mm long; blades ovate-lanceolate, 3.5-7 x 2-3.5 cm, base acute or cuneate, apex acute, both surfaces persistently and densely strigose pubescent, basal veins 2, one or both with round, flat, axillary glands, remaining veins usually 5, straight and ascending, margin with conspicuous serrate teeth often tipped with a single one or a cluster of larger stiff hairs, becoming callose on maturity and rounded. Staminate inflorescences axillary, 1.5-2 cm long, with 5 to 7 separated flower clusters, each subtended by broadly ovate bracts, 2 x 2.2 mm, apex acute with clusters of rigid hairs, densely strigose, subtending 6 to 8 flowers, maturing basipetally with pedicels 2 mm long, sepals 4, ovate, 1.3 x 1 mm, stamens 10 or 11, filaments 0.5-0.8 mm, anthers ovate, 0.3 mm; pistillate inflorescences terminal and axillary, 5-6 mm long, stoutly racemose with 3 or 4 branches, closely imbricate broadly ovate bracts 3 x 2.4-3 mm, calyx of 3, 4 or 5 ovate sepals 2.5-3 x 2-2.5 mm, pistil 3-carpellate, 2 mm long, strigose, styles deeply divided and seemingly separate for each carpel, 2 mm long, thick and strongly recurved, ovule 1 per locule. Fruit depressed globose 1 cm dia., 0.6 cm high, mature valves woody, strigose externally, shining inside; seed triangular, 6 mm long, 4 mm on each side, mottled with gray-brown scruffy material, the surface layer of dark shiny chestnut-brown color.

St. Lucia: Summit of Petit Piton, Soufrière, altitude 2438', V. Slane & L. L. Jn.-Pierre 722 (holotype, A, pistillate), Oct. 2, 1985; 721 (A, staminate), same data.

This species is clearly distinctive in the dense strigose pubescence of all parts and the seemingly separate styles for each carpel. In contrast, Bernardia dichotoma (Willd.) Muell. Arg. has a soft pubescence of mixed hirsute and stellate hairs and a slightly divided style, while Bernardia corensis (Jacq.) Muell. Arg. is sparsely pubescent when young and glabrate and shiny when mature, with short, clearly bifid styles.

Bernardia laurentii is named in honor of its energetic collector, Laurent Lawrence Jean-Pierre of St. Lucia. The Petit Piton, where the plants were collected, has only recently been accessible to climbing by those not avid and capable rock climbers. No general botanical collections were previously known from its summit. In addition to this and the previous species, a collection of the authentic Juniperus barbadensis L. is one of the exciting discoveries of Slane and Jn.-Pierre from the summit of Petit Piton, where explorations will continue.

*Calliandra slaneae* Howard, sp. nov.

Frutex ad 2 m, rami abbreviati bene evoluti stipulis imbricatis persistentibus; pinnae unijugae; foliola 3-4-juga, elliptico-obovata, 5-7 x 3-4 mm, coriacea, lucentia; inflorescentia 25-30-flora, filamenta staminalia intense rubra; legumen ad 6 cm, 6-spermum.

Shrub to 2 m tall but often 3-4 m diameter, twigs brown, glabrous or slightly pubescent; axillary short shoots to 1 cm with persistent overlapping stipules. Stipules broadly ovate-triangular, acuminate, to 2.5 x 1 mm, coriaceous, strongly striate, persistent, pinnae 1 pair, rachis 7-12 mm, crispose pubescent; leaflets 3 or 4 pairs, middle ones elliptic-oblong to elliptic-obovate 5-7 x 3-4 mm, upper pair slightly falcate and larger, lower pair often very unequal and smaller, obtusely cordate and asymmetrical at base, obtuse and short apiculate at apex, coriaceous, shining, margin entire, ciliolate, midrib acentric, lower half with 2 ascending veins. Inflorescence axillary, capitate, 25- to 30-flowered, peduncle 1 cm, bracts triangular, to 1 mm, calyx campanulate 2 mm, strongly striate, 5-toothed, corolla tube 2-3 mm, lobes ovate, 0.5 mm, glabrous, staminal tube exserted to 7 mm, free portion of filaments to 2 cm, red. Legume to 6 cm x 1-1.2 cm, obtuse and apiculate at apex, margins strongly developed, seeds 6.

Type: St. Lucia, 3 miles northeast of Dennery, May 15, 1985, V. Slane 541 (holotype, A).

Additional collections:
Martinique: Grand Tourneau, Hahn 1121 (A); Espérance, Stehlé 1643 (A).
St. Lucia: Dennery, R. A. Howard & R. E. Weaver 17946 (S), G. L. Webster & J. R. Ellis 9371 (A), P. Beard 1187 (A), V. Slane 351 (A); Marquis Bay, G. R. Proctor 21664 (A), 17549 (A); Vieux Fort, R. A. Howard 11407 (A), 11437 (A); Marigot Lagoon, A. C. Smith 10186 (AS); Cap Estate, B. Sturrock 386 (A).
St. Vincent: Petit Bordel Hill, C. V. Morton 5172a (A).
The Grenadines: Bequia, H. H. & G. W. Smith 285; Petit St. Vincent, R. A. Howard 10908 (A); Mayero, D. Fairchild 2757 (A).
Cultivated: Guadeloupe, Basse Terre, Quentin 154 (A).

This species resembles *Calliandra purpurea* L., from which it is distinguished by the fewer and smaller shining coriaceous leaflets and smaller fruit.

Calliandra slaneae is named in honor of Verna Slane, who has collected extensively in St. Lucia as a member of the United States Peace Corps. The herbarium being developed for the Forestry Department is the result of her work. We are grateful to her for the many collections made in assistance to the production of the Flora of the Lesser Antilles, which will include over a hundred new records for St. Lucia as a result of her efforts.

# A NEW SPECIES OF MONACTIS (ASTERACEAE) FROM NORTHERN PERU

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ABSTRACT - A new species of *Monactis* (Heliantheae-Asteraceae) is described from northern Peru: ***Monactis rhombifolia*** Sagást. & Dillon.

Robinson (1976, 1979) recently reviewed the genus *Monactis* and added several new species. The present paper describes a well defined new species from northern Peru, thus bringing the total for the genus to 11. The genus is restricted to southern Ecuador (5 spp.) and northern Peru (6 spp.).

***Monactis rhombifolia*** Sagast. & Dillon, sp. nov. Fig. 1.

*Monactis lojaensis* H. Robinson accedens sed foliis grandis rhombiformis; *phyllaria* 2-seriata lineari-lanceolata, 6-7(-9) mm longa, 0.6-1 (-1.5) mm lata; achaenia 6-7 mm longa.

TYPE: PERU. Dept. Cajamarca. Prov. Jaén: entre Chamaya y Pucará, ruta Chiclayo-Jaén, 550 m, 2 Jun 1972, *I. Sánchez Vega 979* (HUT, holotype; CPUN, F, isotypes).

Small **trees** or large **shrubs**, 1.7-3.5 (-7) m; stems much-branched, terete, striate, densely cinereo-puberulent to cinereo-tomentose, large central pith. **Leaves** alternate; petioles 1-4 (-6.5) cm long, densely puberulent, broadly winged; blades rhombic to rhombic-ovate, 20-33 cm long, 13-21 cm wide, membranaceous, basally acuminate to cuneate, trinervate from above the base, apically acuminate, the ultimate portion acute to obtuse, the lower surfaces villous, the veins prominent, densely villous, the upper surfaces puberulent, glabrescent, the margins crenate to repand. **Capitulescences** terminal, broadly corymbose-paniculate, the peduncles villosulous, glandular. **Capitula** radiate, pedicellate, the pedicles 2-10 mm long, villosulous, glandular; involucres cylindrical, 6-7 mm high, tending to twist at maturity, often subtended by calyculate bracts, 1.5-2 mm long, densely villosulous; phyllaries ca. 2-seriate, the outer linear-lanceolate, ca. 6 mm long, 0.6-0.8 mm wide, plane to concave or cymbiform, villosulous, apically acute to obtuse, glandular, often slightly reflexed, ciliolate, the inner linear-lanceolate, 7-8 (-9) mm long, 0.8-1 (-1.5) mm wide, concave to cymbiform, villosulous, apically acute; receptacle convex, paleaceous, the paleae similar to inner phyllaries, 7-8 (-9) mm long; ray floret 1 or absent, fertile, the corolla yellow, the tube ca. 1.5-2 (-3) mm long, glabrous, the ligula elliptic, 6-7 (-9) mm long, ca. 3-3.5 (-5.5) mm wide; disc florets (7-) 8-14 (-16), the corolla yellow, the tube ca. 1.5 mm long, sparsely glandular, the limb 1.5-1.7 mm long, broadly campanulate, 5-lobed, the lobes ca. 0.5 mm long, deltoid, the anthers 1.8-2 mm long, brown to black, the style branches ca. 0.75 mm long. **Achenes** fusiform, 6-7 mm long, glabrous subterete, slightly falcate; pappus of a single squamella, ovate-lancelate, ca. 1.5 mm long, ca. 0.5 mm wide, persistent.

DISTRIBUTION: Known from local populations in the Río Chamaya (type locality) and Río Utcubamba valleys, both associated with the Río Marañón drainage system (550-1820 m).

The Río Chamaya and associated valleys have yielded many endemics including the following taxa collected near the type locality: Caesalpinia cassioides Willd. (Caesalpiniaceae), Erythroxylum sp. (Plowman et al. 14253, 14255), Pucara leucantha Ravenna (Amaryllidaceae), Rauhia multiflora (Kunth.) Ravenna (Amaryllidaceae), and Tecoma rosifolia H.B.K. (Bignoniaceae).

Monactis rhombifolia most closely resembles M. lojaensis of southern Ecuador, but is readily distinguished from that species by the former's larger, rhombic leaves and larger, linear-lanceolate phyllaries. These characters also serve to separate it from all other Peruvian species. Only M. wurdackii H. Robinson, from near Chachapoyas (Dept. Amazonas), has leaves (8-14 cm long, 4.5-9 cm wide) approaching those of M. rhombifolia.

ADDITIONAL MATERIAL EXAMINED: PERU. Dept. Amazonas. Prov. Bongara: 21 km N of Pedro Ruiz (Shipasbamba) on road between Moyobamba and Bagua, 1820 m, 15 Apr 1984, T. B. Croat 58310 (F, HUT, MO).

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## ACKNOWLEDGMENTS

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## EXPLANATION OF FIGURE

Fig. 1. *Monactis rhombifolia*. A, flowering branch; B, capitulum; C, ray floret; D, disc floret and palea; E, stamen; F, style branches; G, achene. (Drawn from *Sánchez V. 979*, HUT).


Fig. 1.

# BIBLIOGRAPHY OF BOTANICAL PAPERS PUBLISHED IN SYESIS 1 (1968) - 17 (1984)

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## INTRODUCTION

*Syesis* was a multidisciplinary journal published by the British Columbia Provincial Museum from 1968 to 1984. It was established as a centennial project to fill the need for a regional journal for publishing scholarly papers dealing with both natural and human history in British Columbia and the Pacific Northwest. Longer papers were published in *Supplements*.

The scope of *Syesis* was very wide. The journal published articles on subjects ranging from geomorphology (e.g. tidal wave warning systems) through biology, archaeology, and linguistics to medical problems (e.g. the attrition of teeth). An important factor in the moulding of *Syesis* was the selection of the editor. The first editor of *Syesis* was Dr. Robert F. Scagel, a specialist in marine algae at the University of British Columbia in Vancouver. Under his editorship, from 1968 to 1975, *Syesis* developed into a journal which was very strong in botany and especially phycology. In 1976 Dr. Gilbert C. Hughes, a mycologist at the University of British Columbia, became the second editor of *Syesis*. The journal retained its original character. From the first issue to the last *Syesis* was an excellent regional botanical journal. Among the other biological disciplines, only ichthyological and ornithological papers were relatively well represented. In 1973 *Ecology of western North America*, a series edited by Drs. V.J. Krajina and R.C. Brooke and published by the University of British Columbia, was merged with *Syesis*. This merger brought several important vegetation studies to *Syesis* and further strengthened its botanical character.

In its seventeen volumes *Syesis* published 175 papers dealing with various botanical disciplines (phycology 74, mycology 22, bryology & lichenology 10, vascular plants & floristics 32, plant ecology 19, paleobotany & palynology 5, ethnobotany 8, bibliography & obituaries 5). Nine new genera, 34 new species, one new name and 31 new nomenclatural combinations of algae and fungi and two new varieties and one new form of vascular plants were published in *Syesis*.

Editorial difficulties and financial constraints led to a highly irregular publication schedule, with long intervals between volumes. High quality glossy paper was replaced with cheaper, but still acceptable paper. Nevertheless the cost of publishing remained high. There were also serious problems with the marketing of *Syesis*. The multidisciplinary nature of the journal made the content of individual volumes unpredictable and deterred potential subscribers. The irregular publication schedule, on the other hand, deterred potential contributors.

In 1985 the British Columbia Provincial Museum decided to stop publication of Syesis and to replace it with the Contributions series. Three Contributions series (Contributions in Natural Science, Contributions in Human History and Contributions in Museum Studies) will publish individual papers with the priority given to the employees and research associates of the British Columbia Provincial Museum, but papers from workers outside the Museum will also be considered. Editorial control for these series will be the responsibility of the General Publications Committee of the British Columbia Provincial Museum (for more information see Barkley, W.D. 1985. The end of an experiment. Syesis 17:1,2.).

The first section of this bibliography lists botanical papers published in Syesis and its Supplements from issue 1 (1968) to issue 17 (1984). It is divided into major parts according to major specializations. The divisions are broad, and there is no overlap in citations. The second section provides a list of new plant taxa or new names published in Syesis. Publication dates of Syesis and its Supplements are given in the Appendix.

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## APPENDIX

### PUBLICATION DATES OF SYESIS AND ITS SUPPLEMENTS

| | |
|---|---|
| 1 (1968) | September 2, 1969 |
| 2 (1969) | May 1, 1970 |
| 3 (1970) | October 1, 1970 |
| 4 (1971) | February 1972 |
| 5 (1972) | October 1972 |
| 6 (1973) | November 1973 |
| 7 (1974) | January 1975 |
| 8 (1975) | April 1976 |
| 9 (1976) | May 1977 |
| 10 (1977) | November 1977 |
| 11 (1978) | May 1, 1979 |
| 12 (1979) | April 1, 1980 |
| 13 (1980) | September 1, 1981 |
| 14 (1981) | April 1, 1982 |
| 15 (1982) | May 1, 1983 |
| 16 (1983) | May 1, 1984 |
| 17 (1984) | 1985 |

Supplements

| | | |
|---|---|---|
| 3 (1970) | Suppl. 1 | December 1970 |
| 4 (1971) | Suppl. 1 | April 1972 |
| 7 (1974) | Suppl. 1 | August 1974 |
| 7 (1974) | Suppl. 2 | August 1, 1974 |
| 8 (1975) | Suppl. 1 | May 1976 |
| 12 (1979) | Suppl. 1 | June 1980 |
| 15 (1982) | Suppl. 1 | May 1983 |

NOTES ON THE GENUS *CLERODENDRUM* (*VERBENACEAE*). XXIV

Harold N. Moldenke

*CLERODENDRUM* Burm.

Additional & emended bibliography: J. G. A. Forster, Fl. Ins. Austral. Prod. 45. 1786; Hook., Curtis Bot. Mag. 116 [ser. 3, 46]: pl. 7141. 1890; Kolb, Neub. Deutsch. Gartenmag. 43: 129. 1890; Engl., Bot. Jahrb. 13: Übers. 93. 1891; Rehd., Journ. Arnold Arb. 15: 324--325. 1934; Blatter, Caius, & Mhaskar in Kirkikar & Basu, Indian Med. Pl., ed. 2, imp. 1, 3: 1912 & 1945--1952, pl. 743--747. 1935; Rehd., Journ. Arnold Arb. 17: 64 (1936) and 18: 286. 1937; Sobti & Singh, Prod. Indian Acad. Sci. B.54: 141--144. 1961; Manzoor-i-Khuda, Tetrahedron 21: 797. 1965; Kundu & De, Bull. Bot. Surv. India 10: [397]--400 & 402--405, fig. 5, 11, 18, 19, & 33--36. 1968; Jain & Tarafder, Econ. Bot. 24: 249. 1970; Blatter, Caius, & Mhaskar in Kirtikar & Basu, Indian Med. Pl., ed. 2, imp. 2, 3: 1912 & 1945--1952, pl. 743--747. 1975; Oakes & Butcher, U. S. Dept. Agr. Misc. Bull. 882: 90. 1962; Mitchell & Rook, Bot. Dermat. 714. 1979; Mold., Phytologia 60: 462--467, 483--496, 504--506, 508, 510, & 511. 1986.

Balfour (1885) says of this genus: "One species in the Terai forms a large shrub beneath every tree, generally intermixed with ferns, as polypodium, pteris, and goniopteris, and its sweet odour is borne far through the air. *Clerodendron* leaves, bruised, are used to kill vermin, fly-blows, etc., in cattle, and the twigs form toothpicks. Its flowers are presented to Siva (Mahadeo), milk, honey, flowers, fruit (ambrosia), etc. being offered to the pacific gods, as Vishnu, Krishna, etc.; while Mudar (*Calotropis asclepias*), Bhang, *Cannabis sativa*, *Datura*, flesh, blood, and spirituous liquids are offered to Siva, Durga, Kali, and other destroying deities. The Burmese cultivate a fragrant double clerodendron. One species, supposed by Dr. Stewart to be *C. infortunatum*, L., called Kali basuti on the Beas, occurs in the Siwalik tract, and occasionally in the plains, and is probably the one that Edgeworth mentions as being used in the Ambala tract to give fire by friction." Obviously, the double-flowered species referred to here is *C. philippinum* f. *multiplex* (Sweet) Mold. and the one supposed to be *C. infortunatum* is probably *C. viscosum* Vent.

The Jain & Tarafder (1970) reference his been mis-cited in a previous installment of these notes as occurring on page "294" instead of page 249.

*CLERODENDRUM ACULEATUM* (L.) Schlecht.

Additional bibliography: Oakes & Butcher, U. S. Dept. Agr. Misc. Bull. 882: 90. 1962; Mitchell & Rook, Bot. Dermat. 714. 1979; Mold., Phytologia 60: 359--360. 1986.

Oakes & Butcher (1962) and Mitchell & Rook (1979) report that the spines of this plant often produce a dermatitis due to mechanical injury.

*CLERODENDRUM DINKLAGEI* Gürke
Additional bibliography: Mold., Phytologia 59: 253--255 (1986) and 60: 146. 193, 364, 365, & 367. 1986.

*CLERODENDRUM FLORIBUNDUM* R. Br.
Additional bibliography: Nees, Rob. Br. Vermisch. Bot. Schrift. 3 (1): 367. 1827; Mold., Phytologia 60: 464 & 496. 1986.

*CLERODENDRUM FORTUNATUM* L.
Additional bibliography: Edwards, Bot. Reg. 30: pl. 19 in textu. 1894; Mold., Phytologia 60: 465 & 495. 1986.

*CLERODENDRUM GRANDIFLORUM* (Hook.) Schau.
Additional bibliography: Mold., Phytologia 60: 128--152, 359--361, 366, 368, & 462. 1986.

*CLERODENDRUM INCISUM* var. *MACROSIPHON* (Hook. f.) J. G. Baker
Additional bibliography: Boorsma, Meded. Lands Plant. 52: 110. 1902; Mold., Phytologia 60: 275 & 277--281. 1986.

*CLERODENDRUM INDICUM* (L.) Kuntze
Additional & emended bibliography: Boorsma, Meded. Lands Plant. 52: 110. 1902; Blatter, Caius, & Mhaskar in Kirtikar & Basu, Indian Med. Pl., ed. 2, imp. 1, 3: 1945 & 1951--1952, pl. 747. 1935; Kundu & De, Bull. Bot. Surv. India 10: 398 & 402--404. 1968; Jain & Tarafder, Econ. Bot. 24: 249. 1970; Blatter, Caius, & Mhaskar in Kirtikar & Basu, Indian Med. Pl., ed. 2, imp. 2, 3: 1945 & 1951--1952, pl. 747. 1975; Mold., Phytologia 60: 466--467 & 483--496. 1986.

Jain & Tarafder (1970) summarize the reported medicinal uses for this species, with authority for each report, as: fever, atrophy, emaciation, cachexy, gravel, thirst, cholera, consumption, cough, bronchitis, puerperal fever, and blindness.

A key to help distinguish this species from other Indian medicinal species will be found in the present series of notes under *C. inerme* (L.) Gaertn. Other keys that may prove useful are the following, modified by me in a few minor respects and with the nomenclature updated. Bor & Raizada (1954) distinguish the showy-flowered Indian species as follows:

1. Corolla-tube at least 4 inches long..................*C. indicum.*
1a. Corolla-tube only 2 inches long or less.
  2. A climbing plant.................................*C. thomsonae.*
  2a. Shrubs or small trees.
    3. Calyx-rim truncate or very short-toothed...........*C. inerme.*
    3a. Calyx-rim distinctly dentate or lobed.
      4. Corolla red or scarlet........................*C. kaempferi.*
      4a. Corolla white or rose.
        5. Calyx with peltate glands.
          6. Calyx-lobes triangular-acute............*C. philippinum.*
          6a. Calyx-lobes broadly ovate and foliaceous..*C. viscosum.*
        5a. Calyx without peltate glands.
          7. Flowers in a pendulous panicle...........*C. wallichii.*

7a. Flowers in erect panicles.
8. Panicles trichotomous; leaves 6 inches or more long.. *C. trichotomum.*
8a. Panicles dichotomous; leaves 2 inches long or less.. *C. phlomidis.*

Prain (1963) distinguishes the Bengal taxa as recognized by him as follows:

1. Corolla irregularly salverform, 1½ inches long or less.
2. Panicles axillary or if [occasionally in *C. phlomidis*] terminal then the panicle lax and leafy below.
3. Calyx minutely toothed; leaf-blades marginally entire.
4. Leaf-blades obovate or elliptic, subobtuse, opposite or rarely ternate; fruiting-calyx closely appressed to the base of the fruit..............................*C. inerme.*
4a. Leaf-blades elliptic-acute or linear-oblong, generally ternate; fruiting-calyx subpatent........"*C. neriifolium*".
3a. Calyx lobed to the middle; leaf-blades marginally sinuate or serrate.........................................*C. phlomidis.*
2a. Panicles terminal.
5. Calyx subtruncate or short-lobed; bracts ½--1½ inches long.
6. Leaves subsessile; calyx very shortly 5-lobed; panicle dense; leaf-margins always serrate...........*C. serratum.*
6a. Leaves very shortly petiolate; calyx subtruncate; panicle open; uppermost leaf-blades sometimes entire............. *C. serratum* var. *wallichii.*
5a. Calyx deeply 5-lobed; bracts smaller.
7. Panicle pendulous; corolla pure-white; fruit purple; leaf-blades narrowly obovate or lanceolate........*C. wallichii.*
7a. Panicle erect; corolla tinged with pink or rose; fruit black; leaf-blades broadly ovate or subrotund.
8. Calyx large, the segments broadly lanceolate, suberect, & acute; panicle open, pyramidal.............*C. viscosum.*
8a. Calyx small, the segments subulate; panicle compact, corymbose..............................*C. philippinum.*
1a. Corolla narrowly funnelform, 3 inches long or longer.*C. indicum.*

Neal (1965) distinguishes the Hawaiian species as follows:

1. Corollas blue.......................................*C. ugandense.*
1a. Corollas white and/or red, yellowish, or pinkish.
2. Vines or vine-like plants.
3. True vines, not spinose; corolla red.
4. Calyx white; flowers in open clusters.........*C. thomsonae.*
4a. Calyx red to purple; flowers in dense clusters........... *C. umbellatum.*
3a. Vine-like spiny shrubs with long arching branches; corolla white.......................................*C. aculeatum.*
2a. Erect shrubs.
5. Corolla scarlet, not fragrant.
6. Leaf-blades marginally entire or dentate, downy............ *C. speciosissimum.*
6a. Leaf-blades 3--5-lobed, smooth............*C. paniculatum.*

5a. Corolla yellow, white, or pinkish, mostly fragrant.
7. Corolla light-yellow to white................*C. minahassae.*
7a. Corolla white or pinkish.
8. Corolla-tube 3 to 4 inches long..............*C. indicum.*
8a. Corolla-tube much shorter.
9. Downy-leaved shrubs 2--8 ft. tall; leaves to 12 inches long.
10. Leaf-blades downy on both surfaces.
11. Corolla doubled, 1 inch wide, white or pink-tipped *C. philippinum* f. *multiplex.*
11a. Corolla single, ½ inch wide, white and lilac..... *C. macrostegium.*
10a. Leaf-blades only downy (and red) beneath.
9a. Smooth-leaved shrub or small tree; leaves smaller..... *C. glabrum.*

Srivastava (1976) distinguishes the Gorak species as follows:
1. A climbing shrub..................................*C. splendens.*
1a. Erect shrubs or small trees.
2. Leaves less than 7.5 cm. long; calyx not or only slightly enlarged in fruit.................................*C. phlomidis.*
2a. Leaves over 7.5 cm. long; calyx much enlarged in fruit, turning red.
3. Leaf-blades marginally entire.....................*C. indicum.*
3a. Leaf-blades marginally serrate or crenate-dentate........... *C. viscosum.*

Babu (1977) distinguishes the species at Dehra Dun as follows:
1. Corolla-tube 10--15 cm. long, nodding.................*C. indicum.*
1a. Corolla-tube not over 4 cm. long.
2. Calyx 5-parted nearly to the base, bright red in fruit. *C. viscosum.*
2a. Calyx truncate or shortly 5-dentate, green in fruit.
3. Leaves sessile, ternate, the blades serrate-dentate; corolla strongly zygomorphic, violet....................*C. serratum.*
3a. Leaves distinctly petiolate, opposite, the blades entire; corolla actinomorphic, white......................*C. inerme.*

Williams (1905) cites *Schomburgk 302* from open grassy places in Thailand; Fletcher (1938), from the same country, cites *Collins 287* & *1312*, *Haniff 12612*, *Keith 172*, *Kerr 393*, *2738*, & *3904*, *Lakshnakara 428*, *Marcan 2033*, *Pot 1394*, *1985*, & *2539*, and *Winit 544*; Deb (1961) cites his *nos. 1034*, *2613*, & *2614* from Manipur; Singh (1969) *no. 33554* from Lakhaoti; Varma (1981) his *no. 212* from Bhagalpur; and Jain & his associates (1982) *nos. 784* & *929* from Haryana, India. Box, in his unpublished Flora of Antigua, cites *Duss 32*.

It should be noted that the labels accompanying *Hahn 514* and *Robinson 2* do not indicate that the collections were made from cultivated plants, but I am assuming that they were. Some sheets of *Glaziou 8185* are erroneously labeled "*8186*". The *Vidal 2642* called "kôn khan", is sterile and is tentatively placed here -- its leaves are extraordinarily broad.

Material of C. *indicum* has been misidentified and distributed in some herbaria as C. *aculeatum* L., C. *fortunatum* L., C. *infortunatum* L., and C. *ternifolium* H.B.K. On the other hand, the *Sørensen & al. 1147*, distributed as typical C. *indicum*, actually represents f. *semiserratum* (Wall.) Mold., while *Jimenez 4603* and *Mejía & Zanoni 6743* are C. *incisum* var. *macrosiphon* (Hook. f.) J. G. Baker and the *Hort. Bogor. XV.J.B.XXVIII.4*, identified as C. *indicum* by Bakhuizen in 1923 and as C. *nutans* Wall "vel aff." by him in 1922, is not verbenaceous.

Citations: SOUTH CAROLINA: Charleston County: *Sass s.n.* [near Charleston, Dec. 1948] (Hi--34060). Georgetown Co.: *Tarbox s.n.* [Murrell's Inlet, Sept. 3, 1939] (Hi--14258. Jasper Co.: *Ahles & Bell 20993* (Hi--92943); *Leonard & Radford 2771* (Bl--244576, Ld, Ld, Ld, Mi, N, Or--133184, Or--133185). GEORGIA: Camden Co.: *Loomis s. n.* [St. Mary's, Nov. 1916] (W--719758). Grady Co.: *Faircloth 1594* (Ne--120729). Mitchell Co.: *Thorne 6091* (It), *7469* (It). Sapelo Island (McIntosh Co.): *W. H. Duncan 20667* (Au--107518, Hi--106313, Mi, S, Ws). County undetermined: *Bangs s.n.*[Oct. 1923] (A). FLORIDA: Alachua Co.: *O'Neill 7172*(I). Brevard Co.: *Rhoads s.n.* [Cocoa, Sept. 21, 1936] (Fl--12091), *s.n.* [Cocoa, 27 July] (Fl--13172). Columbia Co.: *Huger s.n.* [Lake City, Jan. 1899] (N); *Reimer s.n.* [Nov. 15, 1904] (N). Dade Co.: *Bessey s.n.* [Oct. 18, 1907] (Ln--69966); *Gillis 8892* (Ft, Ft, Ft, Go); *Lightfoot 2* (Ba), *s.n.* [near Little River 1918] (N); *Woodbury s.n.* [Sept. 10, 1937] (Bu). De Soto Co.: *L. H. Bailey 13080* (Ba). Duval Co.: *Curtiss s.n.* [near Jacksonville] (G). Hamilton Co.: *Huger s.n.* [Dec. 1898] (C). Hardee Co.: *F. H. Sargent 6486* (St). Highlands Co.: *L. H. Bailey 13087* (Ba, Ba). Manatee Co.: *Cuthbert s.n.* [Bradenton] (Fl--21053). Orange Co.: *Wescott s.n.* [Orlando, 8-30-29] (Fl--20962). Pinellas Co.: *Thorne 1288* (It). Polk Co.: *D. S. Correll 6293* (No--18209). Sarasota Co.: *J. M. Hall 1609* (It), *1610* (It); *Tracy s.n.* [Sept. 23, 1915] (N). Seminole Co.: *P. C. Schallert 20833* in part (B, Je--7135, Mi, S, Se--196919, Ws), *s.n.* [1/10/52] (Ur). Merritt Island (Brevard Co.): *Beal s.n.* [Nov. 1927] (Ur), *s.n.* [Jan. 1928] (Ur). Sanibel Island (Lee Co.): *Brumbach 8677* (Mi, N, W--2773128). MISSISSIPPI: George Co.: *K. E. Rogers 7043-C* (N). LOUISIANA: East Baton Rouge Par.: *Attabhanyo s.n.* [Nov. 8, 1972] (Lv); *N. F. Petersen s.n.* [Sept. 22, 1909] (N), *s.n.* [Oct. 1909] (Lv, Lv). Jefferson Par.: *L. E. Fox 2120* (Fx, Fx). Lafourche Par.: *Pratt s.n.* [22 October 1971] (Lv); *C. A. Smith s.n.* [June 1970] (Ne--15672). Plaquemines Par.: *Ewan 17489* (Au--120970, Ba, Gg--381236, Tl); *Langlois 206* (F--134003), *s.n.* [Pointe-a-la-Hache 1881] (I). St. Charles Par.: *Smith & Smith 559* (Ne--78310). St. James Par.: *Ewan 19856* (Ac, Ba). St. Mary Par.: *Dooley & al. 433* (Ne--69054). Terrebonne Par.: *Arceneaux 136* (It); *Wurzlow s.n.* [Nov. 20, 1913] (N), *s.n.* [1913] (W--693288, W--693289), *s.n.* [Oct. 16, 1914] (Lv, Lv, Lv, N, N), *s.n.* (Lv). Washington Par.: *Thomas & al. 74529* (Ne--181192, Ne--181193). Parish undetermined: *C. A. Brown 2295* (Mi). TEXAS: Harris Co.: *Thurow s.n.* [Sept. 25, 1914] (W--865604). CUBA: Havana: *Herb. Cub. Estac. Cent. Agron. s.n.* [Nov. 1909] (Es); *Serre s.n.*

[1909] (Bg, Br). Pinar del Río: *Van Hermann 6315* (Es). JAMAICA: *Caley s.n.* (Bm). HISPANIOLA: Dominican Republic: *Beauvois s.n.* (P). VIRGIN ISLANDS: St. Croix: *Herb. Univ. Christian. s.n.* (01); *A. E. Ricksecker 489* (S), *498* (B, E--118881, F--70912, N, N, Ob--14858, 01, P, W--425470); *L. A. Ricksecker 442b* (B, F--86577, 01, P); *J. B. Thompson 1092* (N). St. Thomas: *Friedrichsthal 407* (V). LEEWARD ISLANDS: Antigua: *Duss 32* (N). Dominica: *Eggers s.n.* [Decbr. 1881] (B); *Imray 153* (K); *Wilbur, Dunn, Hespenheide, & Wiseman 8028* (Ld, Mi, W--2534460). Guadeloupe: *Duss 2943* (B, B, L, N, W--849945); *Quentin 19bis* (P), *233* (P); *Stehlé 2014* (W--1784144). WINDWARD ISLANDS: Barbados: *Barrow s.n.* [Bot. Stat. Herb. Barb. 261] (N, N). Martinique: *Bélanger 559* (P); *Duss 1229* (B, B, N, N); *Hahn 514* (B), *541* in part (Br), *1016* (Bm, Cb, Cb, G, P, P, P, W--57701, X); *Larsen & Larsen 35270* (Ac). St. Lucia: *Hastings s.n.* [July 30, 1900] (It); *Plée s.n.* (P); *Vélez 3279* (W--1957376). St. Vincent: *Guilding 25* (Bm, Ed), *s.n.* [1822] (B, Ed, Ed, K); *Morton 5439* (W--1884349); *Smith & Smith 75* (B, C), *1275* (K), *1600* (B, Bm, G). TRINIDAD AND TOBAGO: Tobago: *W. E. Broadway 3372* (K), *s.n.* [Nov. 8, 1932] (A, E--1031106, I), *s.n.* [Botanic Station] (R); *Eggers 5500* (B, K, W--934988). Trinidad: *Britton & Britton 2083* [Trin. Bot. Gard. Herb. 10459] (G, N, R, W--1069270); *Fredholm s.n.* [Oct. 23, 1906] (R). WEST INDIES: Island undetermined: *Herb. Reichenbach f. s.n.* (V). GUYANA: *Herb. Brit. Guian. For. Dept. 7101* (Mi); *Herb. Otterbein s. n.* [Essequibo] (L, Ld--photo, N--photo); *A. S. Hitchcock 16778* (G, N, S, W--1056038); *Irwin 1088* (Au--178021, Mi), *R.125* (Au--165427); *Jenman 1525* (K, U); *W. Parker s.n.* [Demerara] (K); *Persaud 93* (F--532471); *Rich. Schomburgk 118* (B, B, K). SURINAM: *Soeprato 118* (Ut); *Splitgerber 1100* (Le), *s.n.* (P); *Tulleken 26* (Le); *Wullschlägel 1053* in part (B, Br, Br). FRENCH GUIANA: *Bouquié 97* (P), *s.n.* [Mana 1855] (P); *W. E. Broadway 369* (G, N, W--1068662); *Sagot 1318* (Bm, N, V). BRAZIL: Rio de Janeiro: *Glaziou 8185* (P); *Pieri s.n.* [Herb. Jard. Bot. Rio Jan. 24149] (N). NOSY-BÉ: *Hildebrandt 3401d* (L, P). PAKISTAN: Northwest States: *Royle s.n.* [N.W. India] (L). NEPAL: *Banerjee, Shrestha, & Upadhyay 2505* (W--2581499); *Wallich 1784/1*(Cp, L). INDIA: Assam: *Chand 2467* (Mi); *W. R. Fisher s.n.* [Colonial Herb. 16191] (Na); *Hooker & Thomson s.n.* [Mont. Khasia] (S, W--2497087); *Jenkins s.n.* [Assam] (Mu--861); *Kingdon-Ward 18856* (N); *Mann s.n.* [Khasia hills] (L); *Prain's collector 451* (Bz--19434); *Simons s.n.* (Bz--19436, Pd). East Punjab: *J. R. Drummond 26181* (Ca--244820). Kerala: *Stocks, Law, &c. s.n.* [Malabar, Concan] (Cp, L, Mu--858, Pd). Karnara: *Collector undetermined 177* (Pd). Madras: *Herb. Ledebour s.n.* [Madras] (L); *B. Schmid 3708* (Pd); *Yeshoda 509* (N). Maharashtra: *Adatia s.n.* [Bombay, 20.10.45] (Xa); *Bell 142.16* (Xa); *L. J. Sedgwick 3153* (Xa). Sikkim: *C. B. Clarke 36643* (X); *J. D. Hooker s.n.* [Sikkim, 1000 ped.] (Cp, L, Pd); *Ribu & Rhomoo 3321* (Ca--348687). Surguja: *Koelz 19147* (Mi). Uttar Pradesh: *Choudhury 90* (W--1170161); *Collector undetermined 186* (Pd); *Duthie s.n.* [9-6-98] (Gg--127016), *s.n.* [11-6-98] (Ca--269787); *Koelz 21564* (Bv, N); *Mani s.n.* [18/8/30] (N); *Punj 96* (N); *Raizada 97* (N); *Samnasena 99* (Ca--228163); *M. Singh 97* (N); *U. Singh 371* (Dp--30713, La, N, S). West Bengal: *C. B. Clarke 4188* (W--802205); *J. M. Cowan s.n.* (It);

*Herb. Schumacher s.n.* (L); *Inayat s.n.* [4-6-1900] (L); *Kuntze 6543* (N); *Stiernecrantz s.n.* (S); *T. Thomson s.n.* (L). State undetermined: *Carey s.n.* (K); *Falconer 744* (L, Mu--1184, T); *Herb. Hohenacker s.n.* (Cp); *Herb. Liebmann s.n.* (Cp, Cp); *Herb. Schreber s.n.* (Mu--857); *Herb, Vahl s.n.* (Cp, Cp); *Roxburgh s.n.* (Br, Ld--photo, N--photo, S); *Wallich 1784/4* (L), *1784/F* (L); *R. Wight 2317* (L), *s.n.* [Penins. Ind. Orient.] (L). BANGLADESH: *C. B. Clarke 17988* (L); *Hooker & Thomson s.n.* [Silhet] (Cp, L, Mu--859, N, Pd); *King's collector 146* [Colonial Herb. 16199] (Na); *Wallich 1784/I* (L). SRI LANKA: *Amaratunga 1628* (Pd), *1751* (Pd); *Balakrishnan NBK.939* (N, Pd, W--2686663), *940* (W--2686662); *Collector undetermined s.n.* (Pd); *Sumithraarachchi & Sumithraarachchi DBS.846* (W--2804886, W); *Worthington 4206* (K). BURMA: Lower Burma: *Kuntze 6264* (N, N, N). Upper Burma: *D. J. Anderson s.n.* (Bz--19435); *Belcher 766* [U.S.A. Typhus Comm. 766] (W--2213245); *Khalil 37* [Colonial Herb. 19554] (Na), *s.n.* [Saga 1894] (W--369346); *Prager s.n.* [1890] (L); *J. F. Rock 854* (W--1171505). CHINA: Kwangtung: *N. J. Andersson s.n.* [Whampoa, Dec. 1852] (S). THAILAND: *Chitr 128* (Fg); *Mrs. D. J. Collins 1312* (W--1701119); *Geesink, Hattink, & Phengklai 6462* (Ac); *Khit 135* (S); *Put 2539* (B); *J. F. Rock 1909* (W--1213329). LAOS: *Vidal 2141* (Ld), *2620* (Sm), *2642* (Sm). VIETNAM: Annam: *Pierre 5223* (B, Ca--54871). Cochinchina: *Thorel 102* (B). MALAYA: Kedah: *M. R. Henderson 22922* in part (Bz--19433). Pahang: *Poore 1366* (Kl--6366). Perlis: *M. R. Henderson 22922* in part (N). Singapore: *N. J. Andersson s.n.* [28 Jan. 1853] (S, S); *Sinclair 5284* (W--2912697). GREATER SUNDA ISLANDS: Java: *Backer 2589* (Bz--19403), *4692* (Bz--19404), *9899* (Bz--19406, Bz--19407), *14833* (Bz--19405), *18011* (Bz--19397), *21384* (Bz--19396), *22355bis* (Bz--19408), *31263* (Bz--19392), *s.n.* [1902] (Bz--19410, Bz--19411), *s.n.* [25 Jan. 1903] (Bz--19412), *s.n.* [Mrt. 1903] (Bz--19413); *Bakhuizen 282* (Bz--19391, Bz--19409), *2168* (Ut--24898A), *4077* (Bz--19395), *6217* (Bz--19401, Bz); *Beumee 5398* (Bz--19393, Bz--19394); *Blitar s.n.* [VIII.1939] (Bz--19388); *Brinkma 224* (Bz--19390); *Herb. Bogoriense 19415* (Bz); *Kollmann s.n.* [Java] (M); *Opium en-Zoutregii s.n.* (Bz--19398, Bz--19389); *Siebold s.n.* (Mu--862); *Van Semarang s.n.* [Nov. 1929] (Bz--19400); *Van Steenis 2866* (Bz--19399); *Vorderman s.n.* [Batavia] (Bz--19414). Kalimantan: *Polak 701* (Bz--72991); *Posthumus 2038* (Bz--19381). Sumatra: *Bünnemeijer 3242* (Bz--19429); *Herb. Bogoriense 19426* (Bz), *19432* (Bz); *Hooker s.n.* [1841] (K); *Koens s.n.* (Bz--19431); *Lörzing 3596* (Bz--19428); *Ultee 130* (Bz--19430); *Voogd 397* (Bz--19427). MOLUCCA ISLANDS: Ternate: *Beguin 1375* (Bz--19425). NEW CALEDONIAN ISLANDS: New Caledonia: *Franc 1284* (Ca--385987); *Le Jolis s.n.* [Nouvelle Calédonie] (X). HAWAIIAN ISLANDS: Oahu: *Judd s.n.* [Hakipuu, Nov. 28, 1938] (Bi, N); *H. N. Moldenke 21873* (Mi); *Wilder s.n.* [July 27, 1934] (N); *Zimmerman & Judd s.n.* [11/28/38] (N), *s.n.* [June 14, 1943] (N). SAMOAN ISLANDS: Tutuila: *D. W. Garber 942* (Bi); *Genzell s.n.* [Pago Pago] (S). SOCIETY ISLANDS: Raiatea: *J. W. Moore 626* (Bi, Bi). Tahiti: *Setchell & Parks 157* (Ca--219977). CULTIVATED: Alabama: *Fuller s.n.*[Nov. 1925] (E--922709). Bermuda: *Brown, Britton, & Wortley 1808* (D--556140, N). Brazil: *Glaziou 8185* (B, Cp, F--605790, K, L, P). Cuba: *C. F. Baker 7276* (B, Po--63796); *Ponce y Ramos s.n.* [Herb. Roig 305] (Es).

Egypt: *Mahdi 195* (Gz), *s.n.* [5/10/1963] (Gz, Gz, Gz), *s.n.* [6/11/1963] (Gz, Gz), *s.n.* [8/10/1968] (Gz); *Reyer s.n.* [Horto Rhada Cahirae] (V); *Täckholm s.n.* [7/9/1959] (Gz, Gz), *s.n.* [24/10/1962] (Gz); *Täckholm & Elsayed 206* (Gz, Gz), *s.n.* [15/5/1961] (Gz), *s.n.* [24/11/1961] (Gz, Gz, Gz). Florida: *L. H. Bailey s.n.* [Dec. 31, 1896] (Ba); *Dress 1271* (Ba); *Hawkes s.n.* [October 1958] (Sm); *E. G. Hume s.n.* [Orlando, July 21, 1930] (Ba, Ba, Ba, Bi, I), *s.n.* [Orlando, July 31, 1930] (Ba); *P. O. Schallert 20833* in part (B, Mu, S, Ws); *Sias s.n.* [Harbor View, Oct. 1903] (W--441440); *Tidestrom 4211* (Ar--19850); *Wedding 139* (Ar--19849). Georgia: *A. Brown s.n.* (Ms--30954); *Harmer 178r* (Ws); *Ridenhour s.n.* [Columbus, Oct. 1930] (Ga, Ga, Ga). Guyana: *Herb. Brit. Guian. Bot. Gard. s.n.*[Sept. 1907] (K, U); *W. Parker s.n.* [Demerara] (K). Hawaiian Islands: *Kuykendell 129* (Bi); *J. F. C. Rock 12516* (Bi, Bi); *G. P. Wilder s.n.* [July 26, 1930] (Bi, Bi), *s.n.* [July 27, 1934] (Ba, Ca--539995), *s.n.* [Honolulu, 5.1945] (Mu). Hong Kong: *Hance 395* (Bm). India: *Collector undetermined 1306/43* (L); *D'Almeida 1581* (Xa); *Herb. Hort. Bot. Serampore s.n.* (Cp); *Santapau s.n.* [Vict. Gardens, Oct. 1950] (Xa); *Voigt s.n.* [H. B. Seramp.] (Cp); *Wallich 178* (Pd), *885* (Cp), *1784* (K), *1784/E* (Mu--860), *1785/5* (K), *s.n.* (S). Java: *Herb. Hort. Bot. Bogor. XI.B.VI.51* (Bz--25809), *XII.B.IV.96* (Bz--26230, Bz--26240), *XV.K.A.45.17* (Bz--19382, Bz--19383), *XV.K.A.XLV.17* (Bz--19384, Bz--26576), *s.n.* (Bz--19385, Bz--19386); *Koorders 38942b* [1*] (Bz--19416), *38943b* (Bz--19419, Bz--19420), *38945b* [1473*] (Bz--19421), *39148b* (Bz--19422), *40842b* (Bz--19417, Bz--19418), *42060b* [5*] (Bz--19423, Bz--19424); *Wolff van Westerrode 340* (Bz--19387). Louisiana: *Penfound s.n.* [Nov. 1936] (Tl). Martinique: *Hahn 514* (B). Mauritius: *Collector undetermined s.n.* (K). Netherlands: *Herb. Lugd.-Bat. 908.266-354* (Le). Pakistan: *Qureshi s.n.* [April 1966] (Kh), *s.n.* [Nov. 1968] (Kh). Réunion: *Brèon s.n.* [1843] (Du--166595); *Richard s.n.* [Jardin de Bourb.] (P). Ruad Island: *Paul Duke of Würtemberg s.n.* [hort. Ibrahim Pascha 1839] (Mu--1635). St. Vincent: *Morton 4744* (W--1993911). Samoan Islands: *Setchell 241* (Ca--216016, Ca--216017), South Carolina: *Huger s.n.* [Bluffton, Oct. 1933] (A); *Totten s.n.* [Brookgreen Gardens, Sept. 24, 1939] (Hi--11130). Sri Lanka: *Collector undetermined s.n.* [Mrs. D. F. Barnes' place, Oct. 20, 1949] (Pd); *Moldenke, Moldenke, & Jayasuriya 28169* (Pd, W--2764432, W--2764458, W). Surinam: *Focke 918* (Ut, Ut); *Kegel 1030* (Gt); *Wullschlägel 1053* in part (Gt, V, V). Texas: *Drushel, Tharp, & Barkley 13A163* (Au); *Herber s.n.* [September 10, 1949] (N), *s.n.* [Jan. 27, 1950] (N); *E. R. Robinson 2* (F--1055643). Trinidad: *Kalloo B.666* (N). LOCALITY OF COLLECTION UNDETERMINED: *Collector undetermined s.n.* (L); *Herb. A. Braun s.n.* [Poqra, Kujer] (L); *Herb. Linnaeus 807/1* (Ls, N--photo), *807/2* (Ls, N--photo); *König s.n.* (S). MOUNTED ILLUSTRATIONS: Amman, Comment. Acad. Sci. Imp. Petrop. 8: pl. 15. 1736 (Ld); Bor & Raizada, Some Beaut. Indian Climb. 145, fig. 90. 1954 (Ld); Burm. f., Fl. Indica pl. 43, fig. 1 & 2. 1768 (Ld); Duke & Ayensu, Med. Pl. China 2: 637. 1985 (Ld); Lam., Tabl. Encycl. Méth. Bot. 1: pl. 79. 1791 (Ld, Z); R. Wight, Illustr. Indian Bot. 2: pl. 173. 1850 (Ba).

*CLERODENDRUM INDICUM* f. *SEMISERRATUM* (Wall.) Mold., Phytologia 22: 214. 1971.

Synonymy: *Clerodendron semiserratum* Wall., Numer. List [49], no. 1785 hyponym. 1829. *Clerodendron siphonanthus* var. *semiserrata* (Wall.) C. B. Clarke in Hook. f., Fl. Brit. India 4: 595. 1885. *Clerodendron semiserrata* Wall. apud C. B. Clarke in Hook. f., Fl. Brit. India 4: 595 in syn. 1885. *Clerodendron siphonanthus* var. *semiserrata* C. B. Clarke ex Mold., Résumé 269 in syn. 1958.

Bibliography: Wall., Numer. List [49], no. 1785. 1829; Steud., Nom. Bot. Phan., ed. 2, 1: 383. 1840; Schau. in A. DC., Prodr. 11: 675. 1847; Buek, Gen. Spec. Syn. Candoll. 3: 106. 1858; C. B. Clarke in Hook. f., Fl. Brit. India 4: 595. 1885; Mold., Alph. List Inv. Names Suppl. 1: 7. 1947; Mold., Résumé 269. 1958; Anon., Kew Rec. Tax. Lit. 270. 1971; Mold., Phytologia 22: 214. 1971; Anon., Biol. Abstr. 53 (12): B.A.S.I.C. S.51, 1972; Mold., Biol. Abstr. 53: 6372. 1972; Hocking, Excerpt. Bot. A.21: 117. 1973; Mold., Phytol. Mem. 2: 272, 388, 389, 393, & 538. 1980; Brenan, Ind. Kew. Suppl. 16: 71. 1981; H. N. & A. L. Mold. in Dassan. & Fosb., Rev. Handb. Fl. Ceyl. 4: 428. 1983.

This form differs from the typical form of the species in its more or less marginally crenate-serrate leaf-blades.

The form is based on *Wallich 1785* from Prome and Segain, Upper Burma, collected in 1826 and deposited in the East India Company Herbarium at Kew. Clarke (1885) comments that it is "Apparently a much-branched shrub; but the specimens are possibly only short imperfect flower-branches rapidly developed from a normal plant of C. *Siphonanthus* cut to the base by a hot-weather jungle fire; for the calyx and corolla are exactly as of C. *Siphonanthus*." He describes the plant as having "Leaves opposite short-petioled elliptic crenate-lobate, panicle terminal 3--4-fld."

Sørensen and his associates encountered what seems to be this form of the species in mixed evergreen forests of Thailand, at 350 m. altitude; their material was identified as and distributed as typical C. *indicum* (L.) Kuntze. It should be noted that not all of the leaf-blades exhibited by this collection exhibit the serration.

Citations: THAILAND: *Sørensen, Larsen, & Hansen 1147* (Cp, Cp).

*CLERODENDRUM INERME* (L.) Gaertn., Fruct. Sem. Pl. 1: 271, pl. 57, fig. 1. 1788.

Synonymy: *Niir-notsjiil* Rheede, Hort. Malab. 5: 97. 1685. *Nir-notsjil* Rheede, Hort. Malab. 5: pl. 49. 1685. *Baccifera malab. fructu oblongo, tetracocco, calyculato* Ray, Hist. Pl. 2: 1573. 1688. *Niir notsjil* Ray, Hist. Pl. 2: 1573. 1688. *Periclymeni similis arbor myrtifolia maderaspavensis* Pluk., Almagest. Bot. pl. 211, fig. 4 (1692) and p. 287. 1696. *Jasmini flore, frutex philippensis, foliis floribusque fere ternis* Petiv., Gazophyl. 67. 1702. *Jasmini flore frutex philippensis foliis floribusque fere ternis* Petiv., Gazophyl. pl. 42, fig. 7. 1702. *Periclymeni similis myrtifolia arbor maderaspatensis* Pluk., Amalth. Bot. 167. 1705. *Jasminum glanduliferum foetidum, zeylanicum* J. Burm., Thes. Zeyl. 127. 1737. *Jasminum litoreum* Rumpf, Herb. Amboin. 5: 86, pl. 46. 1747.

*Volkameria inermis* L., Fl. Zeyl. 231 (1747) and Sp. Pl., ed. 1, imp. 1, 2: 637. 1753 [not *V. inermis* Blanco, 1837, nor Reinw., 1850, nor Sessé & Moc., 1976]. *Ghuraenda* Herm. ex L., Fl. Zeyl. 104. 1747. *Catesbaea? javanica* Osbeck, Dagbok Ostind. Resa 92. 1757. *Volkameria ramis inermibus* L. apud P. Mill., Gard. Dict., abrdgd. ed. 5: *Volkameria* 2. 1763. *Jasminum flore frutex philippensis, foliis floribusque fere ternis* Petiv. apud N. L. Burm., Fl. Indica 137 in syn. 1768. *Volkameria ramis inermibus, foliis ovalibus integerrimis* L. ex N. L. Burm., Fl. Indica 136. 1768. *Jasminum littoreum* Rumpf ex N. L. Burm., Fl. Indica 136 in syn. 1768. *Jasminum glandiferum foetidum zeylanicum* J. Burm. apud N. L. Burm., Fl. Indica 136 in syn. 1768. *Nir notsjil* Rheede apud N. L. Burm., Fl. Indica 136 in syn. 1768. *Baccifera malabarica, fructu oblongo tetracocco calyculato* Ray apud N. L. Burm., Fl. Indica 136 in syn. 1768. *Serouni laut seu jasminum sylvestre* Kleinhof ex N. L. Burm., Fl. Indica 137 in syn. 1768. *Volkameria (inermis) ramis inermibus* L. apud P. Mill., Gard. Dict., abrdgd. ed. 6: *Volkameria* 2. 1771. *Jasmini flore frutex philippensis, foliis floribusque fere ternis* Petiv. apud Jacq., Collect. Suppl. 117 in syn. 1796. *Ovieda inermis* [Retz.], Nom. Bot. 155. 1772 [not *O. inermis* Burm., 1840, nor Burm. f., 1894, nor Jacks., 1921.]. *Niir notsjil* Rheede apud Jacq., Collect. Suppl. 117 in syn. 1796. *Volkameria commersonii* Poir. in Lam., Encycl. Méth. Bot. 8: 688. 1808. *Volkameria inermis, foliis ovatis, integerrimis; corymbo trichotomo; ramis teretibus, apice subpubescentibus* Poir. in Lam., Encycl. Méth. Bot. 8: 688 in syn. 1808. *Volkameria foliis ovatis, integerrimis, nitidis; pedunculis calycibusque glabris* Willd. ex Poir. in Lam., Encycl. Méth. Bot. 8: 688 in syn. 1808. *Peryclimeni similis, myrtifolia arbor, maderaspatensis* Pluk. apud Poir. in Lam., Encycl. Méth. Bot. 8: 688 in syn. 1808. *Nir-notsiit* Rheede apud Poir. in Lam., Encycl. Méth. Bot. 8: 688 in syn. 1808. *Volkameria inermis* Willd. ex R. Br. in Ait., Hort. Kew., ed. 2, 4: 65 in syn. 1812. *Clerodendrum inerme* R. Br. in Ait., Hort. Kew., ed. 2, 4: 65. 1812. *Volkameria nereifolia* Roxb., Hort. Beng., imp. 1, 46 nom. nud. 1814; Fl. Indica, ed. 2, 3: 64. 1832. *Clerodendron ovatum* Poir., Encycl. Méth. Suppl. 4: 352. 1816 [not *Clerodendrum ovatum* R. Br., 1810]. *Clerodendron coriaceum* Poir., Encycl. Méth. Suppl. 4: 353. 1816 [not *Clerodendrum coriaceum* R. Br., 1810]. *Clerodendrum inerme* var. *calicibus campanulatis obtuse dentatis* Blume, Bijdr. Fl. Ned. Ind. 9: 808. 1825. *Clerodendron commersonii* (Poir.) Spreng. in L., Syst. Veg., ed. 16, 2: 758. 1825. *Clerodendron coromandelianum* Spreng. in L., Syst. Veg., ed. 16, 2: 758. 1825. *Clerodendron javanicum* Spreng. in L., Syst. Veg., ed. 16, 2: 759. 1825 [not *C. javanicum* Walp., 1844]. *Clerodendron inerme* R. Br. apud Spreng. in L., Syst. Veg., ed. 16, 2: 788. 1825. *Clerodendrum inerme* Gaertn. ex Blume, Bijdr. Fl. Ned. Ind. 14: 808. 1826. *Clerodendron neriifolium* Wall., Numer. List [49], no. 1789 hyponym. 1829. *Clerodendron neriifolium* β *lanceolatum* Wall., Numer. List [49], no. 1789/B. 1829. *Clerodendrum coromandelianum* Spreng. ex Loud., Hort. Brit., ed. 1, 247. 1830. *Clerodendrum salicifolium* Lodd. ex Loud., Hort. Brit., ed. 1, 247. 1830. *Clerodendrum madagascariense* Lodd. ex Loud., Hort. Brit., ed.

1, 246 in syn. 1830 [not *C. madagascariense* Mold., 1950]. *Clerodendrum coromandelinum* Spreng. ex Sweet, Hort. Brit., ed. 2, 415. 1830. *Clerodendron inermis* var. *plukenatis depicta* Hamilt. ex Wall., Numer. List 87, no. 1789/E. 1831. *Clerodendron capsulare* Blanco, Fl. Filip., ed. 1, 509. 1837. *Clerodendrum javanicum* Spreng. apud Steud., Nom. Bot. Phan., ed. 2, 1: 383. 1840. *Clerodendron commersonii* Spreng. apud D. Dietr., Syn. Pl. 3: 615. 1843. *Nir-notsjit* Rheede apud Walp., Repert. Bot. Syst. 4: 112 in syn. 1844. *Volkameria inermis* L. f. ex Schau. in A. DC., Prodr. 11: 657 & 660 in syn. 1847. *Volkameria neriifolia* Roxb. apud Schau. in A. DC., Prodr. 11: 660 in syn. 1847. *Clerodendron innerme* Seem., Bonplandia 10: 250. 1862. *Clerodendron inerme* var. *oceanicum* A. Gray, Proc. Amer. Acad. 6: 50. 1862. *Clerodendron inerme* var. *genuina* S. Kurz, For. Fl. Brit. Burma 2: 266. 1877. *Clerodendron inerme* var. *neriifolium* (Wall.) S. Kurz, For. Fl. Brit. Burma 2: 266. 1877. *Clerodendron inerme* var. *neriifolium* Kurz apud K. Schum., Engl. Bot. Jahrb. 8: 220. 1887. *Volkameria inermis* Lour. ex Maxim., Bull. Acad. Nat. St.-Pétersb. 32: 83 in syn. 1887. *Clerodendron inerme* Gaertn. ex Watt, Dict. Econ. Prod. India 2: 372. 1889. *Clerodendron inerme* α *ovalifolium* Kuntze, Rev. Gen. Pl. 2: 506. 1891. *Clerodendron inerme* α *ovalifolium* f. *subglobosa* Kuntze, Rev. Gen. Pl. 2: 506. 1891. *Clerodendron inerme* α *ovalifolium* f. *corynocarpa* Kuntze, Rev. Gen. Pl. 2: 506. 1891. *Clerodendron inerme* β *latifolium* Kuntze, Rev. Gen. Pl. 2: 506. 1891. *Clerodendron inerme* γ *neriifolium* (Wall.) Kurz apud Kuntze, Rev. Gen. Pl. 2: 506. 1891. *Ovieda inermis* (L. f.) Baill., Hist. Pl. 11: 94. 1891 [not *Ovieda inermis* Burm., 1840, nor Burm. f., 1894, nor Jacks., 1921]. *Clerodendron nereifolium* Wall. apud Jacks. in Hook. f. & Jacks., Ind. Kew., imp. 1, 1: 56. 1893. *Pharmacum litoreum* Rumpf apud Dymock, Warden, & Hooper, Pharmacog. Indica 3: 77 in syn. 1893. *Volkameria inermis* Willd. ex Hunter, Journ. Straits Br. Roy. Asiat. Soc. 53: 102. 1909. *Clerodendron inerne* Woodrow, Gard. Trop., ed. 6, imp. 8, 437 sphalm. 1910. *Clerodendron inerme* Auct. ex E. D. Merr., Philip. Journ. Sci. Bot. 7: 215 in syn. 1912. *Clerodendron inerme* W. F. Wight apud E. D. Merr., Philip. Journ. Sci. Bot. 9: 135 in syn. 1914. *Clerodendron interme* Firminger, Man. Gard. India, ed. 6, 2: 388 sphalm. 1918. *Clerodendrum neriifolium* Wall. apud H. Hallier, Meded. Rijks Herb. Leid. 37: 61 in syn. 1918. *Clerodendrum commersonii* Spreng. apud H. Hallier, Meded. Rijks Herb. Leid. 37: 61 in syn. 1918. *Clerodendrum capsulare* Blanco apud H. Hallier, Meded. Rijks Herb. Leid. 37: 61 in syn. 1918. *Clerodendron nereifolium* "Wall. ex Walp." apud Bakh. in Lam & Bakh., Bull. Jard. Bot. Buitenz., ser. 3, 3: 110 in syn. 1921. *Clerodendron commersonii* [Poir.] Spreng. apud Bakh. in Lam & Bakh., Bull. Jard. Bot. Buitenz., ser. 3, 3: 108 in syn. 1921. *Clerodendron neriifolius* Wall. apud E. D. Merr., Enum. Born. Pl. 516 in syn. 1921. *Cherodendron inerme* (L.) Gaertn. ex H. J. Lam, Engl. Bot. Jahrb. 59: 28 sphalm. 1924. *Clerodendron inerme* var. *neriifolia* Kurz apud Domin, Bibl. Bot. 89: 1111 in syn. 1928. *Clerodendron commersonii* Chung ex P'ei, Mem. Sci. Soc. China 1 (3): 127 in syn. 1932. *Volhameria inermis* L. apud Hosokawa, Trans. Nat. Hist. Soc. Formosa 23: 232 in syn. 1933.

*Clerodendrum commersoni* Spreng. apud E. D. Merr., Trans. Amer. Philos. Soc. 24 (2): 337 in syn. 1935. *Clerodendron inerme* var. *neriifolium* Wall. apud Fletcher, Kew Bull. Misc. Inf. 1938: 425 in syn, 1938. *Clerodendron commersoni* (Poir.) Spreng. ex Mold., Prelim. Alph. List Inv. Names 19 in syn. 1940. *Clerodendron inermis* L. ex Mold., Prelim. Alph. List Inv. Names 20 in syn. 1940. *Clerodendron littorium* Heyne ex Mold., Prelim. Alph. List Inv. Names 20 in syn. 1940. *Clerodendron inerme* var. *lanceolatum* Wall. ex Mold., Prelim, Alph. List Inv. Names 20 in syn. 1940. *Clerodendron inerme* Naud. ex Mold., Alph. List Inv. Names 18 in syn. 1942. *Clerodendron inerme* (L.) Gaertn. ex Mold., Alph. List Inv. Names 18 in syn. 1942. *Clerodendron inerme* var. *neriifolia* Kuntze ex Mold., Alph. List Inv. Names 18 in syn. 1942. *Clerodendron inerme* var. *oceanicum* Torr. ex Mold., Alph. List Inv. Names 18 in syn. 1942. *Clerodendron inerme* var. *latifolia* Kuntze ex Mold., Alph. 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Mem. 2: 384 in syn. 1980. *Clerodendron inermis* Gaertn. ex Mold., Phytol. Mem. 2: 386 in syn. 1980. *Clerodendron inermis* var. *plukenato depicta* Hamilt. ex Mold., Phytol. Mem. 2: 386 in syn. 1980. *Frutex sylvestris, flore albo, antralia moegri javanis* Kleinhof ex Mold., Phytol. Mem. 2: 405 in syn. 1980. *Clerodendron inerme* var. *pvalifolium* Kuntze apud H. N. & A. L. Mold. in Dassan. & Fosb., Rev. Handb. Fl. Ceyl. 4: 450 in syn. 1983. *Clerodendron inerme* var. *ovalifolium* f. *subglobosa* Kuntze apud H. N. & A. L. Mold. in Dassan. & Fosb., Rev. Handb. Fl. Ceyl. 4: 450 in syn. 1983. *Clerodendron inerme* var. *ovalifolium* f. *corynecarpa* Kuntze apud H. N. & A. L. Mold. in Dassan. & Fosb., Rev. Handb. Fl. Ceyl. 4: 450 in syn. 1983. *Clerodendron inerme* var. *latifolium* Kuntze apud H. N. & A. L. Mold. in Dassan. & Fosb., Rev. Handb. Fl. Ceyl. 4: 450 in syn. 1983. *Clerodendron inermis* var. α *plukenatio depicta* Hamilton ex H. N. & A. L. Mold. in Dassam. & Fosb., Rev. Handb. Fl. Ceyl. 4: 449 in syn. 1983. *Clerodendron enermis* (L.) Gaertn., in herb. *Clerodendron neriifolium* var. *lanceolatum* Wall., in herb. *Volkameria myrtifolia* Portenschlag, in herb.

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An erect, rounded, loosely branched bush or large, heliophilous, many-stemmed, branched, often rambling, scrambling, or semi-scandent to scandent, evergreen shrub, mostly coastal, to 10 m. tall or 12 m. long, sometimes prostrate, sometimes a large liana climbing to 28 m. in trees, often growing in maritime mangrove associations; stem to 4 cm. in diameter, hollow, dark-brown to gray or whitish-gray, smooth, fissured, soft; bark whitish-gray or pale- to dark-brown, soft; wood hard, white; slash light-brown; branches and branchlets slender, terete to obtusely or acutely tetragonal, light-buff or gray, sometimes purplish, very minutely puberulent or glabrous, tuberculate with small persistent petiole-bases, weak, diffuse, often pendent, sometimes arcuate or reclining and much tangled; nodes not annulate; principal internodes 2--7.2 cm. long; leaves decussate-opposite or rarely ternate, aromatic, very variable in shape and size, bitter to taste; petioles slender, 4--11 mm. long, subglabrate, often purplish or red-purple, sometimes leaving prominent corky (but not spinose) sterigmata after being shed; leaf-blades thin-chartaceous when dried, often rather fleshy with the venation sunken on both surfaces when fresh, glossy or semi-glossy, rather uniformly bright- or deep-green on both surfaces or dull dark- or mid-green above and lighter beneath, elliptic, elliptic-oblong, or narrow-lanceolate to ovate or obovate, 2--14 cm. long, 0.8--8 cm. wide, quite variable, apically very shortly acuminate or rounded to an obtuse or blunt point, marginally entire, basally acute, glabrate and shiny above, obscurely pulverulent-puberulent and densely punctate or glabrate beneath; midrib and secondaries often impressed on fresh leaves; veinlet reticulation usually sparse and obscure on both surfaces; inflorescence axillary or supra-axillary; cymes few, solitary, opposite, borne in the uppermost leaf-axils, mostly trichotomous, few- (mostly 3--7-) flowered, 4.5--9.5 cm. long, divaricate, loosely flowered, to 7 cm. wide; peduncles slender, patulous, 1.5--4 cm. long, shorter than the subtending leaf, subglabrate, often red-purple; pedicels slender, 5--13 mm. long, glabrate, often red-purple; large bracts none; bractlets and prophylla few, not obvious, linear-subulate, 1--3 mm. long, borne at the bases of the cyme-branches and pedicels; flower-buds white, the petals purple-tipped; flowers "honeysuckle-like", sweetly fragrant with a musty odor in the early morning hours, later non-odorous; calyx campanulate, about 4 mm. long, green or pale-green, the rim 5-toothed, the teeth broadly triangular, apically acute; corolla hypocrateriform, white or touched with purple, the tube slender, 2--3 cm. long, often sulphur-yellow below and pink above, glabrous, apically ampliate and infundibular, the limb 5-lobed or 5-fid, about 1.3 cm. wide, the lobes obovate, 1/3 as long as the tube; stamens 4, didynamous, long-exserted (to about 2.5 cm.); filaments slender, varying from maroon, crimson, scarlet, or red to blue, bluish-red, magenta, cerise, or purple, sometimes green, usually basally white, about 3 cm. long; anthers yellow or finally purple-brown, ovate, composed of 2 thecae; style exserted, purple or maroon to magenta, pink, or blue; stigma "simple"; ovary imperfectly 4-celled, obsoletely 4-lobed, each cell 1-ovulate; fruit drupaceous.

This is a very widely distributed and polymorphic species of seashores, saline marshes and swamps, muddy tidal riverbanks, and the edges (mostly) of mangrove forests in tropical and subtropical Asia from Pakistan, India, Burma, the Andaman Islands, and Sri Lanka eastward to Thailand, Indochina, and Malaya to the coasts of Australia and almost throughout Pacific Oceanica, north to Hainan, Hong Kong, Taiwan, and the coast of southern China; introduced in parts of the West Indies, coastal Brazil, Zaire, and Mauritius as a sand-binder; cultivated in many places in both the eastern and western hemispheres to check beach erosion, in desert regions, and as a specimen or topiary plant.

Linnaeus originally described the species as from Sri Lanka and India, his holotype *809/3* having been examined by me in the Linnean Herbarium in London. Jacquin (1796) and Raeuschel (1797) regarded it as from (eastern) India. Kurz (1870) recorded it from Aberdeen to South Point in the Andaman Islands, but notes "doubtfully wild" there. Chamisso (1832) noted that it was "Vulgaris hortorum hospes" in Russian gardens, doubtless from plants introduced by the Romanzoff expedition from collections made on the islands of Radack, Guam, and Luzon. He describes the plant as "Suaveolentes amoenas arbusculae flores ornatissimis elegantiae morum laude Radaccensibus grato sunt coronamento". In 1837 Bojer listed it as in cultivation in the royal garden at Pamplemousse, Mauritius. Loudon (1830) informs us that it was introduced, as *C. inerme*, into English gardens from the East Indies in 1824 and, as *C. salicifolium*, in 1832; Sweet (1826), however, gives the date of introduction, as *C. inerme*, as 1692, also from the East Indies, and as both *C. coromandelianum* and *C. neriifolium* in 1824, again from "E. Indies".

Thwaites & Hooker (1861) refer to *C. inerme* as "Very common near the sea" in Sri Lanka. Fernandez-Villar, in 1880, lists the species from Luzon, Mindanao, Panay, Cebu, Paragua, Jolo, and Basilan islands in the Philippines. Koorders (1898) lists it from the southwestern part of Celebes. Balfour (1885) avers that it is "A plant of India, China, the Moluccas, and N. Holland". Briquet (1895) claims that it is only cultivated in Java, but Miquel (1867) and Koorders & Valeton (1900) assert that it is indigenous there.

Brandis (1906) describes *C. inerme* as "A straggling almost scandent evergreen shrub" growing in "Tidal jungles and sea coast of Bengal and both Peninsulas [of India]", flowering there throughout the year, but chiefly from July to November.

Clarke (1885) reported what he called *C. inerme* from only "India and Ceylon near the sea, from Bombay to Tenasserim [Burma]", and what he called *C. neriifolium* from the "Malay Peninsula near the sea, from Chittagong to Malacca, frequent. Distrib. Malaya, China, Australia, Polynesia". Cooke, in 1905, regarded *C. inerme* as occurring naturally "Throughout India near the sea" and in Sri Lanka, where, he avers, it blossoms from November to January. Hunter, in 1909, lists it as cultivated in gardens on Prince of Wales Island, but comments that "I do not know whether or not it is indigenous" there.

Woodrow (1910) says that "This shrub grows on the banks of salt-water creeks in the Concan and the bright green of its sprawling branches on low banks that have little other vegetation, lend a charm to a desolate region. It also grows inland, and in the Municipal Garden, Karachi, a gateway is clothed in its deep green foliage, lit up by white flowers 3/4 inch in diameter". He adds that it may be propagated by seeds or cuttings. Dunn & Tutcher, in 1912, report it common near the sea at Hong Kong. Firminger (1918) describes it as "A subscandent shrubby species, common throughout the Deccan.....[where it] makes a good hedge".

Merrill (1918, 1923) tells us that *Clerodendrum inerme* is common along sandy shores, seashores, and tidal streams "throughout the Philippine Islands". Rodger (1922) records it from Burma. In 1924 Lam gives its distribution, as known to him, as "Britisch Indien, Ceylon, Dekkan, Siam, Hongkong, Hainan, Kwantung, Formosa, Malakka, Sumatra, Java, Kajuadi- und Tanan Djampea-Insel, Timor, Lombok, Buton, Tukan-Besie-Insel, Celebes, Buru, Ceram, Klein-Ceram, Borneo, Philippinen (Luzon, Polillo, Panay), Neu-Guinea, Neu-Mecklemburg, Neu-Pommern, Palau-Inseln, Marianen, Karolinen, Aru-Insel, Queensland, Nord-Australien, Neu-Südwales, Neu-Kaledonien, Fitschi-, Samoa- und Tonga-Insel."

Bakhuizen (1929) calls the species a common, large, rambling shrub and gives its overall distribution, as known to him, as "Along the sea-coast from S. E. Asia and China to Polynesia and Australia, including the Malay Archipelago, Philippines and New Guinea."

Backer (1931) asserts that in Java it is an "Opgerichte of min of meer klimmende heester, vaak met lange, overhangende of zich tusschen andere planten door omhoog werkende en weer afhangende takken", flowering throughout the year in "West- tot Oost-Java, dikwerf op zilte of brakke, vochtige of droge gronden, vooral aan of nabij de zee, aan strandkreken en aan zoutwaterpoelen, minder vaak op zandstrand en in duinen."

Guillaumin (1932) refers to it as a very common seashore shrub at sea-level, with an overall distribution, as known to him, of New Caledonia, the Loyalty Islands, Queensland, New South Wales, North Australia, Fiji, Tonga, Samoa, the Caroline, Mariana, Santa Cruz, and Solomon Islands, Bismark Archipelago, the Admiralty Islands, New Guinea, and Malaysia.

Joshi (1936) calls it a "seashore plant, but very commonly used for hedges and [for] covering banks, walls, etc." in Lahore [Pakistan], flowering there during the summer. Van Leeuwen (1937) records it as native in the Salajar Islands. MacMillan (1943) lists it as cultivated both in India and in Sri Lanka, recommending it "for seacoast and moderately dry regions". Yuncker (1943) reports it native and common on the sea cliffs on Niue Island. Meeuse & Lam (1945) give its natural distribution as the "Mascarenes to Polynesia". St. John, in 1948, records it from Angaur and Pingelap islands in the Caroline group. Pételot, in 1853, assures us that it is "Commun dans toute l'Indochine". Fosberg (1948) found it on Saipan, forming a mangrove-like association with *Acrostichum aureum*, *Hibiscus tiliaceus*, and *Paspalum virgatum*.

Taylor (1950) lists *Clerodendrum inerme* from Rongelap and Bikini Atolls in the northern Marshall Islands, where, he says, "It is chiefly found in the neighborhood of the settlements or coconut plantings on the islands; but [it] ranges widely, though not characteristic either of the dense woodlands or of the tiny more barren islets." Hara (1959) collected it on Tanegashima in the Satsunan group (Ryukyu Archipelago).

Shah (1962) reports it forming dense thickets along the edge of the sea creeks on Salsette Island (near Bombay). Ohwi (1965) found it on "Wet banks along rivers", but "rare", on Kyushu Island (Japan), and gives its overall distribution only as "Ryukyus, Formosa, China, Burma, Malaysia to Australia". Hatusima (1966) refers to the plant as occurring "In the littoral bush" from "India to N. Australia, Polynesia through Malaysia, northwards to the Ryukyus". Shah (1969) lists it from Gujarat; Santapau (1967) from Saurashtra; Santapau & Shah (1969) again from Salsette Island; and Imandar (1971) again from Gujarat, India. Alexander (1971) asserts that it is "Widely distributed from India through tropical Asia and Australia to the Pacific Islands". Fong and his associates (1972) list it from Guam, while Stone (1967) records it from Romonum Island in the Truk lagoon. Sykes (1970) found it again on Niue Island.

Liogier (1965) records it from the West Indian island of St. Croix, but Fosberg (1976) claims that this record is "rather unlikely".

Rao (1971) lists *C. inerme* among the strand shrubs and trees in the Indian states of Kutch, Saurashtra, Gujarat, Maharashtra, Mysore, Kerala, Tamil Nadu, Andhra Pradesh, Orissa, and West Bengal, "often stunted when in the mid- or outer-strand [and] growing under maritime influences". In his 1963 work he reports finding it growing "in white sand with a black tint" in association with *Vitex negundo*, sedges, and grasses on consolidated sand dunes on Ramaswaram Island (off the coast of Tamil Nadu). Rao & Razi (1973) list it again from Mysore, where, they say, it flowers and fruits during the major part of the year and is a common hedge plant, emitting "a foul smell when bruised". Paliwal & Singh (1982) record it from Uttar Pradesh.

Weiner (1971) tells us that the species is frequent near the seashore in the Tongan Islands "and occurs also from India through Malaya to Polynesia"; St. John & Smith (1971) found it growing on the rocky coasts of Futuna Island. Horikawa (1972) gives its distribution in detail on Taiwan and in the Ryukyu Islands.

Fosberg and his associates (1979) report it, as *C. inerme* var.

*oceanicum*, from the Marianas Islands (Guam, Pagan, Saipan, Sarigan, Rota, & Tinian), Caroline Islands (Angaur, Ant, Babeldach, Dublon, Eauripik, Etal, Ifaluk, Kapingamarangi, Kusaie, Lamotrek, Losap, Lukunor, Moen, Namonuito, Ngarakabesang, Nomwin, Nukuoro, Palau, Peliliu, Satawal, Satawan, Sinsorol, Pingelap, Pis, Ponape, Tol, Truk, Ulithi, Uman, & Yap), Marshall Islands (Ailuk, Ailinginae, Ailinglapalap, Arno, Bikini, Eniwetok, Jaluit, Jemo, Kwajalein, Lae, Majuro, Rongelap, Ujelang, Utirik, & Wotho), Gilbert Islands (Butaritari, Nonouti, Onotoa, Tabiteuea, & Tarawa), and Nauru Island. Lasser and his associates (1974) record it as cultivated in Venezuela.

Jafri & Ghafoor, in a personal communication to me, refer to *C. inerme* as "A very common hedge plant of the plains of Sind and Punjab [Pakistan]. In Karachi it thrives well. Its cuttings are used for producing new plants.....[It blooms] Almost throughout the year." They further say of it: "A native of the sea coasts of India and Sri Lanka, introduced and naturalized along sea shores of Burma, Australia and China." However, I know of no evidence that the species was purposefully introduced by man in any of the areas they enumerate; I feel that it is most certainly indigenous there.

Herbst & Allerton found it to be a very common plant in the Gilbert Islands; Solomon & George report it common in jungle areas on Ponape; Berry affirms that it grows on the beaches and in the jungles on Sonsorol Island "to a height of about 8 feet". On Yap it is said by Takamatsu to be common in moist places, while in the Tongan Islands Setchell & Parks say that it "lines the beach in seaside shrubbery"; in Papua Brass reports it "a rambling beach shrub common all along the coast at the inner edge of the mangroves"; Taylor found it common in the Marshall Islands, while Henry reports it common on Taiwan. It is recorded by Rao, Aggarwal, & Mukherjee from Krusadi and Rameswaram Islands off the coasts of India. On the Great Barrier Reef it is referred to by Stoddart as common on Saunders Island, "an extremely common straggling shrub" on Eagle Island, and "common on shingle ridges" on the Two Islands -- Fosberg found it "locally common on lagoon beaches" on Lizard Island. Fosberg also reports it only "occasional" in the forest on steep limestone bluffs on Guam, abundant in soil derived from coral limestone in disturbed ground along roadsides on Peliliu Island, occasional to scattered in village coconut-breadfruit plantations on Wattagai Island, and "clumped to scattered" on savannas on Yap; with Evans he found it common in forests and the peaty edges of taro swamps on Lamotrek Island. In Guam Moran speaks of it as a "2-meter tall shrub with weak often reclining branches on coral beaches under *Cocos* palms". On Guadalcanal Kajewski describes it as a common seaside shrub. On Hainan Island it is said by Fung to be "rare" at the edges of cultivated fields, while Liang describes it as "scandent in open thickets" and Lau refers to it as "fairly common on dry gentle slopes in sand".

In the Marshall Islands this species is said by Fosberg to "form low thickets around abandoned taro pits" on Utirik Island, sometimes "forming masses to 2 m. high in old taro pits" and "forming low thickets generally through the coconut groves" on Ailuk Island. Carroll avers that it is "said to have been present [in the Caroline Islands] before European contact". In the Maldive Islands, according to Fosberg, it inhabits the coral soil of waste places. Mathews found it both cultivated and "wild" in Saudi Arabia, the wild plants said to be escapes from the 10-foot tall hedges widely planted there.

The unnumbered Teijsmann collection, cited below, from the botanical garden at Bogor (Java) is said to have been taken from a plant originally from a Bombay (India) garden. The *Fosberg 11000* collection, also cited below, was taken from cultivated material on Fanning Island [in the Line Islands group], but the plants were originally brought there from the Gilbert Islands "where the species is native". The unnumbered Hartling collection, from material growing at the New York Botanical Garden, was originally obtained from Paris in 1902. The unnumbered Young collection, also cited below, was from material cultivated at Chapman Field, Florida, from seeds collected in Honolulu and presented by Harold L. Lyon on January 21, 1921, originally grown in Honolulu from seeds collected on Prince of Wales Island [Malaya] by J. A. Kusche and said to have been "A small tree growing near the beach" there.

Macbride (1959) is of the opinion that the Ruiz & Pavon specimen, identified as representing this species and presumably collected on the coast of Peru, may actually be C. *tessmanni* Mold., but this is most unlikely.

*Clerodendrum inerme* has been reported by various collectors as an inhabitant of seashores, salt marshes, low sand dunes, sand cays, river sand-bars, saltwater swamps, rocky headlands and limestone cliffs, the edges of brackish canals and tidal streams, and, of course, the mangrove association belt (especially its inner landward edge), often growing in the first row of woody plants on sandy beaches, at the edge of littoral scrub, on coastal bluffs, in tidal mud flats, on and behind sea walls, on coral islands, on coral beaches under coconuts, in lowland and swamp forests, alluvial forests, and the edges of lagoons and foreshores, but also in or at the edges of lava fields, on rocky hillsides, along open country roads, "exposed with no foliage cover on sunny sandy flats", on savannas, in hedge-thickets near houses, in relatively open vegetation along stream banks, in wet humus at the edges of canals, between trees in coastal swamps, in low thickets and dense forest scrub of ravines, from sealevel to about 80 m. altitude, but naturalized or cultivated in areas up to 1550 m. altitude.

Cooray reports the species common in Sri Lanka, where Wirawan refers to it as "a straggling shrub", Fosberg & Balakrishnan describe it as only "occasional" on the levees of rice fields, and Mueller-Dombuis calls it "very abundant in the first row of woody plants on sandy beaches and particularly at the outer margin of open beach areas."

[to be continued]

# MISCELLANEOUS NOTES ON NEOTROPICAL FLORA, XVI.

## NEW TAXA IN THE ESPELETIINAE

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LIBANOTHAMNUS OCCULTUS (Bl.) Cuatr. var. SALOMONII Cuatr. & López-Figueiras var. nov.

Arbor usque ad 5 m alta dimidia parte superiore ramosa. Gemae terminales foliaque incipendia dense crasseque fulvescenti-lanato-villosa.

Folia alterna crasse coriacea rigida. Lamina sessilis (18-)20-28(-30) x 5.4-7(-8)cm, ratio 3-4.5(-4.9):1 oblongo-elliptica apice obtusa vel subobtusa minute mucronata, circa basim attenuata usque ad 20-14(-12) mm latitudem subite angustata, margine revoluta integra; adaxiale juvenilis dilute villoso-lanuginea denique glabra lutescenti-viridis plus minusve viscida, costa anguste impressa, nervis lateralibus leviter impressis vix conspicuis; abaxiale ochraceo-lanata indumento crasso densissimo intricatissimo superficiem totam tegenti sed costa valde elevata robusta conspicuissima, nervis secundariis crebris parum notatis sed infra indumentum prominentibus parallelis 2-4 mm inter se distantibus in angulo (70-) 80-90° divergentibus, venulis in reticulo prominulo instructis alveolis moderatis lanatisque. Vagina 2.6-3.7(-4.5) cm longa apice robusta triangulata inferne tubulosa amplectente adaxiale 1 cm alta annularis, intus glabra crebre nervata extus densissime fulvo-villoso-barbata.

Synflorescentiae terminales corymboide-paniculatae congeste floribundae inferne foliatae superne bracteatae 20-40 cm longae 20-35 cm latae folia adulta paulo superantes. Axis robustus angulatus e basi ramosus. Rami alterni principales 3-4 robusti striati erecti, vel patenti-erecti proximales 18-28 cm longi dimidia vel tertia superiore parte ramificati corymboso-paniculati 8-29 capitula ferentes, ramusculis ultimis 1-3 capitulis instructis. Pedunculi seu pedicelli crassiusculi erecti recti vel ubi vetusti valde recurvati 0.5-5 cm longi. Axes rami ramusculi pedicellique dense longeque lanati pilis tenuibus plus minusve flexuosis intricatis ad 5 mm longis vel longissimis intricato-barbatis indumento crasso ochraceo vel ochroleuco instructis. Folia subtendentia proximalia caulina similia sed breviora, lamina 12-22 x 4-6.5 cm, sursum decrescentia. Superne bracteae subtendentes ovato-oblongae acuminatissimae et acutae 14-2.5 x 5-1 cm, primum quam pedunculi longiores sed maturitate breviores.

Capitula radiata latiuscula 110-131 flores ferentia, ligulis amotis 17-22 mm diam, circulo ligularum 30-35 mm, disco 8-9 mm diametro. Involucrum cupulare circa 17 mm altum dense fulvescens villoso-lanatum. Phyllaria sterilia plerumque 8, quinque exteriora 18-13 x 10-7 mm crasse herbacea ovata acuminata concava densissime fulvo-longe-villosa, altera 9-8 x 5-4 mm ovato-oblonga acutaque sursum villosa. Phyllaria fertilia exteriora 8-6 x 5-4 mm ovata breviterque acuminata acuta crasse membranacea plurivenia basi valde incrassata et indurata dorsale sursumque lanuginoso-villosa, medialia interioraque 7-6 x 4-3 mm, membranacea elliptica cum apice triangulato, argute navicularia amplectentia, plurivenia dorso sursumque pilosa apice dense barbata pilis rigidis erectis ad 1.5 mm, omnia eglandulosa. Receptaculum plano-convexum 8-9 mm diam glabrum. Paleae 6-6.2 x 2-2 mm, firmule membranaceae plurivenosae oblongae apice triangulato breviterque apiculato dorso distale dense barbato pilis acutis et obtusiusculis 0.5 mm longis inferne glabrae, eglandulatae.

Flores radii ligulati 24-26 in capitulo 3-seriati. Corolla albida 9-12 mm longa, tubo 1-1.5 mm longo dense piloso pilis ad 1 mm longis hyalinis obtusis vel clavatis plusminusve intricatis; lamina crassiuscula elliptica 2-3 dentata 3-5 mm lata adaxiale marginibusque papillata abaxiale sparse pilosula, eglandulata. Stylus 3-4 mm longus ramis 1 mm. Achaenia exteriora 3 x 2.8 x 2.5 mm, obovoide-triangulata apice truncata basim versus attenuata basi obtusa duobus faciebus planis dorsali convexa et incurvata, interiora 3.2 x 2 x 1.5 mm, oblonga quadrangulata, carpopodium callosum crassum cylindraceum 0.5 mm longum.

Flores disci 85-106 in capitulo. Corolla lutea vel luteolo-viridis 6-6.4 mm longa, tubulo 2.5 mm longo sparse piloso pilis obtusissimis vel parcis clavatis 0.2-0.6 (-1) mm longis basim versus glabro, limbo tubuloso tantum basin parcis pilis, lobis 0.7-0.8 mm longis triangulatis dorso parcis pilis obtusis vel subclavatis 0.1-0.5 mm interdum duobus lobis abaxialibus glabris, marginibus longi-papillatis, haud glandulis. Antherae 2.2 mm longae appendicibus ovato-lanceolatis 0.5 mm longis. Stylus 6 mm sursum argute papillosum apice emarginato brevius papilloso. Nectarium tubulosum 5-lobatum 0.6-0.7 mm altum.

Typus: Venezuela, Táchira: Pico de Horma, laderas occidentales, zona paramera 7.5 km al SE de Mesa Quintero, 3100 m; arbol hasta 5 m, tronco ramoso a partir de 2.80 m, hoja envés pardo leonada, lígulas amarillo-pálidas, 11 enero 1985, _López-Figueiras, H. Rodríguez & N. Rengifo 31344_ (Holotypus, US); isotypus MERF). Id. small individual, sterile, n° _31345_. Alrededor de pequeña laguna cerca Pico de Horma ladera sur, 3000 m, 11-I-1985, _López Figueiras, H. Rodríguez & N. Rengifo 31346_ (US, MERF). Id. plántulas n° _31347_.

Var. _salomonii_, an endemic form of Pico de Horma mountain, differs from the typical _L. occultus_ of Páramo de Quirorá, by the elliptic leaf lamina which is less restricted at its base (13-20 mm wide), and from the common form found at the neighboring Páramo del Batallón by the outline of the leaf lamina. It differs also by the absolute lack of glands on the phyllaries and pales, and by the light-yellow color of the ray flowers, which in the typical variety of the Páramo de Quirorá are white or cream. From all populations known to me of _L. occultus_, this variety from the subparamo region of Pico de Horma, differs by its dense, thick, lanate-barbate tawny indument that covers the young parts, the inflorescence branchlets and the undersurface of the leaves.

ACKNOWLEDGMENT. This new variety is dedicated to Ingeniero Agrónomo Salomón López Coordinator of a Unidad Técnica for a Conservation Program, CADAFE, of State Táchira, Venezuela, who provided important logistic help to the collector's, including helicopter transportation to reach the isolated almost inaccessible hill of Pico de Horma. His generous help facilitated an initial exploration by Drs. López-Figueiras and Henry Rodríguez, who brought interesting collections among them the new variety of Libanothamnus here described and other taxa under study.

RUILOPEZIA USUBILLAGAE Cuatr. sp. nov.

Caulis brevis lignosus probabiliter pauciramosis, ramis brevibus lignosis omnibus rosulam multifoliatam terminalem efferentibus.

Folia rigidule chartacea rosulata. Lamina 12-20 cm longa 3-3.3 cm. lata elliptico-lanceolata acuta deorsum attenuata basi angustata brevem pseudopetiolum alatum simulans, basi in vaginam triangularem 18-24 mm longam ad 12-14 mm latam gradatim ampliata, margine adaxialiter visu integra vel leviter crenata, sed denticulis mucroniformibus minutis recurvis tantum abaxialiter conspicuis 2-6 mm inter se distantibus; superficie adaxiale viridis minute rugulosa costa impressa reliquis nervis paulo notatis juvenilis copiose villoso-sericea plerumque costa albo-sericea deinde glabrata tantum pilis sericeis tenuibus sparsis fere obsoletis munita; abaxiale costa prominenti nervis lateralibus prominulis numerosis 2-4 mm inter se distantibus inaequalibus in angulo 50-60° ascendentibus distaliter gradatim tenuioribus et cum venulis anastomosatis, venulis reticulum prominentem formantibus, alveolis polygonalibus profundis cum lana minuta alba crispa repletis; superficie abaxiali tota cum indumento denso sericeo albido vel ochroleuco pilis longis sericeis adpressis instructo omnino tegenti.

Synflorescentia terminalis corymboide paniculata circa 56 cm longa 18-20 cm ampla (in specimine unico). Axis fere tener sed rigidus erectusque copiose foliato-bracteatus supra basim 5-6 mm diametro, medulosus striatus copiose subadpresse vel adpresse villoso-sericeus pilis 1-3 mm longis strictis supra basem conicam induratam geniculatis, ceterum antrorsis rectis et plus minusve adpressis 1-3 mm longis. Pars proximalis sterilis circa 22 cm longa basi congeste foliata foliis 10-12 spiraliter subrosulatis instructis cum vaginis imbricatis, sursum duobus internodis nudis 10-12 cm longis. Pars fertilis 34 cm longa duobus ramis inferioribus in specimen incoatis, internodiis 7-6 cm longis sursum gradatim brevioribus, ramis medialibus 15-14 cm longis 6-7 capituliferis, proximalibus 7-6 cm longis, omnibus tenuibus striolatis erecto-patentibus; pedunculis pedicellique longis gracilibus 8-20 cm vel usque 40 cm longis. Rami ramusculi pedicellique densiuscule ochraceo-villosi pilis 1-2 mm longis subpatulis plus minusve flexuosis. Folia alterna basilaria sterilia cum rosularia similima, in parte media folia (seu bracteae) sterilia vel subtendentia etiam similia sed sessilia amplectentia 16-12 x 3-2.7 cm, sursum gradatim breviora bracteosa 5.5 x 1.7, 5 x 1.5 cm ovata acutaque; bracteae supremae oblongae vel lineares acutae 30-12 x 5-1.5 mm, omnes copiose villosae.

Capitula radiata ligulis amotis semiglobosa 15-18 mm ampla 105-128 flores ferentia, circulo ligularum ad 25 mm disco 12-14 mm diametro. Involucrum cupulare ubi complanatum ad 21 mm diam, subadpresse fulvescente villosum. Phyllaria sterilia circa 9 biseriata herbacea anguste ovato-lanceolata acuminata apice calloso acutoque, 11-10 x 4.2-3 mm, adaxiale glabra multinervata nervis laticiferis prominulis, abaxiale dense subadpresse pilosa pilis rigidis antrorsis acutis ad 0.6 mm longis. Phyllaria fertilia exteriora sterilia similia 10-8 x 3-2.6 mm late lanceolata acuminata basi attenuata et incrassata multinervia, dorsale dense vel moderate subadpresse pilosa, ad marginem raris minutissimis glandulis, interiora 7-6 x 2.4-2 mm oblonga subacuta tenuiter membranacea amplectentia inferne crassiora et glabrescentia superne abaxiale adpresse fusci-villosa pilis acutis sed sursum margineque obtusis 0.2-0.3 mm, haud glandulis. Receptaculum circa 4.5 mm diam glabrum. Paleae membranaceae 7-6.5 x 2 mm amplectentes obovato-oblongae distale acute triangulatae dorso sursum dense adpresseque fulvo-pilosae pilis acutis sed in marginibus apiceque obtusissimis seu subclavatis 0.1-0.25 mm longis dimidia parte proximali glabra, haud glandulis.

Flores marginales feminei ligulati 3-seriati 43-58 in capitulo. Corolla fortasse alba violaceo-maculata, 6-7.5 mm longa tubo 1 mm longo dense hirsutulo pilis brevibus obtusis curvato-patentibus hyalinis seu albis 0.3-0.5 mm et parcis patulis acutis; lamina tenuiter membranacea elliptica vel oblongo-elliptica apice obtusa 2-3 denticulata, 1.9-2.3 mm lata 6-7 nervata basi aperta abaxiale sparsis pilis antrorsis acutis 0.2-0.4 mm longis. Stylus 2.5-3 mm ramis 0.7-0.8 mm lineis stigmaticis marginalibus valde crassis. Achaenia immatura exteriora 2-2.3 x 1.2 x 1 mm, atra argute pyriformi-triangulata basi cuneata acutaque; interiora 2.3 x 1 mm quadrangulata.

Flores disci pseudohermaphroditi 62-72 in capitulo. Corolla lutea 5-5.5 mm longa, tubulo 2-2.5 mm dimidia parte superiori pubescenti sparsis pilis hyalinis acutis et obtusis 0.2-0.3 mm; limbo tubuloso basim parcis pilis reliquo glabro; lobis triangularibus 1 mm longis dense brunneo-barbatis pilis obtusis vel clavatis fulvis 0.1-0.2 mm longis, marginibus adaxiale papillosis. Antherae circa 2 mm basi acute sagittatis appendice apicali ovata subacuta 0.35 mm longa. Stylus distale papilloso-pilosus apice acuto triangulato inciso-bifido. Nectarium tubulosum strictum 1 mm altum. Ovarii rudimentum pediculiformi 0.3 mm longum.

Typus: Venezuela, Mérida, Páramo de Aricagua, 3000 m alt., "tronco leñoso", 31 Mar 1922, Alfredo Jahn 1021; US, holotype; VEN, isotype.

The type collections of *R. usubillagae* have been formerly identified as to *E. bracteosa*. *Espeletia bracteosa* was described by Standley using specimens from Páramo de La Cristalina, Trujillo

(Jahn 156) with only fragmentary inflorescence parts and few incomplete old heads. Unfortunately, the collection Jahn 1021 from Páramo de Aricagua, Mérida, was also attributed by A. C. Smith (1935) to *E. bracteosa* St. and was used by him to make his description and illustrations of the flowers of the latter. (Figs 1, 5-8 of plate 2 in A.C.Smith are based on Jahn 1021). Aristeguieta (1965) followed Smith in his description of the Standley species, but he did not make any mention of the Jahn 1021 specimens. In fact, the two species can be perfectly distinguished through the leaves alone, *R. bracteosa* St. having very rigid, coriaceous with long, robust pseudo-petioles, and a thick lanate indument covering the abaxial side of the blades. *R. usubillagae* has chartaceous thinner flexible, shortly contracted at base leaf blades covered by a appressed sericeous indument abaxially, they resemble rather the leaves of *R. atropurpurea*, being only less rigid and lacking the long pseudopetiole also characteristic of that species. Aristeguieta recognized this similarity when he wrote the following annotation on a piece of paper attached to the sheet of Jahn 1021 at VEN. "Las hojas pertenecen probablemente a *E. atropurpurea* Smith, las cabezuelas son probablemente *E. bracteosa* o de otra especie. Por otra parte, si hojas y flores provienen de la misma planta es seguro que esta colección representa una especie nueva". The VEN specimen annotated by Aristeguieta has only a bunch of leaves and two small fragments of a flowering branch. The specimen at US which shows the mutual belonging of both parts (leaves and flowers) of the Jahn 1021, was not annotated by Aristeguieta.

I am pleased to dedicate the new species to Dr. A. Usubillaga, professor at the University of Mérida, who made and promoted important contributions to the chemical compounds of the Espeletiinae especially on the Kauranoid diterpenes.

The new species is distinguished from the closely related species according to the following key.

1--Capitula radiate. Ray corollas ligulate.

2. Leaves rigidly coriaceous, long-pseudopetiolate 20-75 x 2-9 cm, the lamina oblanceolate, obovate-lanceolate or broadly lanceolate, abaxially densely lanate. Ray corollas narrow-oblong, yellow. Synflorescences tall, floribundous, the axes up to 3-4 cm diam. ................................. *R. bracteosa* (Standley) Cuatr.

2' Leaves chartaceous, flexible, sessile or sub-sessile, 12-20 x 3-3.3 cm, the lamina lanceolate-elliptic, abaxially densely, appressed villous sericeous. Ray corollas elliptic, white and more or less purplish blotched. Synflorescences moderate, laxly branched, the axes to 0.6 cm diam. ....... *R. usubillagae* Cuatr.

1--Capitula pseudo-discoid. Ray corollas reduced to the short tube. Leaves rigidly coriaceous, long-pseudopetiolate, 26-65 x 4-9 cm, lamina oblanceolate, obovate-lanceolate or broadly lanceolate, abaxially densely and appressed sericeous. ...................... *R. atropurpurea* (A.C.Smith) Cuatr.

RUILOPEZIA EMMANUELIS Cuatr. sp. nov.

Caulirosula monocarpica. Caulis erectus usque ad 1.20 m altus 4.5-6 cm diam cum foliis marcescentibus vel cum vaginis foliorum persistentibus compressissimis tectus. Cortex rugulosus transverse cicatricoso-striatus 3-4 mm crassus. Stratum lignosum 4-5 mm, inferne usque ad 8-12 mm crassum. Rosula circa 70 cm ampla visu albida. Gemma foliaque incipienda albissima, dense crasse adpresseque villoso-sericea.

Folia coriacea rigida 43-56 cm longa. Lamina 37-48 x 3.8-5.3 cm, lanceolata sursum augustata apice acuta basim versus sine sensu attenuata basi in brevem pseudopetiolum angustata, margine visu integerrima sed dentibus callosis mucroniformibus retrorsis munita; adaxiale costa anguste lineari impressa tantum conspicua, superficie densissime adpresse villosa subsericea, leporina, pilis circa 1.5 (-2) mm inferne patulis ceterum rectis sericeis acutis antrorso-adpressis; abaxiale costa crassa eminenti, nervis secundariis moderate prominentibus 5-8 mm inter se distantibus angulo 45-66$^{o}$ (-70)$^{o}$ divergentibus, reticulo venorum valde elevato alveolis rotundis vel ellipticis parvis omnino dense sublanata, pilis strictis patentibus distale flexuosis intricatisque, ad costam pilis antrorsis rectis densissimis indumento crasso adpresse sericeo instructis. Pseudopetiolus plus minusve alatus 1-4 cm longus. Vagina oblongo-rectangularis apice obtusa basim paulo dilatata, adaxiale viridis plurinervata, sursum apiceque densissime adpresseque villoso-sericea deorsum glabra, abaxiale dense crasseque sericeo-barbata, pilis ad 12 mm longis strictissimis parallele antrosis inter folia adpressis; 4.8-5.5 cm longa 2-3.4 (-3.8) cm lata.

Synflorescentia terminalis corymbiforme paniculata ampla floribunda circa 60 cm alta vel probabiliter ultra. Axis robustus lignosus basi ad 4 cm crassus, fistulosus et superne medullosus, argute angulato-costatus striatusque, dense albo-lanuginosus e basi foliosus et copiose ramosis ramis alternis. Folia proximalia sterilia vel aliquando fertilia alterna numerosa a rosularia similima sed minora, lamina 25-20 x 2.8-2 cm sursum decrescenti lanceolato-oblonga acutaque basi attenuata sessili cum vaginam oblongam producta, sursum gradatim breviora et bracteosa. Rami copiosi ascendentes, in speciminibus valde vetustis siccisque effractis tantum fragmentis adsunt. Ramuli alterni et pedicelli dense fulvo-hirsutuli pilis tenuibus flexuosis ad 2 mm longis patulis tecti; pedicelli 1-3 cm longi rigiduli ebracteati, tantum bracteae subtendentes lineari-lanceolatae acutae hirsutulae 18-7 mm longae ad ramulos presentes.

Capitula radiata ligulis amotis semiglobosa vel subglobosa 10-12 mm lata, 74-125 flores ferentia, circulo ligularum 20-25 mm, disco 9-10 mm diametro. Involucrum cupulatum dense villosum fusco-brunnescens. Phyllaria sterilia 6-8, herbacea crassiuscula lineari-lanceolata vel triangulari-linearia, apice acutissima 5.5-8 x 1.4-2 mm, 5-7 nervis plus minusve conspicuis, abaxiale dense villosa pilis pluricellularibus rigidis antrorsis acutis moderate flexuosis 0.5-

1.5 mm longis, et sparsis glandulis 0.01-0.02 mm longis praedita, adaxiale glabra. Phyllaria fertilia (5.3-) 4.8-4 x 2-1.8 mm obovato-oblonga apice acutata breviterque apiculata plus minusve concava, intima amplectentia membranacea margine scariosa basim incrassata dorso praecipue sursum et apicem dense hirto-barbata pilis fere rectis antrorsis acutis vel obtusiusculis 0.2-0.5 (-0.8) mm longis brunneo-rubescentibus et glandulis sparsis, marginibus sursum ciliato-pectinatis pilis obtusiusculis.

Receptaculum valde convexum, subconicum, 3.8 mm diam, subglabrum (sparsissimis pilis). Paleae 4.5-5 x 1.8-2 mm ellipticae apice saepe incurva attenuatae apiculatae amplectentes saepe 3 nervis conspicuis abaxiale sursum antrorso-pilosae pilis obtusiusculis ad 0.5 mm longis plus glandulis minutis intermixtis.

Flores marginales feminei ligulati 2-3-seriati 24-30 in capitulo. Corolla lutea 8-10 mm longa, tubo 0.5-1.5 mm longo, crasso, dense antrorso-piloso hyalinis crassiusculis obtusis vel subclavatis 0.2-0.4 mm longis, apice interdum appendice adaxiali lineari erecta 1-2 mm longa obsita; lamina crassiuscula oblonga apice 3-dentata deorsum paulo angustata abaxiale deorsum sparsis minutis pilis et glandulis, 5-7 nervis plus minusve conspicuis, adaxiale margineque dense arguteque papillosa papillis rotundatis prominentibus. Stylus 2-3 mm ramis complanatis 0.8-1 mm longis 0.2 mm latis, lineis stigmaticis crassissimis violaceis. Achaenia prysmatico-obovoidea argutissime triangulata apice truncata basi cuneata, 2-2.8 mm longo 1.2-1.5 mm lata, abaxiale curvata.

Flores disci pseudohermaphroditi 45-99 in capitulo. Corolla lutea 4.2-5 mm longa, tubulo 2-2.5 mm longo crassiusculo basim crassius adaxiale sparsis pilis crassis subclavatis vel obtusis 0.2-0.5 mm reliquo glabro; limbo campanulato inferne sparsis pilis obtusis crassiusculis 0.2-0.5 mm, lobis triangularibus 1.2-1.5 mm longis 1 mm latis margine incrassatis papillosisque adaxiale apiceque dense arguteque papillosis papillis oblongo-clavatis, abaxiale parcis pilis obtusis crassis 0.1-0.4 mm. Antherae sulphureae 1.6-1.8 mm longae basi sagittatae appendice apicali anguste ovato-triangulata 0.25-0.35 mm longa. Cellulae endotheciales brevi-rectangulatae cum nodis ad parietes transversas horizontales. Grana pollinis echinata 0.025-0.030 mm. Stylus 4-5 mm longus crassus apice emarginatus dense papillosus papillis 0.02-0.05 mm longis. Nectarium tubulosum 0.6-0.8 mm denticulatum. Ovarium pediculiforme crassiusculum 0.3 mm altum.

Typus: Venezuela, Trujillo: Páramo de Las Rosas, between Las Lajas and Barro Amarillo, 2900-3000 m, extensive open paramo zone with community of _Ruilopezia vergarae_ and _Chusquea_ sp, the vegetation very much damaged by intermitent fires and grassing, this new species building also a large community of "frailejonal", the caulirosulas up to 1.5 m tall, all in vegetative stage except the collected damaged specimen with many bourgeoning new shoots at the base of the old inflorescence, flowers bright yellow, 8 Mar 1985, _Manuel López-Figueiras & Dana Griffin 32405_ (Holotypus US; isotypus MERF). Other collections: Páramo de Las Rosas at Barro Amarillo, 2800-3000 m, damaged specimen with incomplete axis of central inflorescence (distal part lacking), some basal new floral shoots and few flowering heads, ligules bright yellow, 14 Sept 1985, M. López-Figueiras 32490 (paratypus US). Id. id. sterile, trunk 30 cm long, López-Figueiras 32491 (US); id id. trunk 55 cm long, López-Figueiras 32492 (US).

*Ruilopezia emmanuelis* is closely related to *R. josephensis* from which it differs by the shape and indument of the leaves. The blades are more lanceolate and acutely attenuate; the sheaths are oblong or slightly trapezoid and much longer than wide, in contrast with the broad semiorbicular shape exhibited by those of *R. josephensis*, and the adaxial side of the lamina is permanently densely appressed subsericeous with leporine touch, rather than becoming glabrous as in *R. josephensis*. *R. emmanuelis* has also narrower blades, with a ratio of 9-9.7:1, and the secondary nerves have a more acute deviation angle (45-66°), whereas in *R. josephensis* the ratio is 6-6.6:1, and the deviation angle 65-80°. The involucral bracts are also more narrowly-lanceolate, longer, and densely villous, whereas in *R. josephensis* they are ovate-acuminate, sparsely villous, and more copiously glandular.

*R. emmanuelis* is dedicated to Dr. Manuel López Figueiras an indefatigable explorer of the Venezuelan Andes flora and my close collaborator in the Espeletiinae collecting. The species is found in communities near the top of the hills at the eastern end of the Cordillera of Venezuela (Páramos of Ñepes-Cendé-Rosas-Jabón). The caulirosulas are of all sizes up to 1.5 m. I have seen it in sterile stage every time that I have been in the region, especially at the Páramo del Turmal close to formations of *Ruilopezia jabonensis* which dominates some open areas of the paramo between this and Páramo del Jabón. It seems that *R. emmanuelis* shares the area at some more humid depressed spots. This monocarpic species, *R. emmanuelis*, similar in habit and ecology to *R. josephensis* and *R. coloradarum*, shows an intriguing rate of flowering. My associates (mainly López Figueiras), in spite of repeated visits made almost yearly and in different months of the year, were not able to find the species in flower for fifteen years, since the time of our first observation in 1969. In March 1985 Manuel López Figueiras finally reported that the reticent *Ruilopezia* of the Páramo del Jabón had been found with flowers in the Páramo de Las Rosas. Only one flowering individual was found, severely damaged, with the inflorescence broken by cattle with still enough bourgeoning branchlets and flowering shoots available for a preliminary study. Manuel persisted visiting the area again in September walking across extensive formations of the species. He could only find one other specimen with a dry, old, and damaged central inflorescence, bearing a few flowers and fruits. This fragmentary material, in spite of lacking the distal part and most branches, shows the kind of inflorescence and allows for a diagnosis and a fair interpretation of the species.

RUILOPEZIA VERGARAE Cuatrecasas & López-Figueiras sp. nov.

Caulirosula sessilis copiosissime foliosa ad 60 cm lata visu albida et argenteo-sericea, caule brevi robusto 10-15 cm longo ad 5 cm diam, radice axonomorpha parce ramosa.

Folia crassa coriacea sessilia 23-41 cm longa. Lamina lineari-oblonga vel oblanceolato-linearis vel linearis subobtusa vel subacuta saepe basim versus paulo angustata sed basi denuo ampliata, 19-38 cm longa 1.1-2 (-2.8) cm lata, supra basim 0.8-1.2 cm minima latitudine, margine revoluta; adaxiale crasse densissime adpressaque vestita, pilis sericeis circa 1 mm longis basi recta patentissima ad mediam geniculatis parte distali horizontaliter antrorsa adpresseque superficie visu uniformiter plana sericea vel subsericea instructis, tantum nervo medio cum depressione lineari parum signato; abaxiale costa ampla crassissima densissime adpresse sericea, infra indumento argute reticulato-venosa et parcis nervis secundariis elevatis 10-15 mm inter se distantibus angulo acutissimo 5-20$^{o}$ (-35)$^{o}$ ascendentibus evanescentibusque, ubique dense subadpresse sericea pilis 1.5-2 mm longis geniculatis obtecta sed imo alveolis candido tomentoso pilis brevioribus sericeis rectis patulis spisse praedito. Vagina crassa rigida in folia rosularia adulta late ovata usque ad 3 x 4 cm, apice subrotundato, altera ovato-oblonga vel oblonga apice obtuso vel gradatim attenuata 2.5-3.5 (-4) x (2-) 2.6-3 cm, adaxiale viridis glabra conspicuissime nervata, abaxiale spisse villoso-sericea.

Synflorescentia terminalis thyrsoideo-paniculata valde ramosa floribundaque ad apicem late corymbosa, plerumque circa 1 m alta. Axis robustus striatus medullosus et fistulosus, basi 2.5-4 cm diam, sursum gradatim angustatus, visu albo-cinereus pilis tenuissimis longis et longissimis albo-sericeis nitidissimis antrorsis sed intricatis vestimento sericeo gossypino subcompresso ubique ad modum veli sericeo-arachnoidei instructis; inferne valde vel dense foliatus foliis cum rosularibus similimis sed minoribus, 20-24 x 0.9-1.2 cm, saepe supra basim vel etiam e basi ramosus. Rami alterni numerosi erecto-ascendentes, proximales saepe magis robusti longioresque ad 70 cm longi, sursum gradatim minores, distales saepe breves mediales longiores non attingentes. Rami tantum ad extremum corymboso-ramulosi, plerumque nudi vel basales longiores copiose foliati; ramuli corymborum 3-10 etiam alterni, 0.5-8 cm. longi 6-3 capitula breviter vel longe pedicellata ferentes, tantum 1-4 ramuli distali monocephali. Rami principales subapicales 1-4 etiam ad modum pedunculorum monocephali. Pedicelli erecti 0.4-4 (-5) cm longi. Bracteae subtendentes foliaceae cum ramis valde breviores proximales 24-18 x 1.2-0.9 cm, lanceolato-lineares, sursum gradatim minores, mediales 12-8 x 0.9-0.8 cm, distales lineares circa 20 x 2-3 mm. Bracteolae subtendentes 30-10 mm longae 3-1.5 mm latae, lineares. Bracteae bracteolae sicut pedunculi pedicellique albo villoso-lanuginei.

Capitula radiata erecta vel reclinata, 100-180 flores ferentia, ligulis amotis 12-17 mm diam, circulo ligularum 26-35 (-40) mm, disco (9-) 10-16 mm diametienti. Involucrum cupulatum dense albo-floccoso-lanatum. Phyllaria exteriora sterilia 8-14, lineari-lanceolata vel lineari-subulata, acutissa, crassiuscule herbacea, rididula, (14- 12-7 x 1-2 (12.4) mm, abaxiale densiuscule barbato-lanata pilis ad 5 mm longis tenuibus intricatis, adaxiale glabra 3-5 nervis notatis. Phyllaria fertilia anguste elliptico-laceolata acuminata vel acuta plana basim incrassata, 7-4.5 x 2-1.4 mm etiam acuminata, 3-5 nervata plus minusve amplectentia margine scariosa dorso subcarinata, breviter sericeo-villosa sursum barbata pilis 0.5-1 mm subacutis vel obtusis. Receptaculum convexum (4-) 5-7 mm diam hirtulum pilis erectis 0.3-0.8 mm. Paleae 4.5 x 1.5-2.5 mm scariosae dorso brunnescenti regidulo, ovales subacutae vel acutae late hyalino-marginatae, costa subcarinata pilosula, 2-4 nervis utroque latere, sursum barbatae pilis erectis acutis et supremis obtusis 0.4-0.8 mm.

Flores radii ligulati 3-4 seriati 28-60 in capitulo. Corolla lutea 11-19 mm longa tubulo 1.2-2 mm longo dense piloso pilis hyalinis patulo ascendentibus, crassiusculis obtusis vel subclavatis 0.2-0.5 (-0.8) mm longis, ad apicem interdum appendice abaxiali lineari 0.5-3.5 mm longo; lamina crassiuscula firmula anguste elliptica apice obtusa, 2-3-dentata, 2-3 mm lata, 5-8 nervata, nervis arurantiaco-notatis subtus prominulis, abaxiale sparse inferne copiose pilosa pilis obtusis 0.15-0.3 mm longis, adaxiale minutissime velutino-papillosa. Stylus 3-5 mm longus ramis 1-2 mm longis. Achaenia exteriora 2-2.4 x 1.3-1.7 mm abovata triangulata angulis argutis dorso arcuato basi acuta, interiora 2.4-3 x 1-1.2 mm, oblonga, quadrangulata.

Flores disci 68-144 in capitulo. Corolla lutea 4.7-5.5. mm longa, tubulo 2-2.3 mm angusto basi excepta dense pilosulo pilis antrorsis crassiusculis obtusis vel subclavatis 0.3-0.7 mm, limbo tubuloso-campanulato tantum basi parcis pilis, lobis triangularibus 0.7-1 mm, marginibus incrassatis papillosis abaxiale parcis pilis obtusis 0.1-0.3 (0.4) mm. Antherae 1.8-2.2 mm longae basi obtuse sagittatae appendice ovata subacuta vel subobtusa circa 0.35 mm longa. Stylus 4.8-5.2 mm, apice paulo dilatatus conicus emarginatus papilloso-pilosulus. Nectarium tubulosum crassum 0.7-0.8 mm, minute obtuseque 5-dentatum. Ovarii rudimentum pedi-culiforme 0.3 mm altum.

Typus: Venezuela, Trujillo: Sierra de Barbacoas: La Palma, between Carache and Agua de Obispo, km 10-15, secondary opening surrounded by Andean forest, 2390 m alt. acaulirosula, inflorescence central, ligules yellow, "frailejón blanco," 4 Apr 1976, López-Figueiras 12960 (Holotype, US; isotype MERF). Id. id. seedling from the same population, López-Figueiras 12961 (US). Same locality, 2400 m, sterile rosette plus an axis of a death synflorescence, 24 May 1980, Cuatrecasas, López-Figueiras & H. Rodríguez, 28985 ((US, MERF). Páramo del Cendé, 3300-2900 m, vet. occid, acaulirosula 70 cm, rosula 30 cm tall, leaf indument white-greenish sylvery throughout, ligules yellow, species rather rare here, 10 Jun 1971, Ruíz-Terán & López-Figueiras 2058 (US, MERF). Páramo del Cendé, 3200 m, acaulirosula, synflorescence central, "frailejón plateado de hoja ancha" 31 Mar 1976, López Figueiras 12951 (US, MERF, paratypus). Páramo del Turmal below Páramo del Jabón, at Hoyo de Los Tábanos, 2500 m, acaulirosula, adult leaves up to 28 mm wide, "frailejón plateado hojiancho", 8 June 1971, Ruíz-Terrán & López-Figueiras 1997 (US paratype). Id id, 2850-2800 m, acaulirosula, central synflorescence partially damaged, paramo between Tres Pozos and Hoyo de Los Tábanos, "frailejon plateado hojiancho", Cuatrecasas, Ruíz-Terán & López-Figueiras, 28548, 28546, 28547 (US, MERF).

*Ruilopezia vergarae* is closely related to *R. jabonensis* from which it mainly differs by the shape of the leaves. The leaf lamina of *R. vergarae* is a flat lamina, ensiform, or narrow-oblanceolate and rather subobtuse at the apex, usually 20-28 cm long and 1.1-2 cm wide, occasionally up to 3 cm wide; the large rosettes may have leaves up to 40 cm long; the length: width ratio varies (11-) 14-20:1; abaxially the nervation is conspicuous, at least in old leaves, although often the thick indument conceals it. The leaf bases in adult specimens are ovate or oblong-ovate much broader than the lamina and wider than longer, e.g. 3-3.8 x 4-4.3 cm. In contrast, the laminas in *R. jabonensis* are strictly narrow-linear and acute at the apex, 10-30 x 3-7 mm, and strongly revolute at the margins, converging to the midrib; the leaf bases, being narrowly rectangular, oblong, flat, almost the same width of the lamina never exceeding 7(-8) mm wide. The hairs on the leaves are at least twice as long as in *R. vergarae*. Both species are silvery shining but the brightnees is much stronger in *R. jabonensis*. Both species being sympatric are found side by side. *R. vergarae* on slopes at lower altitude than *R. jabonensis* which dominates the top of the hills and their upper slopes, as e.g. in Páramo del Jabón, Páramo del Turmal, and Cendé. Hibrids are produced in the ecotonic zone.

The species is dedicated to Mr. Bernardino Vergara, a technician at the Facultad de Ciencias Forestales, ULA, Mérida, who discovered several species in the region of Los Granates and has efficiently cooperated with botanists and chemists in collecting Espeletiinae material for scientific studies.

## References

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Smith, A.C. & M.F. Koch, 1935. The genus Espeletia: a study in phylogenetic taxonomy. Brittonia 1 (7): 479-530, and 2 plates. New York.

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# NEOTROPICAL MYRSINACEAE — XX

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Just as the very distinct genus Icacorea Aubl. has been ridiculously submerged as a subgenus of Ardisia Sw. for generations, we can also assume that the vagaries of taxonomists will result in the reduction of such recently described genera as Auriculardisia Lundell, Gentlea Lundell, Graphardisia Lundell, Oerstedianthus Lundell, Ibarraea Lundell, Amatlania Lundell, and Zunilia Lundell to subgenera of Ardisia. The transfer of the following species is made to that genus to obviate the incentive of workers to undertake such unnecessary reductions to subgenera.

ARDISIA ALAJUELAE (Lundell) Lundell, comb. nov. Icacorea alajuelae Lundell, Phytologia 56: 141. 1984. Costa Rica: Alberto M. Brenes 15092 (holotype, NY).

ARDISIA ALBIPEDICELLATA Lundell, nom. nov. Icacorea parvifolia Lundell, Phytologia 57: 452. 1981. Costa Rica: William Burger & Richard Baker 9628 (holotype, F). non Ardisia parvifolia Humb. ex Willd.

ARDISIA ALBISEPALA (Lundell) Lundell, comb. nov. Auricu-lardisia albisepala Lundell, Wrightia 7: 266. 1984. Panama: S. Knapp & K. Sytsma 2548 (holotype, LL).

ARDISIA AZAHARENSIS Lundell, nom. nov. Auriculardisia microcalyx Lundell, Wrightia 7: 270. 1984. Costa Rica: Ronald Liesner et al. 15575 (holotype, LL). non Ardisia microcalyx Lundell, Wrightia 4: 46. 1968.

ARDISIA BEKOMIENSIS (Lundell) Lundell, comb. nov. Icacorea bekomiensis Lundell, Phytologia 56: 414. 1984. Costa Rica: Gerrit Davidse 25710 (holotype, LL).

ARDISIA BRISTANII Lundell, nom. nov. Auriculardisia parviflora Lundell, Wrightia 7: 271. 1984. Panama: Narciso Bristan 1236 (holotype, US). non Ardisia parviflora Talbot.

ARDISIA CHIRIQUIANA (Lundell) Lundell, comb. nov. Auriculardisia chiriquiana Lundell, Wrightia 7: 267. 1984.

Panama: Bruce A. Stein, Bob Schmalzel & David W. Roubik 1223 (holotype, LL).

ARDISIA COIBANA (Lundell) Lundell, comb. nov. Graphardisia coibana Lundell, Phytologia 59: 429. 1986. Panama: Robin Foster 1600 (holotype, LL).

ARDISIA CONTRERASII Lundell, nom. nov. Gentlea crenulata Lundell, Wrightia 6: 96. 1979. Guatemala: C. L. Lundell & Elias Contreras 21004 (holotype, LL). non Ardisia crenulata Lodd., non Ardisia crenulata Vent.

ARDISIA CUNEIFOLIA (Lundell) Lundell, comb. nov. Gentlea cuneifolia Lundell, Wrightia 7: 245. 1983. Mexico: John H. Beaman & Carlos Alvarez del Castillo 5751 (holotype, LL)

ARDISIA DRESSLERI Lundell, nom. nov. Auriculardisia roseiflora Lundell, Wrightia 7: 271. 1984. Panama: S. Knapp, J. Mallet & R. Dressler 3646 (holotype, MO). non Ardisia roseiflora Pitard.

ARDISIA DRYERI Lundell, nom. nov. Auriculardisia micrantha Lundell, Wrightia 7: 269. 1984. Costa Rica: V. J. Dryer 577 (holotype, MO). non Ardisia micrantha H.B.K., non Ardisia micrantha Donn. Sm.

ARDISIA EBINGERI Lundell, nom. nov. Graphardisia purpurea Lundell, Phytologia 59: 431. 1986. Panama: John E. Ebinger 751 (holotype, US). non Ardisia purpurea Reinw.

ARDISIA ECILIATA (Lundell) Lundell, comb. nov. Zunilia eciliata Lundell, Phytologia 58: 490. 1985. Mexico: D. E. Breedlove 28973 (holotype, LL).

ARDISIA ELLIPTIFOLIA Lundell, nom. nov. Amatlania elliptica Lundell, Phytologia 56: 19. 1984. Mexico: Gpe. Martinez C. 884 (holotype, XAL). non Ardisia elliptica Thunb.

ARDISIA ESQUIPULASANA Lundell, nom. nov. Graphardisia nicaraguensis Lundell, Phytologia 59: 429. 1986. Nicaragua: Paul J. Shank & Antonio Molina R. 4719 (holotype, F). non Ardisia nicaraguensis Oerst.

ARDISIA EUCUNEATA (Lundell) Lundell, comb. nov. Auricu-lardisia eucuneata Lundell, Phytologia 57: 449. 1985. Panama: G. de Nevers & Ceremiro de Leon 3598 (holotype, LL)

ARDISIA EURUBIGINOSA (Lundell) Lundell, comb. nov. Auriculardisia eurubiginosa Lundell, Phytologia 56: 413. 1984. Panama: G. Davidse, L. D. Gomez, G. Herrera, C. R. Chacon, I. & A. Chacon 25486 (holotype, LL).

ARDISIA FENIANA Lundell, nom. nov. Zunilia Purpusii Lundell, Phytologia 58: 491. 1985. Mexico: C. A. Purpus 100 (holotype, US). non Ardisia Purpusii T. S. Brandegee.

ARDISIA GUANACASTENSIS (Lundell) Lundell, comb. nov. Icacorea guanacastensis Lundell, Phytologia 56: 415. 1984. Costa Rica: G. Davidse et al. 23307 (holotype, LL)

ARDISIA GUINEALENSIS (Lundell) Lundell, comb. nov. Icacorea guinealensis Lundell, Phytologia 56: 416. 1984. Costa Rica: Gerrit Davidse & G. Herrera Ch. 26215 (holotype, LL).

ARDISIA HETEROTRICHA (Lundell) Lundell, comb. nov. Auriculardisia heterotricha Lundell, Wrightia 7: 268. 1984. Panama: T. M. Antonio, H. E. Moore & F. E. Putz 3417 (holotype, MO).

ARDISIA HIRSUTISSIMA Lundell, sp. nov. — Arbor parva, 4 m. alta, rufo-hirsutissima, ramulis gracilis; folia hirsuta, membranacea, petiolata, petiolo crasso, marginato, 3—6 mm. longo; lamina, utrinque stellato-hirsuta, oblongo-lanceolata vel oblongo-oblanceolata, 7.5—15 cm. longa, 2—4.5 cm. lata, apice caudato-acuminata, basi acutiuscula, margine integra vel subintegra, parce punctata; inflorescentia terminalis, crassa, dense hirsuta, pauciflora, anguste paniculata, 3—6 cm. longa; flores fructiferi geminati; pedicelli crassi, dense rufo-hirsuti; sepala rufo-hirsuta, anguste lanceolata, 3—5 mm. longa, acuminata; ovarium glabrum, dense nigropunctatum.

Panama: Prov. Cocle, Continental Divide above El Cope, tropical wet forest, elev. 650—750 m., Nov. 27, 1985, G. de Nevers, A. Henderson, H. Herrera, G. McPherson & L. Brako 6408 (holotype, LL), tree, 4 m., fruits with tiny maroon dots.

Three species from Panama and Costa Rica, Ardisia Nevermannii Standl., Ardisia ursina Lundell, and Ardisia hirsutissima Lundell, are unique in that they are all densely hirsute with long reddish hairs which are either simple or stellate-branched apically.

Ardisia hirsutissima, known only from an immature fruiting specimen, has a reduced inflorescence with few paired young fruits, and relatively small leaves caudate-acuminate apically.

ARDISIA HORNITOANA Lundell, nom. nov. Icacorea reflexa Lundell, Phytologia 56: 20. 1984. Panama: J. P. Folsom, R. Dressler & R. Channell 7257 (holotype, LL). non Ardisia reflexa Wall.

ARDISIA HUGONENSIS (Lundell) Lundell, comb. nov. Auriculardisia hugonensis Lundell, Wrightia 7: 268. 1984. Colombia: E. Forero & R. Jaramillo 2812 (holotype, NY).

ARDISIA INTIBUCANA Lundell, nom. nov. Gentlea lancifolia Lundell, Phytologia 58: 273. 1985. Honduras: Antonio Molina R. & Albertina R. Molina 25547 (holotype, F). non Ardisia lancifolia Merrill.

ARDISIA IXCANENSIS (Lundell) Lundell, comb. nov. Icacorea ixcanensis Lundell, Phytologia 58: 489. 1985. Mexico: D. E. Breedlove 38965 (holotype, Dudley).

ARDISIA JALISCENSIS (Lundell) Lundell, comb. nov. Icacorea jaliscensis Lundell, Phytologia 53: 412. 1983. Mexico: H. H. Iltis & M. Nee 1437 (holotype, LL).

ARDISIA JITOTOLANA Lundell, nom. nov. Gentlea tenuis Lundell, Wrightia 7: 24. 1981. Mexico: D. E. Breedlove 23144 (holotype, F). non Ardisia tenuis Lundell, Wrightia 4: 149. 1970.

ARDISIA KNAPPII (Lundell) Lundell, comb. nov. Auriculardisia Knappii Lundell, Phytologia 55: 235. 1984. Panama: S. Knapp 1843 (holotype, LL).

ARDISIA LATISEPALA (Lundell) Lundell, comb. nov. Auriculardisia latisepala Lundell, Wrightia 7: 269. 1984. Costa Rica: Peter H. Raven 21953A (holotype, F).

ARDISIA LEPTOPODA (Lundell) Lundell, comb. nov. Auriculardisia leptopoda Lundell, Phytologia 57: 450. 1985. Panama: R. L. Wilbur, J. A. Teeri, Robin Foster 13111 (holotype, F).

ARDISIA MOLINAE (Lundell) Lundell, comb. nov. Gentlea Molinae Lundell, Wrightia 4: 150. 1970. Honduras: Antonio Molina R. & Albertina R. Molina 24389 (holotype, LL).

ARDISIA MONTEVERDEANA (Lundell) Lundell, comb. nov. Icacorea monteverdeana Lundell, Phytologia 57: 451. 1985. Costa Rica: Suzanne Koptur SK-251 (holotype, LL).

ARDISIA MORAZANENSIS Lundell, nom. nov. Gentlea maculata Lundell, Phytologia 58: 274. 1985. Honduras: Antonio Molina R., Louis O. Williams, William C. Burger and Bruce Wallenta 16972 (holotype, F). non Ardisia maculata Poit.

ARDISIA NEBULOSA (Lundell) Lundell, comb. nov. Auriculardisia nebulosa Lundell, Wrightia 7: 270. 1984. Panama: Kenneth J. Sytsma 1980 (holotype, LL).

ARDISIA NEOHYALINA Lundell, nom. nov. Graphardisia hyalina Lundell, Wrightia 7: 273. 1984. Costa Rica: Thomas B. Croat 43565 (holotype, LL). non Ardisia hyalina Lundell, Wrightia 3: 99. 1964.

ARDISIA NEOMIRANDAE Lundell, nom. nov. Zunilia Mirandae Lundell, Phytologia 58: 491. 1985. Mexico: Dr. F. Miranda 7004 (holotype, MEXU). non Ardisia Mirandae Merrill.

ARDISIA OAXACANA (Lundell) Lundell, comb. nov. Icacorea oaxacana Lundell, Wrightia 7: 48. 1982. Mexico: S. D. Koch, P. A. Fryxell y T. Wendt 79512 (holotype, LL).

ARDISIA OBTUSATA (Lundell) Lundell, comb. nov. Graphardisia obtusata Lundell, Phytologia 59: 430. 1986. Panama: S. Mori 7034 (holotype, LL).

ARDISIA PARVIAURICULATA Lundell, nom. nov. Gentlea auriculata Lundell, Phytologia 58: 273. 1985. Guatemala: Julian A. Steyermark 43277 (holotype, F). non Ardisia auriculata Donn. Sm.

ARDISIA PARVIDENTICULATA Lundell, nom. nov. Icacorea denticulata Lundell, Phytologia 56: 415. 1984. Costa Rica: V. J. Dryer 1010 (holotype, F). non Ardisia denticulata Blume.

ARDISIA PARVIPUNCTATA (Lundell) Lundell, comb. nov. Icacorea parvipunctata Lundell, Wrightia 7: 274. 1984. Mexico: Thomas B. Croat 46150 (holotype, MO).

ARDISIA PARVISSIMA Lundell, nom. nov. Gentlea parviflora Lundell, Wrightia 5: 89. 1975. Guatemala: C. L. Lundell & Elias Contreras 19212 (holotype, LL). non Ardisia parviflora Talbot.

ARDISIA QUADRATA (Lundell) Lundell, comb. nov. Auriculardisia quadrata Lundell, Phytologia 56: 413. 1984. Costa Rica: Gerrit Davidse, G. Herrera Ch. & R. H. Warner 25645 (holotype, LL).

This was erroneously published as Auriculardisia quadratus.

ARDISIA RIOMONTEANA Lundell, nom. nov. Graphardisia oxyphylla Lundell, Phytologia 59: 430. 1986. Panama: J. P. Folsom 3975 (holotype, LL). non Ardisia oxyphylla Wall.

ARDISIA SAMALANA (Lundell) Lundell, comb. nov. Icacorea samalana Lundell, Phytologia 57: 451. 1985. Guatemala: Julian A. Steyermark 34962 (holotype, F).

ARDISIA SERANOANA (Lundell) Lundell, comb. nov. Graphardisia seranoana Lundell, Phytologia 59: 431. 1986. Panama: J. P. Folsom 4029 (holotype, LL).

ARDISIA SORDIDA (Lundell) Lundell, comb. nov. Auriculardisia sordida Lundell, Wrightia 7: 272. 1984. Costa Rica: Thomas B. Croat 43538 (holotype, LL).

ARDISIA SQUAMATA (Lundell) Lundell, comb. nov. Auriculardisia squamata Lundell, Phytologia 56: 19. 1984. Costa Rica: William C. Burger & Robert G. Stolze 5853 (holotype, F).

ARDISIA STANDLEYI (Lundell) Lundell, comb. nov. Gentlea Standleyi Lundell, Wrightia 4: 69. 1968. Costa Rica: Paul C. Standley & Juvenal Valerio 50613 (holotype, US).

ARDISIA STEINII Lundell, nom. nov. Auriculardisia baruana Lundell, Wrightia 7: 267. 1984. Panama: Bruce A. Stein 1267 (holotype, LL). non Ardisia baruana Lundell, Wrightia 6: 61. 1979.

ARDISIA STEVENSII (Lundell) Lundell, comb. nov. Gentlea Stevensii Lundell, Wrightia 6: 97. 1979. Nicaragua: Warren Douglas Stevens 6042 (holotype, LL).

ARDISIA TARARIAE Lundell, sp. nov. — Arbor parva, 3—4 m. alta; ramuli graciles, dense rufo-furfuracei; folia chartacea, petiolata, petiolo 5—8 (12) mm. longo, canaliculato, subtus furfuraceo; lamina anguste oblanceolata, 8—13 cm. longa, 2—3.4 cm. lata, apice subabrupte acuta vel acuta, basi acuminata, supra glabra, subtus adpresse furfuracea vel lepidota, punctata, margine subintegra vel denticulata; inflorescentia terminalis, paniculata, 9—13 cm. longa, densiflora, furfuracea; flores 5-meri, umbellati vel corymboso-umbellati; pedicelli 4—6 mm. longi, parce furfuracei vel glabrati; sepala parva, auriculata, ovata vel lanceolata, 1.2—1.5 (2) mm. longa, acuta, eroso-ciliata, parce punctata, glabra; corolla glabra, 3.5—4 mm. longa; filamenta gracilis, ca. 2 mm. longa; antherae ovatae, ca. 1.5 mm. longae, acuminatae vel acutae; ovarium minute nigropunctatum.

Costa Rica: Limon, Cordillera de Talamanca, Atlantic slope, Cerros Tararia (locally known as Tres Picos), oak forest on lower slopes, elev. 2400—2600 m., Sept. 10, 1984, G. Davidse, G. Herrera Ch. & M. H. Grayum 28882 (holotype, LL), understory treelet 4 m. tall, flowers pinkish-white, the corolla lobes with pink dots, anthers light yellow.

Two additional collections from the same region, G. Davidse et al. 28656, 29065 (paratypes, LL) are referable to this distinctive furfuraceous taxon.

ARDISIA TOROANA (Lundell) Lundell, comb. nov. Auriculardisia toroana Lundell, Wrightia 7: 273. 1984. Panama: T. Antonio 3079 (holotype, LL).

ARDISIA TRIANGULA (Lundell) Lundell, comb. nov. Icacorea triangula Lundell, Phytologia 56: 417. 1984. Costa Rica: G. Herrera y I. A. Chacon 1579 (holotype, LL).

ARDISIA USTUPOANA (Lundell) Lundell, comb. nov. *Graphardisia ustupoana* Lundell, Phytologia 59: 432. 1986. Panama: *W. G. D'Arcy 9535* (holotype, LL).

ARDISIA UTLEYI (Lundell) Lundell, comb. nov. *Icacorea Utleyi* Lundell, Phytologia 57: 452. 1985. Costa Rica: *John and Kathy Utley 3023* (holotype, F).

ARDISIA WARNERI Lundell, nom. nov. *Icacorea brevipes* Lundell, Phytologia 56: 414. 1984. Costa Rica: *Gerrit Davidse, G. Herrera Ch., & R. H. Warner 25680* (holotype, LL). non *Ardisia brevipes* Lundell, Wrightia 3: 97. 1964.

ARDISIA WENDTII (Lundell) Lundell, comb. nov. *Ibarraea Wendtii* Lundell, Wrightia 7: 46. 1982. Mexico: *Tom Wendt, A. Villalobos, R. Lara M., & I. Navarrete 2584* (holotype, LL).

ARDISIA ZARCEROANA Lundell, nom. nov. *Auriculardisia sessilifolia* Lundell, Wrightia 7: 272. 1984. Costa Rica: *Louis O. Williams et al. 28998* (holotype, F). non *Ardisia sessilifolia* Mez.

## BOOK REVIEWS

Alma L. Moldenke

"TREES OF THE SOUTH" collected and organized by Gary O. Robinette, drawings by Susan Van Gieson, v & 517 pp., 500+ b/w draw. & 1 map. Van Nostrand Reinhold, New York, N. Y. 10003. 1985. $35.00.

From *Acacia baileyana* to *Zizyphus jujube* for over 200 deciduous and a few evergreen trees (such as *Phoenix* spp. and *Magnolia grandiflora*) line drawings on a scale of 1/8 inch to 1 foot are made of mature open-grown tree specimens (outline, bare-branched and leafed) as they would (or could) appear in landscape situations. This book is a unique "design studio reference" giving "a general overview of the trees most commonly used or found in designed or constructed southern landscape situations" and planned "for urban foresters, for landscape architects and for planting designers." Since this approach and resource material (for copying) are new, this book and others in the series belong in the libraries of the involved schools, universities and landscaping offices.

"FERNS TO KNOW AND GROW" -- Third Revised and Enlarged Edition of 'The Gardener's Fern Book' by F. Gordon Foster, xiii & 227 pp., 44 b/w photo., 656 line draw. & 4 tab. Timber Press, Portland, Oregon 97225. 1984. $29.95.

This third edition is welcomed with "three cheers" because of its larger size, its inclusion of more species and illustrations, and its larger range including many western species. The author, long known to us and like us (until recently) is an Easterner and his fern garden selections previously were also for the most part for an eastern garden. The range of the book is now from coast to coast. The author explains what fern structures are, how to identify the species, and how to grow and propagate them in the garden and indoors. The illustrations are particularly helpful. This book will surely be appreciated by indoor and outdoor gardeners, by landscape gardeners and by the horticulture departments of colleges and universities.

"FLOWER EXPRESSIONS - Ichiyo School of Ikebana" by Akihiro Kasuya, 32 pp., 31 color pl. & 31 matching b/w line draw.. Charles A. Tuttle Company, Inc., Rutland, Vermont 05701-0410. 1986. $3.95 heavy, shiny paper, plastic spiral binding.

The color photos of exquisite arrangements are themselves exquisite as presented by the author-headmaster of this school who stresses imagination as an essential part of creative design. This handy sized book should make an ideal little gift for anyone needing "cheering up" by looking at something easy to hold and beautiful to contemplate or as token prizes in garden club activities.

"THE DIFFERENT FORMS OF FLOWERS ON PLANTS OF THE SAME SPECIES" by Charles Darwin, xxxii & 352 pp., 15 b/w fig. & 38 tab., University of Chicago Press, Chicago, Illinois 60637. 1986. $13.95 paperbound.

This handy inexpensive edition has a new exploratory foreword by Herbert G. Baker. It also has the preface to the reprint of 1884 by Francis Darwin listing additional literature on tri- and dimorphic heterostyled and cleistogamic plants. The first edition appeared in 1877. Both of these editions were dedicated to Asa Gray by Darwin. Baker states that this book "is not merely a botanical classic but is a major source of information for present-day workers on the reproductive biology of plants". It should be noted that on pages 124 and 286 observations are made on an "*AEgiphila obdurata*", but the species here being referred to is *Aegiphila obducta* Vell. Libraries, biology and/or botany students and teachers will surely profit from reading and/or studying this impressive book.

"THE BOTANY OF MANGROVES" by P. B. Tomlinson, xii & 413 pp., 84 b/w multi-fig. with 67 photo., 13 tab. & 6 maps. Cambridge University Press, Cambridge & London, U. K., & New York, 10022. N.Y. 1986. $69.50.

At the outset the author differentiates between the term "mangrove" for those tropical trees and shrubs restricted to intertidal and adjacent communities at the mouths of rivers and "mangal" for the community that contains mangrove plants. The text deals with the former for ecology, floristics, biogeography, plant structure, flowering and economic utilization which should be "treated as a resource to be sustained in perpetuity". Then there are detailed descriptions of mangrove plants in 31 more families than just the *Avicenniaceae, Combretaceae, Rhizophoraceae* and *Sonneratiaceae*. Excellently detailed drawings, photographs, descriptions, other special features, geographic distributions and species keys make this section continue in value as an outstanding study. This important book belongs in all kinds of biological, botanical and ecological libraries.

"PACIFIC NORTHWEST GUIDE TO HOME GARDENING" by Ray A. McNeilan & Micheline Ronninger, 302 pp., 141 b/w draw. or draw. inserts & 51 tab. Timber Press, Portland, Oregon 97225. 1982. $19.95 paperbound.

For years the authors have been assisting gardeners and directing the Master Gardener Program in Oregon. This book organizes, amplifies and pictorially demonstrates this information for the gardener "ready to learn how to use the land and climate and his or her abilities to produce food.....for any and all food crops adapted to the Northwest." There are chapters on climate, soil, pests, vegetables, small fruits, tree fruits and management calendars for each of the food crops. The writing style is clear, logical and interesting: the many illustrations by the second author are particularly good. Not only is this book really valuable for individual gardeners but it is also for training groups in agriculture courses in many kinds of communities and schools.

"IN THE RAINFOREST" by Catherine Caufield, xi & 305 pp. & 1 b/w map. University of Chicago Press, Chicago, Illinois 60637. 1986. $9.95 paperbound.

The cover (but not the title page) calls this interesting book a "Report from a Strange, Beautiful, Imperiled World"; the 2-paged world map show the locations of the "Rainforests of the World"; and the text in its well organized chapters relates what has happened to them, specifically in Costa Rica, Brazil and New Guinea. The losses in fresh water, topsoil, worldwide humidity/weather control, habitat for endemic plants and animals and tribal peoples, and so many as yet unknown factors are considered. The author stresses how the success of U. S. hamburger stands depends on low-priced beef herded on haciendas overtaking these forests, and how we are still in the early learning stages about what rainforest plant and animal chemical compounds can be added to our pharmacopeia to alleviate human suffering. There is much more in this easy-to-read book.

"INTRODUCTION TO BRYOLOGY" by W. B. Schofield, xvi & 431 pp., 174 b/w multi-fig. incl. 37 photo., 5 tab. & 20 geogr. distrib. maps. Macmillan Publishing Company, New York, N. Y. 10022. 1985. $45.00.

Welcome to this needed excellent text and bryophyte source book! It has important geographic distribution maps and many drawings that show structures very clearly and attractively. "Further reading" gives a full, succinctly annotated bibliography. [Personallly, I enjoyed seeing there the names of Prof. Elva Lawton who taught "my" bryology course, Dr. A. J. Grout whose text we used and whose Torrey Botanical Club field trips took us around his native haunts, and Dr. William Weber who was in our high school biology classes and nature club.] The first ten chapters deal broadly with true mosses and their 7 subclasses -- lantern, peat, four-toothed, hair-cap, bug, jointed-toothed and large-spored. The next 6 deal with hepatics or liverworts -- moss-like ones, scale-mosses, thallose, bottle, giant thallose and chambered. Then the next chapter deals with the hornworts. After that there are general chapters on such topics as:

history, genetics, physiology, ecology and geography. The valuable appendix of over a hundred pages gives information on collecting, slide and culture preparations, keys for determining higher taxa and manuals for various parts of the world. Since there are but few bryologists in our campus botany departments, interested members could easily teach such a course with this fine course book, rather than ignore this form of plant life altogether. Academic libraries should certainly acquire this book.

"HUASTEC MAYAN ETHNOBOTANY" by Janis B. Alcorn, ix & 982 pp., 23 b/w fig. incl. 4 maps, 18 tab., 13 graphs & 12 photo. University of Texas Press, Austin, P.O. 7819, Texas 78712. 1984. $40.00.

This detailed text stresses a cultural anthropological approach to the Huastec-Teenek Indians of Mayan origin in greater detail than most of the ethnobotanical studies of recent years. "Ethnobotanical interactions occur in an open dynamic ecosystem of natural and social components" and they are described in the living pattern of several families in this hilly area inland from the Gulf of Mexico and north of Tuxpan. Plant hunting, care and cultivation for their various uses in this predominantly subsistence culture are given throughout the text and summarized under each plant listed alphabetically under its scientific name. There is also a listing of these plants under their families and with their collection numbers. The book is prepared by computer print-out. It belongs in libraries and the personal possession of students and scientists in the anthropology-botany fields.

"A GARDENER TOUCHED WITH GENIUS - The Life of Luther Burbank", Revised edition by Peter Dreyer, xiii & 293 pp., 14 photos. & 1 pl. University of California Press, Los Angeles & Berkeley, California 94720. 1985. $10.95 paperbound.

About a half century ago another biology teacher and I paid a tourist visit to the Burbank Experimental Gardens in Santa Rosa. We left impressed and laden with inexpensive bags of experimental plums, apricots, peaches, apples, etc. that served to review our old and new learning experiences and revived us most delectably. Reading this book had much the same effect. The author analyzes reasonably the exaggerated impressions pro and con, mostly taken from newsprint but also from Burbank's own catalogs [but what successful sales catalog ever downgraded the merchandise?] Had we known of amphidiploids or allotetraploids in his time, his pure breeding hybrid crosses would not have caused so much trouble. This study is a balanced appraisal of this gifted, pressured person whose contributions to horticulture have been considerable. This is the only reasonable study extant and so deserves wide circulation.

"BIOTECHNOLOGY IN AGRICULTURE AND FORESTRY I - TREES I, edited by V. P. S. Bajaj, xv & 515 pp., 130 b/w fig. incl. photo. & 86 tab. Springer-Verlag, Berlin, Heidelberg, & New York, N. Y. 10010. 1986. $110.00.

"Biotechnology......by replacing some of the ages-old practices of breeding, can [now] and hopefully in the near future produce novel and improved plants and animals that can better serve human beings....The techniques of cellular and subcellular engineering, such as gene splicing and recombinant DNA, cloning, hybridomas and monoclonal antibodies, production of human insulin, protein engineering, industrial fermentation, artificial insemination, cryopreservation and ovum transfer, plant tissue culture and somatic hybridization, nitrogen-fixation, photomass production for biofuel" can produce improved plants and animals. There are 8 chapters using these techniques in connection with "Tissue Culture of *Alnus* spp. with Regard to Symbioses", one with details on 10 different fruit trees, and one with details of 13 forest and nut trees. This is certainly an important publication for all arboriculture, forestry, fructiculture oriented, working and teaching institutions. It is, however, expensive!

"A FIELD MANUAL OF THE FERNS & FERN-ALLIES of the United States and Canada" by David B. Lellinger, ix & 389 pp., 26 fig. & 45 color pl. with 412 color photo. by A. Murray Evans. Smithsonian Institution Press, Washington, D. C. 20560. 1985. $45.00.

The author gives, besides collecting techniques and well working keys, an almost text-like and interesting introduction to this whole group of fascinating plants including classifications, floristic provinces and geographic distribution, including disjunctions and introductions, ecology, anatomy, life cycles, geologic times and evolutionary trees, hybridity complexes with diagrams, very limited and unwise food and medicinal uses, and access to fern societies for the "smitten". The hundreds of lovely color photos on center plates usually "catch" important characteristics needed for identification; they are keyed by number to the species descriptions. This book will also be needed for college courses in institutions throughout both Canada and the United States.

"BIOLOGY OF AMPHIBIANS" by William E. Duellman & Linda Trueb, xvii & 670 pp., 368 b/w fig. of draws., photos. & geog. distrib. maps. McGraw-Hill Book Company, New York, N. Y. 10020. 1986. $40.00.

If you are especially interested in any or all knowledge about *Amphibia*, you will need and treasure this fine text and will find a handy place for it on a book shelf next to your now eclipsed but still very useful G. K. Noble's "Biology of the *Amphibia*" of 1931. The authors are a husband-wife team on the staff of the University of Kansas, well travelled, with much valuable research credits, and with the illustrations to the credit of L. Trueb. The information is encyclopedic in scope but is arranged topically: introduction (historic & prospective), life history (metamorphosis), ecology (species diversity), morphology-physiology, evolution-biogeography, and classification-phylogeny. All libraries of bio-scientific learning need this very reasonably priced and excellent publication.

"THE LIVING PLANET - A Portrait of the Earth" by David Attenborough, 320 pp., 733 full or double color photo. & 1 double color map. Little, Brown & Company, Boston, Massachusetts 02106. 1984. $17.95 paperbound.

Sequel to the BBC TV and book series "Life on Earth", this copiously and beautifully illustrated, excellently explained and easily read text parallels the second TV series. It is composed of 12 chapters dealing with furnaces of the earth, the frozen world, northern forests, jungles, the sky above, and worlds apart. The author uses common names for ease in the text, but the index has the scientific ones added. There is a double-paged world map colored to accord with the numbered chapters. With the author's usual acknowledgments is his "ultimately indebted to the innumerable scientists who have laboured over lifetimes to piece together coherent descriptions of animal communities in different environments." This book and "Life on Earth" not only offer excellent reviews of the TV shows but also are worthwhile ecological nature books.

"THE STORY OF THE EARTH" Anon.
"THE AGE OF THE EARTH" by John Thackray
"EARTHQUAKES" by Susanna van Rose

These 3 attractive and informative paperbound booklets were first published in England a few years ago for the Institute of Geological Sciences' Museum. The text contents are effectively organized and displayed by the Diagram Corp. Each consists of 68 pages with carefully explained text and excellent illustrations. They are now (1986) being published in the United States and Canada by Cambridge University Press and sell for $2.95 each.

"THE IKEBANA & BONSAI 1987 DESK DIARY CALENDAR" 120 pp., 58 color photos. Charles K. Tuttle Company, Inc., Rutland, Vermont 05701-0410. 1986. $7.50.

The innominate compiler should be recognized for the excellent choice of beautiful plates which face each week's pages provided for appointments and/or notes. What an exquisitely pleasant way to approach the new day's responsibilities by first seeing a lovely floral arrangement! The calendar is planned for international use with the months and days written in English, French, German and Spanish. At the bottom of each page of illustrations are listed the name of the arranger, school, plant material and container. This "diary for engagements" was first issued in 1950. It is far too lovely to discard at year's end.

"CREATING JAPANESE SHOKA" by Patricia Swerda, Second Printing, 140 pp., 13 color pl., 12 b/w photo. pl. & 9 b/w fig. Charles E. Tuttle Company, Inc., Rutland, Vermont 05701-0410. 1979. $8.95 paperbound.

This delightful handsized book is the work of a very devoted student of this type of the Ikebana artful arrangement of floral displays. Fortunately there is a glossary at the end of the text. The instructions are virtually reverently given with interpretations of the meanings of all placements in appropriate containers. This book would make an excellent gift for an indoor gardener who might like to try something new - yet ever so old.

"THE PLEASURES OF ENTOMOLOGY - Portraits of Insects and the People Who Study Them" by Howard Ensign Evans, 238 pp., 20 b/w photo. draw. Smithsonian Institution Press, Washington, D. C. 20560. 1985. $14.95 paperbound.

This book is a charmer, encompassing pertinent bibliographic and entomological information. With the author's thanks for help received, there is also "for inspiration, to all the insects I have known". His chapters include accounts of the lovebug, flea, boll weevil, Mormon cricket, gypsy moth, "killer" bees, blister beetles, medfly, bee-wolf, marsh flies, milkweed bug, tobaccoworm, and home garden insects. There are also chapters on (really, tributes to) American entomologists from the early years and now. It is wonderful for one to love one's life work!

"BETWEEN PACIFIC TIDES" Fifth Edition by Edward F. Ricketts, Jack Calvin & Joel W. Hedgpeth, Revised by David W. Phillips, xxvi & 652 pp. Stanford University Press, Stanford, California 94305. 1985. $29.50.

As long as there are the Pacific tides on our western coast, there should be this fine book, continually updated as needed. Welcome to this new edition! It is enlarged, much enriched with additional organisms and activities, provided with many new photographs and yet retaining much of the contents and feeling as expressed by Ed Ricketts, as it ought to do and still retain the original 1939 title. Part I deals with the protected outer coasts' rocky shores and sandy beaches; Part II with the open coasts' rocky shores and sandy beaches; Part III describes the bays and estuaries; Part IV deals with wharf pilings; and Part V deals with the area between and beyond the tides. There is an outline of major animal taxa and an excellent, detailed, annotated systematic index new to this edition. This is an exceedingly valuable reference and field book needed by aficionados of this ocean's edge and by institutions of higher learning throughout at least this region.

"ATLAS OF HAIRS FOR NEOTROPICAL *MELASTOMATACEAE*" by John J. Wurdack. Smithsonian Contributions to Botany Number 63, 80 pp. & 244 SEM photos. Smithsonian Institution Press, Washington, D. C. 20560. 1986. Paperbound.

Superb, large, exquisitely clear SEM micrographs show the hairs and background texture of "412 taxa representing 66 genera of New World *Melastomataceae*.....Hair diversity probably is the result of evolution for protection against arthropod predators". There is a list of 46 types of glands and hairs. "There is no adequate correlation with climate or edaphic factors.....Perhaps the glandular hairs are of importance in chemical or mechanical protection, as has been studied in other plant families." There is a several-page catalog listing the material studied with plant name and authority, collector and number, locality of collection in Central or South America, figures illustrated and indument types. This is indeed a most valuable reference study.

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# P H Y T O L O G I A

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# TWO NEW SPECIES OF AGERATINA (ASTERACEAE-EUPATORIEAE) FROM DURANGO, MEXICO

B. L. Turner
Department of Botany, University of Texas, Austin, TX 78713

Routine identification of Asteraceae from northwestern Mexico has revealed the following novelties.

AGERATINA GRASHOFFII B. L. Turner, sp. nov. Fig. 2

A. cordifolia accedens sed foliis deltoideis vel triangulario-ovatis, capituescentibus nonglandularibus.

Erect, sparsely branched, perennial herb, 0.8-1.5 m high, arising from stout corm-like rhizomes, the root-system fibrous. Stems terete, striate, 2-5 mm wide, sparsely puberulent, purplish or purplish-mottled, the upper nodes remote, at mid-stem the internodes 10-40 cm long. Leaves opposite, 10-25 cm long, 5-12 cm wide; petioles 3-10 cm long; blades triangular-ovate to deltoid, 3-5 nervate from the base or from somewhat above, sparsely puberulent above and below primarily upon the venation, the margins irregularly crenulo-dentate. Heads numerous in remote, somewhat rounded, corymbose panicles, the latter (1)3-7 arising out of the upper axils, the ultimate peduncles puberulent, mostly 5-15 mm long. Involucre broadly turbinate, 6-8 mm long, 2-3 seriate, subequal; bracts ca 20, linear-lanceolate, green or purplish, ca 1 mm wide, the apices acute to acuminate. Receptacle plane, glabrous. Florets 18-25, somewhat longer than the involucre; corollas tubular, white or pinkish, 5-6 mm long, glabrous, the throat gradually tapering into the tube, the lobes ca 1 mm long. Anthers ca 2 mm long. Stylar appendages minutely papillose. Achenes columnar, 3-4 mm long, hispid; pappus of 20-30 fragile, barbellate bristles, mostly 3-5 mm long. Chromosome number, 2n = ca. 34 pairs (as determined by the late J. Grashoff who collected the type).

TYPE: MEXICO. DURANGO: 26 mi WSW of Durango on highway 40 to Villa Union. Few seen in rocky soil, 28 Sep 1970, Jerold Grashoff 496 (holotype TEX).

Additional specimens examined: DURANGO: Mpio. Durango, 1 km E of Otinapa, along the arroyo that passes through Otinapa, 6 Oct 1978, Garcia 788 (TEX). Mpio. Mezquital, W of Station Madre de Ocotan, along an arroyo, 16 Oct 1984, Gonzalez & Acevedo 1508 (TEX); 3 km S of Station Madre de Ocotan, 17 Oct 1984, Gonzalez & Acevedo 1559 (TEX); ca 10 km from La Guajolota, 30 Sep 1985, Solis 407 (TEX); 8 km from La Guajolota, 6 Oct 1985, Solis 433 (TEX).

Ageratina grashoffii belongs to the subgenus Neogreenella and is clearly related to A. cordifolia (B. L. Rob.) K. & R., a species with conspicuous glandular trichomes in the capitulescence and possessing strongly cordate leaves. As noted by McVaugh (1984) the A. cordifolia complex is in much need of revisionary study but the taxon described here, what with its deltoid leaves and non-glandular capitulescence, appears clearly distinct.

It is a pleasure to name this taxon for the late Jerold Grashoff who collected the holotype and who's unpublished doctorate (Grashoff, 1972) on the North American Stevias is the most incisive study of that difficult genus to date.

AGERATINA SUNDBERGII B. L. Turner, sp. nov. Fig. 1

A. acutidentata accedens sed foliis latioribus, petiolis brevioribus, capitulis magnioribus.

Erect perennial herbs 50-70 cm high. Stems simple, terete, striate, purplish, coarsely puberulent. Leaves opposite, mostly 3-5 cm long, 1.5-4.0 cm wide; petioles 1-2 mm long; blades ovate-elliptic, 1 1/2 to 2 times as long as wide, somewhat leathery, sparsely puberulent above and below along the veins, 3-5 nervate from the base to somewhat pinnately reticulate, the margins rather evenly serrate. Heads 30-60 in terminal rounded corymbose panicles 3-6 cm high, 10-15 cm across, the ultimate peduncles 3-10 mm long. Involucre turbinate, subimbricate, 2-3 seriate, 6-7 mm high, bracts 10-12, lanceolate, 1-2 nervate, 3-7 mm long, 1.0-1.8 mm wide, puberulent. Receptacle plane, glabrous. Florets 8-16 per head; corollas tubular, white, 5-6 mm long, glabrous or nearly so. Anthers ca 2 mm long. Style branches papillose, somewhat enlarged at the apex. Achenes black, columnar, 3.5-4.0 mm long, sparsely ciliate, the podocarp markedly differentiated; pappus of ca 25 white, flattened, rather persistent barbellate bristles, 5.0-6.5 mm long.

TYPE: MEXICO. DURANGO: Mpio. Durango, 41 mi WSW of Durango along highway 40, 39.9 mi E of Las Adjuntas; on sandstone in oak-pine-madrone forests, 27 Sep 1984, Scott Sundberg & Matt Lavin 2894 (holotype TEX; isotype MEXU).

Additional collection examined: DURANGO. Mpio. Mezquital, ca 10 km from La Guajolota, pine-oak forest, 30 Sep 1985, I. Solis 406 (TEX).

The species belongs to the subgenus Neogreenella and is apparently most closely related to Ageratina acutidentata (B. L. Rob.) K. & R. which, in my opinion, includes A. durangensis (B. L. Rob.) K. & R. Ageratina sundbergii is readily distinguished by its much larger heads and broader leaves with shorter petioles.

It is a pleasure to name the taxon for Dr. Scott Sundberg, promising synantherologist whose speciality is the genus Aster. I am grateful to Dr. M. C. Johnston for the Latin diagnoses.

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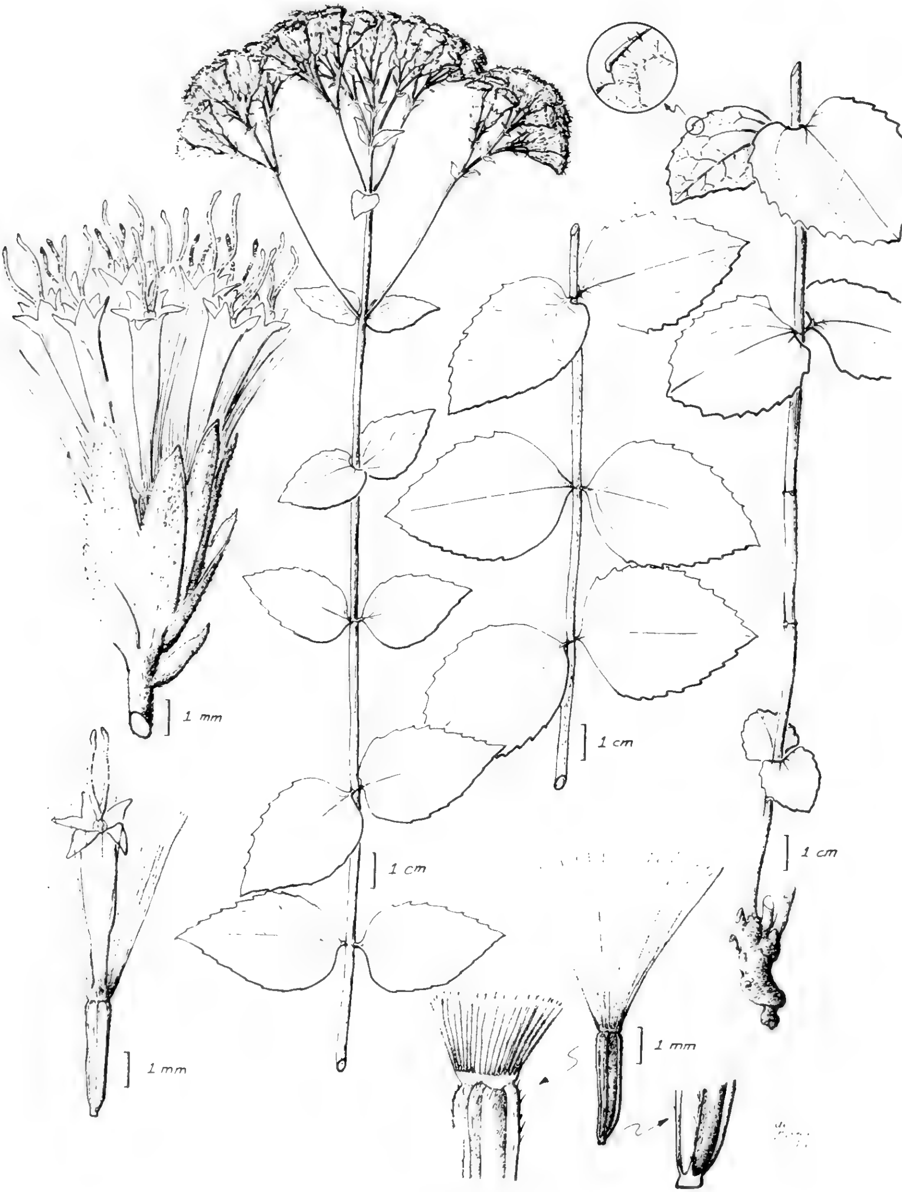


Fig. 1. Ageratina sundbergii, from holotype.

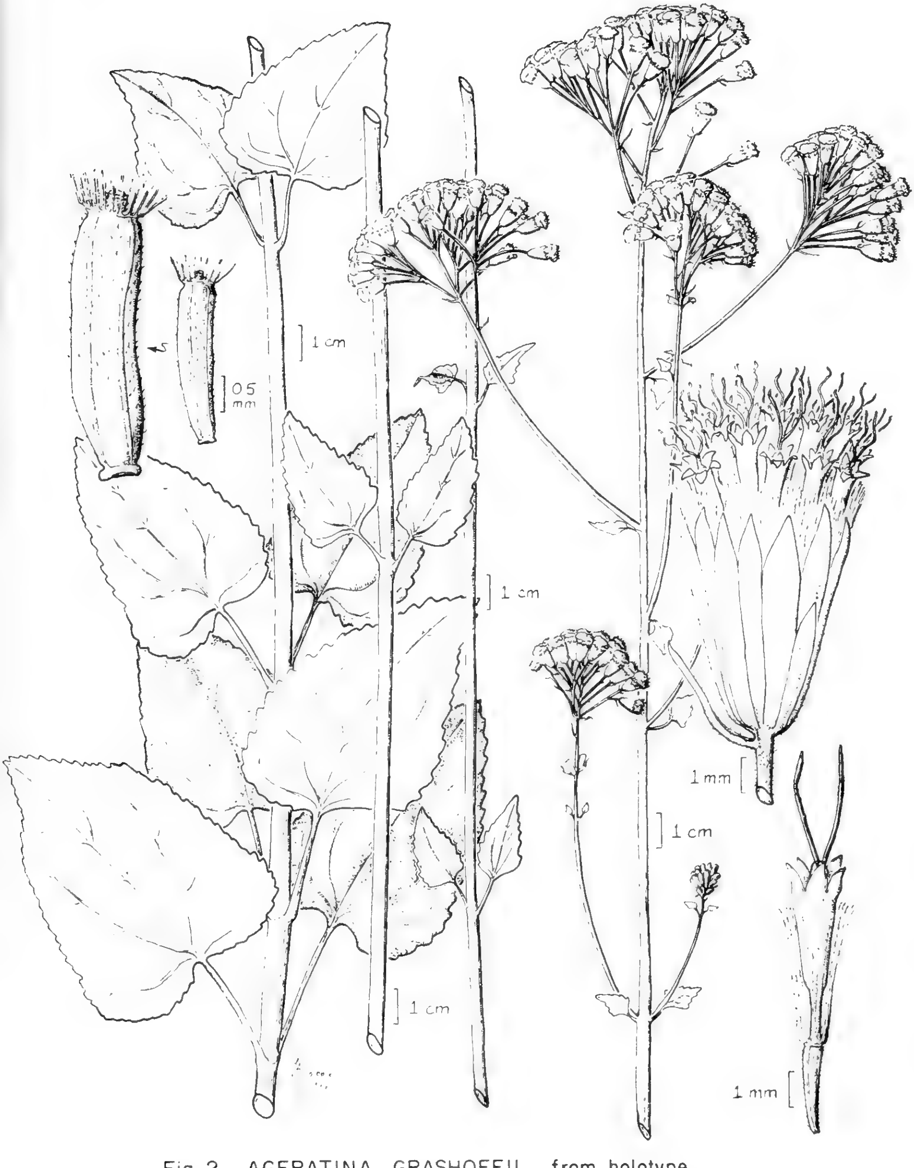


Fig. 2. AGERATINA GRASHOFFII, from holotype.

## NOTES ON THE GENUS *CLERODENDRUM (VERBENACEAE)*. XXV

Harold N. Moldenke

*CLERODENDRUM* Burm.

Additional & emended bibliography: Wight, Icon. Pl. Indiae Orient., imp. 1, 4 (3): 12 & 13, pl. 1471--1473. 1849; J. G. Baker, Journ. Linn. Soc. Lond. Bot. 22: 482 & 513. 1887; C. B. Clarke, Journ. Linn. Soc. Lond. Bot. 25: 57. 1890; Pammel, Man. Poison. Pl., ed. 2, 65, 708, 857, 858, & 932. 1911; Schubert, Contrib. Gray Herb. 154: 23. 1945; Mold. in Gleason, New Britt. Br. Illust. Fl. 3: 137 & 138. 1952; Verdcourt, Kew Bull. Misc. Inf. 1953: 119--120. 1953; Barton, Cheung, Cross, Jackman, & Martin-Sm., Journ. Chem. Soc. 1961: 5061--5073. 1961; Barton, Cheung, Cross, Jackman, & Martin-Sm., Proc. Chem. Soc. 1961: 76--78. 1961; Sim, Hamor, Paul, & Robertson, Proc. Chem. Soc. 1961: 75--76. 1961; Oakes & Butcher, U. S. Dept. Agr. Misc. Publ. 882: 90. 1962; Paul, Sim, Hamor, & Robertson, Journ. Chem. Soc. 1962: 4133--4145. 1962; Wight, Icon. Pl. Indiae Orient., imp. 2, 4 [Cramer & Swan, Hist. Nat. Class. 31]: 12--13, pl. 1471--1473. 1963; Mold., Phytologia 61: 22--50. 1986.

*CLERODENDRUM INERME* (L.) Gaertn.

Additional bibliography: Mold., Phytologia 61: 23--25 & 30--50. 1986.

In Papua this species is described by Croft & Vines as a scrambling shrub at the water's edge in low altitude swamp forests in the river tidal zone. In Hong Kong it is said by Alexander (1971) to thrive "along seashores and on lowlands", Thrower (1971) reports it "restricted to coastal beaches....often associated with mangroves", and Taam refers to it as "a semi-woody climber to 5 feet fairly common but scattered in dry sandy soil".

In India, according to Naskar & Bakshu (1982), it grows in association with *Acanthus* sp., *Ceriops* sp., *Phoenix* sp., and *Rhizophora* sp. in "ridge forests" and Dagar & his associates (1978) report that it "regenerates from exposed roots in badly eroded habitats" in Madhya Pradesh. Rao & Sastry (1972) found it to be a constituent of the "middle mixed zone of the strand vegetation in western India", growing along with *Calotropis gigantea* R. Br., *Capparis decidua* (Forsk.) Edgw., *Senra incana* Cav., *Sericostoma pauciflorum* Stocks, and *Tamarix troupie* Fole. Navalkar (1961) found it growing in the 7th (most distant from the sea) stage of succession zone in the mangrove swamps of Salsette Island (Bombay), an area of increasing aridity and very little salinity. Puri (1960) found it in the third story of small trees and shrubs in northern Kanara; Prain (1891) found it comprising a part of a common sea-face jungle-fence inside of first and second beach forest lines at the edge of the Coco group of islands. Saldanha refers to it as a common undershrub in Mysore.

Sedgwick & Bell found *Clerodendrum inerme* growing in a region of 115 inches of annual rainfall in Bombay. In the same area Santapau (on *Santapau 21320*) says of the plant: "a large shrub, the leaves remarkably small for the species, but the branches when grown in the University Compound give leaves of the normal size" -- his *no. 142.13H* was collected "at highwater limit". The plant is commonly used as a hedge in Bombay.

Arora & Aggarwal (1965), in writing of this species in India, describe it as occasional on the main strand -- thickets of this species follow *Acanthus ilicifolius* as most common on muddy banks -- found with *Derris uliginosa* and *Premna obtusifolia* in thickets of *Scaevola taccada* along river backwaters -- with *Premna* and *Calophyllum inophyllum* in very light gray soil without any clay -- with *Premna* and *Derris* it makes a dense cover above hightide mark and salt spray -- it occurs behind the *Ipomoea pes-caprae* zone or in association with *I. pes-caprae* in dull white soil. Prain (1963), writing of it in Bengal and the Sundribuns [Bangladesh], describes it as "A straggling, littoral shrub of muddy shores" -- in Chittagong he refers to it as "A bushy, littoral shrub of rocky shores on the seacoast". Sebastine & Ellis (1967) report it common in Madras near roads and pathways along with *Vitex negundo* and *Ficus benghalensis*. Rao and his associates (1963) describe it as a denizen of "inland sandy habitats interspersed among dominants" on the Krusadi Islands. Gaussen and his associates (1964) refer to it as growing on "banks of salt swamp saline marshes and halophilous pseudosteppe".

In Indochina it is said by Squires to grow "in salty tide water" at Hue. Hartley and his associates (1973) describe it as a "Woody climber in scrub back of [the] ocean beach" at Huon Gulf, citing their *nos. 9741* & *11068*. Hu found it to be very common along rocky shores on Tamon Island (near Hong Kong).

Hallier (1918) reports finding *C. inerme* on Luzon Island in the Philippines, growing with *Ipomoea biloba* Forsk., *Canavalia* sp., *Erythrina* sp., *Pongamia glabra* Vent., *Caesalpinia nuga* Ait., *C. bonducella* Fleming, *Hibiscus tiliaceus* L., *Terminalia catappa* L., *Strophanthus* sp., etc. on the strand at Subic Bay. On Yap he found it growing on *Pandanus* steppe.

In New Guinea Gray & Floyd describe it as "scandent along river banks", while McKee calls it "a climber at the edge of mangrove swamps" and "straggling through mangrove trees to 15 feet tall", while Brass refers to it as a "large rambling shrub common in strand forests". Merrill tells us that it is a small shrub common throughout the Philippines in salt water swamps along the seacoast.

In the Pacific Oceanica region Fosberg found this plant abundant on dissected limestone, "an extensive vine-like shrub pendent over limestone cliffs" on Nauru Island; in the Marshall Islands he describes it as a low scrambling shrub forming low thickets generally throughout coconut groves, around abandoned taro pits, and in tangled masses up to 3 m. tall along the inner edge of beach scrub. On Dublon Island he encountered it on steep wooded slopes and ridges, partially cleared and cultivated below, near the lower edge of the forest, and on Pis Island he refers to it as "a scrambling shrub forming thickets in flat coral sand and rock substratum, mostly planted with coconuts, with a dense brushy understory toward the outer beach of *Scaevola* mixed with other shrubs, *Messerschmidia* fringing the wet beach". Canfield refers to it on Peleliu Island as a common liana at the border of swamps in limestone soil, growing with *Acrostichum, Hibiscus tiliaceus* L., *Ipomoea*, and *Derris*; on Manauli Island Fosberg calls it "local on lagoon beach ridges in a mosaic of halophytic vegetation on low sand islands". Raulerson, on Pagan (in the Mariana Islands) calls it "a common sprawling shrub in strand vegetation but rare elsewhere."

Nierling, on Werua Island, encountered *C. inerme* in thickets in breadfruit-coconut plantations covering limestone rock and on coral rubble banks of *Cyrtosperma chamissonis* pits, locally abundant and profusely flowering. Fosberg & Evans, on Lamotrek Island, report it common in forests and the peaty edges of taro swamps in interior coconut-breadfruit plantings, and, on Krakatoa Island, only rare on flats of cinders and volcanic sand and ash at the base of cinder cones. Fosberg, Falanruw, & Sachet (1975) refer to it as a "common component of undergrowth in semi-shade" on Pagan and Sarigan Islands. St. John (1977) found it growing in volcanic soil, dry forests on ridges, and secondgrowth forests in the Tongan Islands. Hosaka refers to it as a constituent of the swamp forest association on Moen Island.

In the Gilbert Islands Moul describes *C. inerme* as "tending to be vinelike in habit in thickets of palms, *Guettarda*, and *Scaevola*. On Saipan it is said by Fosberg to be an abundant semi-scandent shrub forming large masses in swamps with *Acrostichum aureum, Hibiscus tiliaceus*, and a few large trees of *Casuarina equisetifolia*. In New Britain Croft & Katik found it colonizing the crests of pebble beach areas where the soil is sparse to non-existent, the leaf-litter sparse, and exposure is to sea spray. Evand reports it growing on coral platforms just above high tide on Guam, straggling through the branches of large *Barringtonia asiatica* trees. Long reports it common in *Artocarpus* plantations in the Central Pacific Islands [e.g., Hull Island. In the Gilbert Islands, according to Herbst & Allerton, the species is cultivated, being propagated by cuttings "because it sets few seeds" there.

Araujo reports it from Rio de Janeiro (Brazil), where it "formando pequenas moitas entre *Cyperaceae* na orla do mangue".

Collectors have encountered *Clerodendrum inerme* in flower and in fruit in every month of the year, and several authors also assert this as fact [e.g., Shah & al. (1971) in Gujarat]. Rao & Razi (1973) assert that it flowers and fruits throughout the major part of the year in Mysore; Patel (1968, 1971) says "almost throughout the year, but mostly from July to November" in Melghat and from July to October in Gujarat. Bor & Raizada (1954) also say "throughout the year, but chiefly July to November". Roxburgh (1874) asserts that in India it blooms "chiefly in the cold season"; Alexander (1971) found that in Hong Kong it blooms "in summer".

Mullan (1933) tells us that "*Clerodendron inerme*, Gaertn. is a straggling shrub which is often found along with the mangroves on the verge of high-water mark where its roots are washed by the rising tides. It thrives equally on wet or dry saline soil, as well as under mesophytic conditions. A plant was taken from the sea-shore and cultivated under mesophytic conditions for ten months. Figs. 184 and

185 are photographs (taken in the dry season) of the halophytic and mesophytic forms respectively. In the halophytic form the small, thick leaves arrange themselves on one side of the branch, thus assuming a profile position. In the mesophytic form, the leaves are broad and thin and, standing wide apart, present their full upper surface to the light." He proceeds to compare the anatomy of the leaves and stems of both forms. Among the many interesting facts which he presents is: "At the end of the monsoon, the old leaves get thick and succulent, being nearly thrice as thick as the functional leaves. Such leaves are pale yellow in colour and act mainly as water-reservoirs." The root cortex is "lacunar and resembles somewhat that of the mangroves......As in *Acanthus ilicifolius*, the lacunar cortex seems to be a congenital structure, for it persists even in individuals which live in well-drained soil.....In the mesophytic form, photosynthetic activity is more vigorous and the cortex is full of chloroplasts with included starch. The pith is not lignified throughout. In the leaf, the cuticle and the waxy coating are poorly developed and the glands are mostly devoid of contents. The lower epidermis, in surface view, is no longer composed of small cells with straight walls.....but consists of large cells with irregular wavy walls....The lamina is thinner than that of the halophytic form...and the old leaves do not become thick and succulent."

Backer & Bakhuizen (1965) describe the species, in Java, as an erect, drooping, or straggling shrub, 0.5--10 m. tall, blooming throughout the year, and found "mainly in saltish localities near the sea; often numerous".

The *Spence 435* collection from Truk Island is described by the collector as having been "a woody vine-like shrub, sometimes growing in shrub fashion, at other times climbing into the taller trees...the corolla-lobes pale pink near the base, wavy or undulate, differing from others seen in semi-shade to open sun" [this constitutes a voucher specimen for NIH grant NOI-CM-33747].

Taylor (1950) tells us that in the northern Marshall Islands this species is "a small shrub forming tangled thickets or more shapely scattered specimens, nearly leafless when first observed in March or only with leaves of the past season, rapidly forming new growth with the advent of the wet season and very conspicuous and attractive in July."

Although mostly described as a straggling shrub, some collectors actually describe this species as a "tree" [e.g., *Dissing 2591*, *Køie & Olsen 1668* "5--10 m. tall"]; on *Kajewski 2244* it is described as "a small tree to 5 m. tall"; Stoddart refers to it as a "tree 3 m. tall" on Manauli Island, but his *no. 4441*, from East Hope Island [Great Barrier Reef] had a "creeping habit" and his *nos. 4507* & *4645*, from Two and Three Isles, were "a creeping shrub". Hosaka refers to the plant as a "viney shrub" and it is definitely called a "vine" on *Christophersen & Hume 2006*, *Mueller-Dombuis & Cooray 6712107*, *Robinson 297*, *Stone 6240*, and *Walker 7578*; Brown refers to it as a "honeysuckle-like shrub", and Evans as a "straggling shrub with branches many meters long"; on *Stone 8686* it is called "a climber" and on *Fosberg & Balakrishnan 53627*, from Sri Lanka, "a sprawling shrub". On *Whistler W.1882* it is said to have been "a high-climbing scandent shrub", while on *Liang 62947*, from Hainan, it was "scandent on shrubs in open thickets". *Streimann & Stone LAE.53607* bear a label describing the plant as "an epiphyte". In the Solomon Islands (on New Georgia Island) it is described by Maunu's as "a climber reaching 40 feet above ground in well-drained secondary forests"; on *Stephens 56* it is called a "woody vine 25--30 feet long"; on *Taam 1341* it is said to be "climbing to 5 feet"; on *Vanpruk 839* it is a "prostrate shrub 2 feet high, 5 feet long".

According to MacMillan (1943) in India and Sri Lanka the tree form is callet "pinari", while the shrubby form is known as "walgurenda" -- the very distinct names implying that the two forms are recognized by the natives as being quite distinct and different.

*Clerodendrum inerme* is described as a "scrambling shrub" on *Bristol 2343* and *Yuncker 9733*; as a "scandent shrub" on *Bristol 1997* & *2383, Henty & Frodin NGF.27267, Lampureux 4867, Liang 62887, Smith 1187, Whistler W.1332,* and *Yuncker 9733;* and as a "sprawling herb" on *Forbes 54986* and *Fosberg & Balakrishnan 53627.* In Guam it is reported on *Moran 4550* to be "scrambling 2 m. shrub forming thickets". In the Fiji Islands *Degener & Ordonez 14191* was taken from a "tree 5 m. tall", but *Degener 14958* was a "shrubby creeper sprawling over rocks in an isolated dry forested ravine"; in the Samoan Islands *Yuncker 9096* is said to have been "scrambling over shrubs in thickets" while on Niue Island *Yurcker 10042* & *10218* were taken from a "trailing shrub on sea cliffs". In Queensland *Flecker 988* was taken from a "tree about 10 feet tall in a swamp". In West Irian *Pleyte 364* is described as from a "liana 28 m. long, 3 cm. in diameter, growing in open spots on the seabeach"; in Papua Brass refers to the plant as a scrambling shrub at the inner edge of the mangroves; Garber, on Tau Island, definitely refers to it as a "tree or vine"; Smith, in the Fiji Islands, calls it a scandent shrub 2 m. tall. In the Mariana Islands Falanruw refers to it as having "long bending branches tangled through *Ficus* trees below a semi-open canopy"; on *Bryan 338* it is called "a woody climber in trees, 4--5 m. tall, on sea beach". In the Tongan Islands Yuncker calls it a "large liana with many pendent branches climbing in the trees of the strand forest" and "common in the sandy-calcareous soil of beach thickets [on Tongatapu] and "a trailing or scrambling shrub in thickets just back of the sea [on Nomuka], or "a somewhat scrambling shrub on coastal cliffs" [on Lifuka], and "sprawling over shrubs at 10--20 m. altitude" [on Eua]. Blatter, in Bombay, found it growing "within 10 yards of high tide".

In addition to the apparent great variability of this species as to habit and habitat, there is a similar variability in the morphologic character of the foliage. On *Bristol 1997* the leaves are unusually large, on *Moldenke & al. 28119* the blades are uniformly thick in texture (when fresh) and apically distinctly pointed. Shivarajan, on the label of his unnumbered collection of 10-12-74, says: "leaves invariably acuminate as in this specimen. Possibly might be a different variety." On *Mueller-Dombois 68042002* the blades are oblong-orbicular, light-green, and quite thickish in texture. On *Hu 12065* the collector notes that the corolla-tube is "only 2 cm. long".

Trimen (1895) comments about *Clerodendrum inerme* in Sri Lanka: "The foliage has a peculiar fetid but rather aromatic odour when bruised, and a hot taste: and the vernacular names are the same [here] as for *Celtis cinnamomea*, the scent of which is very much more offensive."

Burkill (1935) describes *C. inerme* in the Malay Peninsula as "An untidy sea-shore shrub, with somewhat soft greenish-brown or black fruit (from which it gets the first part of its [native] names terong jambul and limau lĕlang), found from Bombay to the Pacific; in the [Malay] Peninsula it is round the coasts".

Smith (on his *no. 9506*) describes the filaments and style as "nearly white proximally, rich blue distally" and the anthers as yellow.

The chromosome number is given as 23 haploid, 46 diploid by Raman & Kesavan (1963), Sharma & Mukhopadhyay (1963), and Cave (1964), but as 48 ("a tetraploid species") by Sobti & Singh (1961).

Nieuwenhuis (1907) describes and illustrates the nectaries found on the leaves and calyxes. Malaviya (1965) reports finding spheroidal sclerids formed by the conversion of the collenchyma cells of the cortex.

Inamdar & Patel (1969) discuss in detail the anatomy of the petiole and lamina and found that in the petiole and midrib the vascular bundles are arranged in a ring and the phloem does not form a continuous arc. The smaller vascular bundles originate from vascular meristems with delayed differentiation. The accessory vascular bundles in each wing of the petiole originate either from a single strand or fusion of 2 separate strands. Lignified or unlignified bundle caps which are primary phloem fibers are present in all the vascular bundles, the latter being of varying size. The vascular cambium with its characteristic radial alignment of cells is present between the xylem and phloem.

Shah (1968) and his associates (1969) studied the nodal anatomy and report that "the compound single trace is formed by the fusion of 2--3 bundles.....Before entering the leaf, the fusion of 2 bundles in *C. inerme* occurs at a lower level in the node as compared with that in *C. splendens*. All unilocular nodes do not appear to be homologous."

It should be noted here, for the record, that the Sri Lankan *Cooray 69092807R*, *Mueller-Dombois 68042002*, *Wirawan 1114*, and *Wirawan & Balakrishnan 951* are voucher collections for ecologic studies and *Carroll 27* & *84* are vouchers for ethnobotanic studies; *Yates 936*, from Sumatra, is accompanied by an in situ photograph of the collection site.

The corollas of *C. inerme* are mostly described by authors and collectors as "white", as, for instance, by Dunn & Tutcher (1912) and by Shah & al. (1971) and on *Amaratunga 332* & *1890*, *Bristol 1997*, *2343*, & *2383*, *Fosberg 54997*, *Fosberg & al. 50907*, *53455*, & *53627*, *Hu 11970*, *12065*, & *12159*, *Kraemer 244*, *Larsen & al. 1216*, *Ledermann 14088*, *Mac Daniels 2152*, *Nafday 124*, *Peekel 571*, *Rechinger 4936*, *Saldanha 15340*. *Santos 4333*, *Schmidt 321* & *552d*, *Sohmer & al. 8869*, *Stoddart 4019*, *4237*, *4441*, & *4890*, *Taam 1341*, *Weber 26*, and *Wirawan 1114*, but they are described as "off-white" on *Grupe 120*, "greenish-white" on *Eames 1*, "white with a hint of purple" on *Long 3487*, "white, tinged with pink" on *Hosaka 2870* and *Steere 123*, "white touched purple" on *Young s.n.* [FHB.39192], "whitish" on *Wilson 9867*, "white and purple" on *Stoddart 4806* & *5077*, "white & lilac" on *Robinson 297*, "white-violet" on *Waalkes 665*, "white with purple center" on *Stoddart 1553*, "white tipped with red" by MacMillan (1941), "white with light purple tinge" on *Christophersen & Hume 2006*, "white, externally somewhat purple" by Mueller (1868), "tube greenish-white, lobes white" on *Lam 2683*, "creamy" on *Cummings s.n.*, "cream tinged with mauve" on *Brass 853*, "slightly purplish along margins of corolla-lobes" on *Royen 3355*, "pale-pink" on *Waas 732*, "pink" on *Glassman 2464*, "yellow" on *Moszkowski 466*, and "liliaceous" on *Pleyte 160*.

Keys to distinguish *C. inerme* from other Indian species will be found under *C. griffithianum* C. B. Clarke (60: 134--136), from other Bengal and Dehra Dun species under *C. indicum* (L.) Kuntze (61: other Indochinese species under *C. hahnianum* Dop (60: 141--143), other Taiwanese species under *C. intermedium* Cham., other Madagascar species under *C. baronianum* Oliv. (58: 184--190), and other Chinese species under *C. canescens* Wall. (58: 416) and *C. henryi* P'ei (60: 180--181). Some other keys that may prove helpful are the following (all with modifications to bring them up-to-date, but, in some cases, a distinction being left between what the original author regarded as "true" *C. inerme* and some of its edaphic forms).

Henderson (1974) separates the Malayan species known to him as follows:

1. Inflorescences short and few-flowered; plant of tidal mud......... *C. inerme.*
1a. Inflorescences large and branched, with many flowers; not in tidal mud.
  2. Inflorescences pendent; corolla white................*C. nutans.*
  2a. Inflorescences erect, pyramidal; corollas red and yellow....... *C. phyllomega* var. *myrmecophilum.*

Fletcher (1938) keys out the Thailand taxa known to him as follows:

1. Corolla hypocrateriform, the tube less than 5 cm. long. Subgenus *Euclerodendron* C. B. Clarke.
  2. Cymes axillary or in terminal leafy panicles, the lower ramifications being axillary.
    3. Cymes axillary.
      4. Cymes few-flowered from most axils; calyx-teeth very short.
        5. Leaf-blades elliptic to lanceolate; calyx externally only faintly glandular.......................*C. neriifolium.*
        5a. Leaf-blades ovate to elliptic; calyx externally markedly glandular.................................*C. inerme.*
      4a. Cymes in deflexed, pedunculate, close panicles from the upper leaf-axils; calyx-lobes linear-lanceolate.*C. deflexum.*
    3a. Cymes in terminal leafy panicles, the lower ramifications being axillary
      6. Calyx-lobes ventrally glabrous.
        7. Leaf-blades elliptic, glabrous above or occasionally with a slight pubescence on the venation....*C. disparifolium.*
        7a. Leaf-blades oblong to obovate, thinly covered with jointed

hairs above..............................*C. lankawiense.*

6a. Calyx-lobes ventrally markedly pubescent.

8. Leaf-blades markedly pubescent above with jointed hairs; corolla-tube at most 2.5 cm. long.........*C. lloydianum.*

8a, Leaf-blades slightly pubescent above with short hairs; corolla-tube at least 2.5 cm. long......*C. garrettianum.*

2a. Cymes in definite terminal panicles.

9. Panicle more or less nutant or pendulous.

10. Leaf-blades glabrous above, occasional only very faintly pubescent along the midrib.

11. Leaf-blades at most 6 cm. wide, basally slightly tapering; calyx-lobes lanceolate..................*C. nutans.*

11a. Leaf-blades at least 6 cm. wide, rounded, basally sometimes slightly attenuate; calyx-lobes ovate and apically cuspidate...........................*C. umbratile.*

10a. Leaf-blades decidedly pubescent beneath, basally subdeltoid or lobate..............................*C. schmidtii.*

9a. Panicles erect.

12. Panicles elongate or pyramidal.

13. Panicles elongate.

14. Main rachis-ramifications to the cymes 0.5--1 cm. long; calyx-teeth at least 1 mm. long; leaf-blades marginally very deeply serrate..................*C. vanprukii.*

14a. Main rachis-ramifications to the cymes 1.5--5.5 cm. long; calyx often truncate, the teeth at most 0.75 mm. long; leaf-blades marginally only distantly serrate or denticulate.

15. Leaves and bracts opposite; petioles at least 2 cm. long; leaf-blades marginally mostly subentire; inflorescence at most 15 cm. long

16. Leaf-blades glabrous on both surfaces...*C. venosum.*

16a. Leaf-blades strongly pubescent on the midrib and secondaries above and on all the venation beneath. *C. venosum* var. *pubescens.*

15a. Leaves often ternate and the bracts generally so; leaves subsessile or short-petiolate.

17. Leaves subsessile, the blades basally cuneate...... *C. serratum.*

17a. Leaves generally petiolate, but sometimes only slightly so when the leaf-blades are basally decurrent and acuminately narrowed.................. *C. serratum* var. *wallichii.*

13a. Panicles pyramidal.

18. Leaf-blades conspicuously lobed.........*C. paniculatum.*

18a. Leaf-blades unlobed.

19. Leaf-blades marginally entire; calyx lobes extending little more than halfway to the calyx base.......... *C. villosum.*

19a. Leaf-blades often marginally dentate; calyx-lobes extending almost to the calyx base......*C. viscosum.*

12a. Panicle corymbose or subcapitate.

20. Panicles corymbose; calyx-teeth small, at most 1 mm. long..................................*C. colebrokianum*.
20a. Panicles subcapitate; calyx-lobes large, at least 8 mm. long.
21. Corolla-tube at least 3 cm. long; calyx-lobes triangular-lanceolate, at least 10 mm. long; corolla single..............................*C. lasiocephalum*.
21a. Corolla-tube at most 2 cm. long; calyx-lobes triangular, apically acuminate, at most 10 mm. long; corolla "doubled".........*C. philippinum* f. *multiplex*.
1a. Corolla infundicular, the tube more than 5 cm. long. Subgenus *Siphonanthus* (L.) C. B. Clarke; leaves usually verticillate..... *C. indicum*.

Cooke (1905) distinguishes the Bombay taxa as follows:
1. Cymes few-flowered, axillary, distinct..................*C. inerme*.
1a. Cymes collectively forming a terminal panicle.
2. Calyx not conspicuously enlarged in fruit.
3. Calyx-lobes long, ovate, acuminate; leaves opposite, less than 3 inches long..................................*C. phlomidis*.
3a. Calyx-lobes very short, broadly triangular; leaves often ternate, to over 6 inches long....................*C. serratum*.
2a. Calyx much enlarged in fruit, turning red..........*C. villosum*

Maheshwari (1963) distinguishes the Delhi species as follows:
1. Corolla-tube less than 5 cm. long.
2. Corolla white, rarely pink; cymes axillary and terminal.
3. Leaf-blades ovate, elliptic, or oblong, subfleshy; flowers in axillary mostly 3-flowered cymes.................*C. inerme*.
3a. Leaf-blades ovate or rhomboid, thin-textures; flowers in dichotomous cymes forming a rounded panicle......*C. phlomidis*.
2a. Corolla not white; cymes only terminal.
4. Habit erect; corolla pink, doubled.*C. philippinum* f. *multiplex*
4a. Habit climbing; corolla crimson, single.........*C. splendens*.
1a. Corolla-tube more than 5 cm. long.....................*C. indicum*.

Blatter and his associates (1935) key the Indian medicinal species as follows:
1. Corolla-tube less than 3.8 cm. long.
2. Peduncles mainly axillary.
3. Leaf-blades obovate or elliptic, subobtuse, entire, glabrate.. *C. inerme*.
3a. Leaf-blades ovate, sinuate or serrate, puberulent or pubescent beneath when mature......................*C. phlomidis*.
2a. Peduncles terminal.
4. Inflorescence paniculate, elongate, conspicuously bracteose... *C. serratum*.
4a. Inflorescence capitate or corymbose.............*C. viscosum*.
1a. Corolla-tube more than 7.5 cm. long...................*C. indicum*.

The pollen of *Clerodendrum inerme* is described by Nair & Rehman (1962) as spheroidal, diameter 63 mu, range 56--58 mu, apocolpium diameter 35 mu, based on *Indian Nat. Bot. Gard. 44116, slide 2631*, from Bombay. Huang (1972) describes the grains as oblate to subprolate, 42--67 mu x 56--71 mu, based on *Huang 3342* from Taiwan.

Maiti (1968) reports the presence of a green oil, a sterol, and much saponin in *C. inerme*, but a negligible amount of alkaloid and no terpene.

Hafaz & Younis (1969) found experimentally no change occurring in stomatal opening response in carbon dioxide free air. Bose and his associates (1977) found significant promotion of rooting with use of ethylene and acetylene.

Wehmer (1931) reports the extraction of chirettin (chiratin) and ophelic acid from the leaves, while Al-Rawi & Chakraverty (1964) report that the fresh leaves contain an amorphous bitter principle and the ash contains sodium chloride. Abdul-Alim (1971) isolated from the leaves a water-soluble bitter principle with alkaloid attributes, as well as a sterol, an aliphatic alcohol and ketone, also glucose, fructose, and sucrose as free sugars.

Subramanian & Nair (1972) report the presence of a unique flavonid, scutellarein-4'-L-arabinoside, in the leaves of this plant, claimed to be "the only scutellarein pentoside so far known. The presence of high proportions of free scutellarein with small quantities of its glycoside in *C. nerifolium* is unusual in *Tubiflorae* and may be due to the easy hydrolysibility of scutellarein-4'-arabinoside....Luteolin and apigenin which have been recorded to be common flavones of *Verbenaceae* are absent in *C. nerifolium*." This same researcher and his associates (1973) have found the sterol, (24S)-ethylcholesta-5, 22, 25-triene-3β-ol, in the leaves, based on their *no. 11/71* deposited in the Jipmar Herbarium at Pondicherry.

Common and vernacular names recorded for this widespread plant are understandably very numerous, including: "abuts", "aihua", "añg-angri", "a-la-loi-alugi", "aloalo-atai", "alo alo itai", "alo alo tai", "aloalo tai", "aloalotai" [=seaside *Premna*], "amahoesoe", "anjali", "apuech", "apuoch", "apwec", "ara", "aria", "ariya", "arni", "aupui", "awai", "ayer putri", "baliscug", "baliseng", "baliskug", "ban-jai", "bán-jai", "banjai", "banjoi", "banjuen", "ban-juen", "ban-jumet", "barga", "bat-raj", "batraj", "ben juen", "biring djéné", "boerende", "bonjoi", "bon-joí", "bunga pawang" [=sorcerer's flower], "bunjoin", "bun-join", "bunjumat". "bun-jumat", "burenda", "burende", "busel-busel", "chamvert", "chhoti-arni", "chia bam", "chirettakraut", "cholora", "chong gong", "choti-arni", "ch'ou-k'u-lang", "clerodendro do cagillas", "Coromandel chlerodendrum", "dariai arni", "didi leman", "di hia", "dungeti", "embreret", "embrert", "eru-pichcha", "eru-pichecha", "erupucha", "eru puchcha", "etin", "etipisangi", "eti pisinika", "etipisinika", "etiu", "fa long shue", "false jasmine", "foo long", "foo long shue", "foo yis hai", "fouksha", "fuefuesina", "gabwi", "gambir-lant", "gambit-laut", "gambir laoet", "gamwert", "garden quinine", "gashangi", "geki", "genguti", "ghuraenda", "girila-mari", "glory-bower", "glorybower", "goo yis hai", "gowie", "gulinda", "habiya", "habui", "habwi", "ibanjoi", "ibota-kusagi"[=*Ligustrum* clerodendrum], "ibotakusagi kunin", "ihlau", "ilau", "ilaw", "Indian privet", "isamdhárí", "isandhari", "isandhári", "kakoli", "karamoto", "kawak", "kellel-lap-ni", "kam bang boegang", "kĕmbang boegang", "kĕmbang lugang", "kĕmbang-luqanq", "kèmbang lygang", "ketoewèr", "ketoewér", "khó'nâ-pôa", "koi a koi", "koivel", "koiya", "koli", "koyanal", "kshudrágnimantha", "k'u-lang-shu", "kundah", "kundali", "kywe-yan-nge", "kywe-yan-ngè", "la bul mago", "lagoendi", "lagoendi alas", "lahan-khari-narvel", "lahán-khári-narvel", "lan-jai", "lanjai", "lán-jai", "lapalapa", "laruch", "leruc", "limau lĕlang", "lodagao", "lodegau", "lodigao", "lodogao", "lodugan", "lodugao", "lodúgao", "lodugau", "l'ruch", "ludugao", "ludugao vaca", "mañgongot", "mangotngot", "manka-hogi", "manka-hógi", "manoeroe dowongi", "manor oetan", "manumara", "manummala", "melati air", "mĕlati oetan", "melati utan", "naitakkile", "naitokkili", "nalla-kupi", "nayitakkali", "niir-notsjiil", "niir-notsjil", "nillavuppi", "nirnochi", "nir notsjil", "nir-notsjil", "nir-notsjit", "oleander-leaved clerodendrum", "oviedo flor blanca", "parian-salojon", "parian solojon", "pawan", "peh-hoe-khò'-na-pôaⁿ", "penni ka", "pinari" [growing as a tree, in India & Sri Lanka], "pinarichangu", "pinarichanganguppi", "píná-shengam-kuppi", "pinchil", "pinchul", "pin laí kyouk pán", "pinie-kyauk-pan", "pinley-kyong-ben", "pinyin", "piran", "pirolaikyou", "pirolai kyont", "pisangi", "písangi", "pishinika", "pishmika", "pisingha", "pisíngha", "pisinika", "pua", "pucherik", "pumb-arg-aru", "qesmat aghaji", "samin-anga", "saminanga", "samudrayuthika", "sān fú mún", "sanfu-mun", "sangam", "sangam-kupi", "sangamkuppi", "sanganuppi", "sangkupi", "sang-kupi", "sang-kúpi", "sang-kupi", "sarupparachi", "seashore glorybower", "seashore tube-flower", "seaside clerodendron", "shangam-kupi", "shamgam-kuppi", "shen-gan-kupi", "shen gankuppi", "shengan-kuppi", "shen-gankuppi", "shengankuppi", "shoalo tai", "shui-hu-man", "shuǐ hú măn", "smooth clerodendron", "snagkupi", "sómbah", "sorcerer's flower", "sund", "tabang-ongong", "tabangongong", "takkolakamu", "takkolamu", " tak-kólapu-chettu", "takko-lakamu", "tapval", "tapvan", "tatkari", "taw-kyaungban", "tehiya", "te inato", "te inoto", "tĕrong gambul", "terong jambul", "tihia", "ti natu", "tituhina". "tivar" [applied also to many other coastal plants], "toelang", "ttkari", "tulang-tulang" [=like bones, from its twiggy appearance], "tutuhina", "ula", "úla", "ulej", "ulig", "ulij", "ulo", "umbreret", "unarmed clerodendrum", "unbewehrter Losbaum", "uti", "utichetta", "úti chettu", "utichettu", "valayati mendi", "vana-jai", "vanajai", "vanajoi", "vanayuthika", "vanjai", "vere", "verevere" [=tangled, applied also to *Colubrina asiatica, Smythea pacifica, Tetrastigma vitiensis*, and *Ventilago vitiensis*], "vilayti-mendhi", "vishmadhari gida", "volcameria", "volkameria sans épines", "volkamier de Commerson", "volkamier sans épines", "wael-boo-raenda", "wael-bu-raenda", "wal-burenda", "wale-puti-lohaha" [=white strand cord], "wal-gooranda", "walguranda", "wal-gu-renda", "wal-gurenda" [growing as a shrub, in India and Sri Lanka], "wal-gúranda", "wal-gurenda", "wild jasmine", "wilij", "willow-leaved clerodendrum", "wiri salo", "woel-bu-roenda", "wules", "wuletch", "yasamin zafer", "zingi", and "ziyakara'ppu". Sasaki (1928) lists six vernacular names in Japanese characters; Tingle (1967) supplies another in Japanese; and Santapau (1953) supplies two names in Hindi characters.

*Clerodendrum inerme* is widely used in native pharmacy and medicine and has numerous other uses. Starting with the medicinal uses, the following reports are arranged more or less geographically and chronologically -- the undated references, as usual, are taken from herbarium specimens.

Kosteletzky (1834) notes that "Die stark riechende, bittere Wurzel, so wie die nicht minder stark riechenden, bitterlich-scharfen Blätter werden als alterirende Mittel gegen Scropheln und syphilische Krankheiten gebraucht; die Wurzel und die Früchte sind auch als Gegenmittel nach dem Genusse schädliche Fische bekannt."

Altschul (1973) asserts that when a man has trouble with his eyes, including blindness, the leaves of this plant are placed in hot water in a dish and a calico sheet is thrown over the head and dish, allowing the fumes to reach the eyes.

Abdul-Alim (1971) lists it as a medicinal plant in Egypt. Al-Rawi & Chakravarty (1964) report the species cultivated in Iraq and the leaves used there as an alterative and febrifuge.

Watt (1889) says: "A large, ramous, often scandent evergreen shrub, common in tidal forests in Bengal, Burma, and the Andamans... An exquisite perfume is said to be derived from the flowers of this plant.....Dr. Dymock says that the plant has a reputation as a febrifuge in remittent and intermittent fevers. This fact is supported by Dr. Sakharam Arjun, who, upon the authority of Dr. Hojel, states that 'the thick succulent leaves are very bitter, and on expression yield a large quantity of thickish mucilaginous juice, with a slightly saline but intensely bitter taste. Although not generally known, it has of late been used as a febrifuge and antiperiodic with marked benefit.'"

Dymock and his associates (1893) discuss in detail the chemical composition of the leaves. They note, among many other medicinal and pharmaceutical tidbits, that "The dried leaves have been found to be quite as efficient as the juice of the fresh plant; they should be dried in the shade to preserve their aroma, and may be administered in decoction with aromatics, or powdered and made into pills. A tincture has also been found to be an efficient preparation." They report, further, that "This is a shrub the medicinal properties of which are widely known in the East. Some identify it with the Kshudrágnimantha of the Rája Nirghanta. It is the Gambir-laut of Java, the Woel-bu-roenda of Ceylon, and the Sanfu-mun of Cochin-China. Ainslie says the juice of the leaves and root is considered alterative in scrofulous and venereal affections, the dose being a tablespoonful with or without a little castor oil. Rheede speaks of the use of the dried leaves for the same purpose, and of a poultice of the leaves to resolve buboes; he also says a bath prepared with them is used in mania, while the root boiled in oil affords a liniment useful in rheumatism. *C. inerme* is the *Jasminum litoreum* and *Pharmacium litoreum* of Rumphius (Lib. vii. cap. 47), who says the Amboinan name is Wale-puti-lohaha, which means 'white strand cord'. The Malays and Macassars administer the berries or the root to people poisoned by eating unwholesome fish; the leaves smeared with oil are heated over the fire and applied to recent wounds; they are also one of the leaves used for preparing the green rice of the Malays; he concludes by saying 'larga ac fausta natura in cunctis fere litoribus hanc obviam profert plantam'. In Bombay the plant has a great reputation as a febrifuge; the juice of the leaves is used in doses of half an ounce. It is mucilaginous, very bitter, somewhat saline, and with a fragrant, apple-like odour. The medicinal properties of C. *inerme* closely resemble those of Chiretta."

Woodrow (1910) says much the same, namely that this plant "Is well known on eastern shores from its medicinal properties, which (Pharm. Ind., III., 77) resemble those of Chiretta; the dried leaves in infusion and tincture, and the juice of the fresh plant in ½ oz. doses, have a reputation as febrifuge and alterative in scrofulous and allied affections." In his 1889 work he notes that "The leaves are valued as a febrifuge and the plant assumes a neat habit when pruned occasionally".

Kirtikar & Basu (1918) and Nadkarni (1927) also report that the roots, boiled in oil, are applied in a liniment to treat rheumatism. A tincture or decoction of the leaves is used to treat both intermittent and remittent fevera and as a general substitute for quinine. Blatter and his associates (1935) repeat all the above information virtually verbatim. Sastri (1950) also repeats much of the same information, adding, however, that the Chiretta referred to is *Swertia chiryita* Buch.-Ham. and that the amorphous bitter principle in the leaves is accompanied by a resin, a gum "and a brown colouring matter. Steam distillation yields a stearopten-like body having the fruity odour of the fresh plant. The other extract is fragrant. The ash of the leaves is rich in sodium chloride." Dastur (1952) repeats much the same information regarding the plant's use as an alterative, febriguge, and in the treatment of venereal and scrofulpus diseases, recent wounds, buboes, mania, itches, and rheumatism. Bor & Raizada (1954) add that a tonic is made from the wood, roots, and leaves. Pattnaik (1956) says that it is used as a febrifuge in Orissa, where it blossoms from December to April.

Patel (1971) asserts that the plant is cultivated for hedges in Gujarat, where the juice of the fresh leaves is, again, used as an alterative in treating venereal diseases; in his 1963 work he refers to the plant as a "very hardy and quick growing shrub very suitable for hedges". Bhalla and his associates (1982) confirms its use in treating scrofulous and venereal diseases. Trimen (1895) states "I do not know that it is used in native medicine here [Sri Lanka], but in India the plant is much esteemed as an alterative and tonic." Hu (1981) tells us that it is readily procurable in the medicinal herb markets in China under the name "Ramus Clerodendri Inermis"; Walden & Hu (1984) repeat that it is used medicinally in China. In Hainan Lau asserts that its leaves in boiling water are used to wash boils.

Alexander (1971) avers that in Hong Kong "Local herbalists use its stems and leaves in the treatment of malaria and skin diseases". On Okinawa Sonohara and his associates (1952) report the use of its wood as fuel.

Burkill (1935) informs us that the plant is not used by the Malays, but is regarded as medicinal in Celebes, the Philippines,and Guam. Rumpf (1747) avers that the sailors of Macassar (Celebes) always took its fruits and roots to sea with them, the seeds being considered the more useful because a decoction made from the pounded seeds was used when the "stomach had been upset by eating poisonous fish, crabs, &c." He also claims that the leaves, if eaten with rice, will increase the appetite.

Guerrero (1921, 1929) reports that the decocted roots are used in the Philippines as a febrifuge and general alterative, while a poultice made from the leaves serves as a resolvent. Quisumbing (1951) summarizes as follows: "the bitter principle of the leaves is entirely removed by ether, and subsequent treatment by alcohol and water affords extracts which are free from any bitterness. In its dual nature, this bitter principal shows a very remarkable resemblance to that found in Chiretta (*Swertia chirata*), a gentianaceous plant" and that the ash contains 24.01 percent of sodium chloride.

Miquel (1867) reports that the fruits were in his day sent from Celebes to Java for use as a medicine against dysentery. Safford (1905) reports that "The wood, the root, and the leaves are bitter, and are used by the natives of Guam, the Philippines, and Samoa as a remedy for intermittent fevers. The leaves, made into poultices, applied to swellings, prevent supporation." He notes that the narrower-leaved "species or variety,........*Clerodendrum nereifolium* Wall." is preferred by the natives over the broader-leaved plant."

Parham (1943) reports that in the Fiji Islands the natives consider this a very useful plant medicinally and use a tea made from the leaves when suffering from severe internal pains. Yuncker (1943) asserts that the plant is used in the preparation of native medicines on Niue Island. Pételot (1953) claims that in central Vietnam "les feuilles grillées puis bouillies servant à faire une boisson pour combattre le béribéri."

Stone (1970) avers that in Guam "The leaves are used as a poultice to prevent swelling after bruises. The roots, etc. are bitter and may still be in use as a treatment for fever." Weiner (1971) reports that the leaves are used also in Samoa in treating fevers, while in Tonga an infusion of the pounded leaves is drunk as a remedy for liver disorders and in treating ulcers. Also in Samoa. it is reported by Zepernick (1972) that "Gegen Blutbrechen zerstöszt man zusammen die Blätter der *Erythrina variegata* var. *orientalis* und des *Clerodendrum inerme*. Laut Rezept 'reibe damit ein'......Häufige Sympome und allgemeine Krankheitsbehandlung...Man bereitet eine Abkochung aus Blättern des *Clerodendrum inerme*". Duke & Ayensu (1985) tell us that both in Guam and Samoa the plant is used in the treatment of fever, headache, hematemesis, pneumonia, stomach ache, and wounds. Elsewhere it is used for seafood poisoning, blindness, buboes, ophthalmia, and rheumatism. In India it is suggested for scrofula, venereal diseases, fever, and mania. The oil from the root is used for rheumatism. In the Solomon Islands fumes from steaming leaves are used to treat eye ailments, including blindness. They assert that the leaves are a depurative, a wash for skin diseases, and in decoction for beri-beri, "and the seeds are antidote to poisonous fish, crabs, etc." This is a fair summation of most of the previously quoted literature.

Alkire reports that in the Caroline Islands the stems are used in the construction of native fish traps, the flowers are used in garlands, and the juice forms an ingredient of "some medicines". St. John & Smith (1971) found the leaves actually used as food on Futuna Island. Evans reports that on Guam *Clerodendrum inerme* is used in combination with acangoang, gasoso, and amot tumaga as a fever cure. On the same island Safford & Seale report that "all parts [are] used medicinally".

Walker & Tawada inform us that on Iriomote Island the plant is a semi-vinelike shrub growing 5--6 feet tall and is planted as wave protection along the seashores.

Salomon & George found that on Ponape Island [in the Carolines] a local native medicine is made from this species and used to "stop babies from urinating too often in their sleep". On the same island, according to Fosberg, a perfume is made from the flowers -- he also reports that on Rota Island it is used medicinally to treat backache, while on Peliliu it is used as a fish-poison (as well as a medicine). Hosaka found it used medicinally on Saipan.

On Sonsorel Island, in the Carolines, according to Berry, "When a person has a fall from a tree or while working, the leaves of this plant can be pounded, squeezed into a cup, and the juice drunk. This will help to settle the stomach after the fall and make waste disposal normal. The leaves are also pounded, mixed with coconut oil and spread on a mat for the injured person to lie on. This medicine is used every day after the fall until he is better. Both the stomach medicine and the vomit medicine naatu are used after a fall, either one may be used first, but the first medicine is used only on the day of the fall."

In addition to the many medicinal uses listed above, *Clerodendrum inerme* has numerous other uses. Maheshwari (1963) says that it is "Commonly cultivated aS [a] hedge plant along foot-paths in lawns [in Delhi, India]. [It is] Also grown as a trailing shrub to cover the stony circles and dirty areas of gardens. The leaves are considerably variable in size depending upon the habitat," and it flowers there from July to November. Navalkar (1956) also reports it being planted as hedges "and along the margins of streams". Chopra and his associates (1965) say that hedges made of this plant are "common all over India...its thick succulent leaves are very bitter and the hedge is [therefore] safe from [browsing] animals". Bose (1965) adds that the hedges so formed are "compact and clean", flowering "during the rains". Badhwar & Fernandez (1968) report that it is a "choice hedge plant" in the Himalayas. Sharma (1975) and Babu (1977) report that it is "sometimes cultivated as a hedge" in the Punjab and in Dehra Dun. Lord (1978) found it so used at Brisbane, Australia. Varma (1981) insists that it "makes a very fine hedge". Maheshwari & Singh (1965) and Stewart (1961, 1971) also speak of its ornamental use in gardens in the Punjab, in Sind, and at Rawalpindi (Pakistan).

Bailey (1935) lists only Taihoku as a source supplying this species to the horticultural trade.

On Yap Island, according to Cushing & Mitag, the flowers are used in make into garlands; in the Gilbert Islands they are used to make wreaths.

This species is listed as "one of the main sand-stabilizing plants of the deserts and semi-deserts of the world", a fact which probably accounts for its introduction in places like Brazil, Egypt, Florida, Guam, Hawaii, Iraq, Jamaica, Martinique, Mauritius, Reunion, Saudi Arabia, South Africa, and Zaire.

Graf (1963) illustrates the use of this species in topiary art, showing an "elephant" and a "dinosaur" made of it in the Feroze Mehta Hanging Gardens in Bombay, trained over wire frames, sheared every 2 weeks, and introduced from the mangrove areas nearby.

Petrov (1971) also speaks of its value as a sand-stabilizing plant. Rao and his associates (1963) report that it is employed with *Vitex negundo*, *Cyperus stoloniferus*, and *Sporobolus maderaspatanus* to stabilize the sand-dunes on Ramaswaram Island, India. Parker (1924) refers to it as "A very hardy and quick-growing shrub which might perhaps be useful for afforestation work". Garber, on Tau Island, found its wood used for making the crown crosspieces of mosquito tapa tents.

Sharaf and his associates (1969) isolated from its leaves a bitter principle soluble in water and showed that both it and an alcoholic leaf extract have ecbolic, hypertensive, and laxative properties. Also that "A sterol was isolated as crystals from the unsaponified fraction, and 6 alkaloidal components were isolated by chromatography. The sterol appeared to have no oestrogenic, androgenic, or gonadotrophic effects." Norton and his associates (1973) found that the leaf extracts had some inhibitory effects on *Nocardia* in vitro and produced some hypertension in rats, and therefore are "worthy of further study" pharmaceutically.

In regard to pests and parasites of *Clerodendrum inerme*, Leeuwen-Reijnvaan (1911) lists and illustrates various leaf- and stem-galls produced by cecidomyid gall-midges on this plant. Yamamoto (1936) found the fungus, *Cercospora kashotoensis* Yamamoto, infesting the leaves. Hansford (1961) reports the fungus, *Meliola cookeana* var. *viticis* Hansf. attacking it in Java, citing "*BO 4661*". Mani (1965) describes another cecidomyid gall-midge forming pyriform swellings on the tender shoots, citing his gall *no. 253*.

Kalani (1966) reports the ascomycete fungus, *Tryblidiella rufula*, attacking this plant; Tilak & Kale (1969) found another ascomycete, *Ophionectria clerodendri* Tilak & Kale on its dead stems in India. Venkatareddi (1969) tells us that the plant is "rarely" parasitized by the dodder, *Cuscuta reflexa* Roxb., in Indian gardens.

Pande & Yadava (1975) record the mite, *Tetranychus macfarlanei*, as a pest on this plant in the semi-arid regions of Rajasthan, India, causing the plants to become stunted in growth or even to dry up completely. Singhal, Vats, & Singh (1976) report that leaf damage may be caused by the grasshopper, *Poecilocerus pictus*, in India. Valentine found on Viti Levu (in the Fiji Islands) that the plant may often be infested by large brilliant bugs, particularly on the fruits, and by some nitidulids on the flowers.

The rather involved nomenclature and taxonomy of *C. inerme* may be summarized as follows. In the Linnean Herbarium, under genus 809 [788], *Volkameria*, sheet No. 2 is inscribed "*aculeata*" in the handwriting of Linnaeus, but is actually *C. inerme*. Sheet No. 3 is inscribed "*inermis*" in his handwriting, is correct, and, according to Savage (1945), was present in the second enumeration, and is regarded as the type (holotype) by Fletcher (1938). Sheet No. 4 is also inscribed "*inermis*" and "(V°.) *Douglassia* Houst. gen. in Millero" in Linnaeus' hand and is correct.

*Volkameria inermis* L. appears actually to be based on *Hermann 23* from Sri Lanka, deposited in the British Museum herbarium; *V. inermis* Ait. is a synonym of *C. ligustrinum* (Jacq.) R. Br.

When Linnaeus' species was transferred from *Volkameria* to *Clerodendrum* by Gaertner (1788) he noted: "*Clerodendrum inerme.* ibid. *Nir notsjil.* Rheed. mal. 5. p. 97. t. 49. bene. *Volkameria ramis inermibus.* Linn. syst. veg. 577. *Burende.* zeylonens. E collect. sem. hort. lugdb. Bacca turbinata (a), tetracollis, tetrapyrena (b), per maturitatem quadripartibilis (c.c.). Caro crassiusculo, suberosa, forso pyrenarum adnata. Pyrenae coriaceo-crustaceae, albicantes, deorsum insigniter acuminatae, superne rotundato gibbae, uniloculares (d). Semina (e) cavitati ossiculorum respondentia. Embryo (f.g.) erectus, carnosus, albus. Unicum quidem semen, suo *Clerodendro*, tribuit Burmannus, & hunc manifestum errorum suum quoque fecit Linnaeus: in omnibus enim *Pinnakolae* baccis con-constanter [sic] reperio semina quatuor, & titidem quoque *Petasitae* suo adscribit Rumphius."

Because the apparent great variability of this taxon may eventually result in its division into several subspecific taxa (as, indeed, has already been suggested by some botanists), it seems worthwhile to repeat here the original descriptions of several of the proposed specific segregates.

*Volkameria nereifolia* Roxb. was originally (1832) described as "Shrubby. Leaves tern, linear-lanceolate. Peduncles axillary, three-flowered. A shrubby species, found indigenous on the Island of Mascal, on the coast of Chittagong; where it blossoms about the close of the rains, and the seeds ripen in February. Stem short, but straight, stout and ligneous, soon dividing into many straight, nearly erect branches and branchlets; bark smooth, and of a light ash-colour and marked with light-coloured, small, elevated specks.eaves tern, rarely opposite, linear-lanceolate, entire, acute, smooth, about three inches long, and very generally under half an inch in breadth. Petioles short, and inserted on permanent elevated leaves. Peduncles axillary, much shorter than the leaves, generally three-flowered. Bractes opposite, ensiform. Calyx campanulate, mouth evenly five-toothed, permanent. Corol with a rather short, slender, curved tube, and unilateral border, composed of five, equal, oval, entire segments. Stamina twice the length of the corol, incurved or recurved, according to the length of time the flower has been expanded. Germ superior, four-celled, with one ovulum in each. Style length of the stamina. Stigma bidentate. Capsule (Berry, Gaertn.) broad-turbinate, four-grooved, size of a nutmeg, when ripe dry, and spontaneously dividing first into two and afterwards into four parts. Cortex pretty smooth, dark brown. Pulp in large quantity, somewhat spongy. Seed in each division of the capsule, oblong, tapering towards the base. Integuments two, both soft, thin and white. Perisperm none. Embryo, erect. Cotyledons conform to the seed, equal. Plumula two-lobed. Radicle inferior, the whole much like *Clerodendrum inerme.* Gaertn. i. t. 57."

Blanco's original (1837) description of his C. *capsulare* (which he kept separate from *Volkameria inermis*) is: "Tronco cuadrado por el extremo. Hojas opuestas, lanceoladas, enteras y lampiñas. Peciolos cortos. Flores axilares, en umbelas de tres flores. Cal. mui pequeño de figura de campana, con cinco dientes: dos á un lado y tres al otro. Cor. larguisima, blanca, con el tubo filiforme, algo encorvada, bilabiada. Labio superior con dos lacinias obtusas. Inferior con tres obtusas. Estam. didinamos, mui largos, fijos mas abajo de las divisiones de la corola, revueltos en la madurez de varios modos. Germen conico. Estilo un poco mas corto que los estambres. Estigma bifido. Cagilla de figura de maza, con un aposento y cuatro semillas grandes. - Arbusto que se eleva á la altura de un hombre. Es frecuente en las orillas del mar. Flor. em Jul." In his 1845 work he adds: "Parece ser variedad del *fortunatum*."

Dietrich (1843) distinguishes the three taxa accepted by him as follows: C. *inerme* --"fol. ovatis vel ovalibus calycibusque glabris; ramis compressis; tubo corollae elongato....In Ind. or. China et Nov. Holl." C. *commersonii* -- "fol. ovatis utrinque attenuatis integerrimis glabris; corymbis axillaribus trichotomis pubescentibus; tubo corollae elongato....In uns. Philippin." C. *coromandelianum* -- "fol. ovatis acutis integerrimis glaberrimis; panicula terminali corymbosa. In Coromandelia et Nov. Holl." The third of these is obviously a description mostly of C. *floribundum* var. *latifolium* F. Muell.

Gray's original (1862) description of var. *oceanicum* is: "foliis majoribus (2½--5-pollicaribus) magis acuminatis; calyce truncato denticulis 5 minutis; cymis nunc 5--7-floris. -- Samoan, Tonga, and Feejee Islands. This must be Forster's *Volkameria inermis*, and perhaps Sprengel's *Clerodendron Commersonii*. I have seen no intermediate forms (though they probably occur) between this and the true C. *inerme* of India, &c., which has smaller and blunter leaves, and, as described by Schauer, a distinctly 5-toothed calyx, 'dentibus lato-triangularibus acutis.'"

Clarke (1885), in keeping C. *inerme* and C. *neriifolium* apart, says for the latter: "Leaves mostly ternate, 3½ by 1¼ in.; or, in the extreme type form of Roxburgh, sublinear, 4½ by 1/3 in. Cymes and drupe rather larger than in C. *inerme*. Calyx often ½ in. diam. in fruit. -- Otherwise as C. *inerme*, of which this may be a var., as Bentham and Kurz have treated it."

Kuntze (1891) gives an interesting discussion of his concept of C. *inerme*:"*Cl. inerme* Gaertn. 1788, R. Br. 1811 (*Volkameria i.* L.) $\alpha$ *ovalifolium* OK. (= $\alpha$ *genuina* S. Kurz 1877 = *Ovieda ovalifolia* Juss. 1806 in Ann. mus. VIII 76 aus Pondicherry; von Schauer in DC. prod. vergessen; = *Cl. ovatum* Poir. 1816) Folia obtusa. Hongkong. Die Früchte sind meist kreiselförmig, wie sie auch Jussieu beschreibt; sie ändern aber (bei $\alpha$ - $\gamma$ ) selten auch fast kugelig (= f. *subglobosa* OKtze.) und länger (1:2--2½) fast keulenförmig = f. *corynecarpa* O. Ktze.; ausserdem beschreibt noch Clarke ein v. *macrocarpa* mit 2--3 X grösseren Früchten. *Ovieda ovalifolia* Juss. = *Cl. ovatum* Poir. ward von Steudel irrig mit dem australischen *Clerodendron ovatum* R. Br. = *Cl. medium** R. Br. prod. 510 em. incl. *Cl. attenuatum, floribundum, ovatum, coriaceum* R. Br. l. c. 511) identificirt; Schauer in

DC. prod. XI citirt hierzu *Volkameria inermis* L. fl.zeyl. p. 231, was Clarke in fl. brit. India copirt; beiden haben übersehen, dass Linné in der fl. zeyl. noch gar keine Speciesnamen hatte, auch steht *Volkameria* fl.zeyl. nicht p. 231, sonder under Nr. 231. β *latifolium* O. Ktze. Folia ovata acuta (1:±2) Java: Batavia. γ *neriifolium* S. Kurz (Wall.) Folia lanceolata (1:±3) Anam: Turong."

If Kuntze is correct in this interpretation of Jussieu's *Ovieda ovalifolia*, then this binomial belongs in the synonymy of *C. inerme* instead of in that of *C. floribundum* var. *latifolium* F. Muell. where it has been placed by me in the present series of notes (59: 427).

Prain (1903) keeps *C. inerme* and *C. commersonii* separate, but adopts Wallich's *C. neriifolium* for *C. commersonii*.

Brandis (1906) regards the true *C. inerme* as from Sri Lanka, Malaya, China, New Guinea, northern Australia, Taiwan, and Polynesia and comments that it is "Closely allied " to *C. neriifolium* Wall. from the "Sea coast of Chittagong, Aracan and Tenasserim: L[eaves] frequently ternate, linear or lanceolate, 2--4 in. long, drupe larger."

Merrill (1912) says: "The type of *Clerodendron commersonii* (Poir.) Spreng. was from the Philippines, Poiret stating that it was collected by Commerson; like the other Philippine plants ascribed to Commerson as collector, it was in all probability collected by Sonnerat." In his 1917 work he says that "several authors have maintained the Malayan-Polynesian form specifically distinct from the typical Indian *Clerodendron inerme* (Linn.) Gaertn. If this distinction is maintained, the Malayan-Polynesian form must be called *Clerodendron commersonii* (Poir.) Spreng., which is the oldest valid name for it. *Jasminum litoreum* was first reduced by Linnaeus to *Volkameria inermis* Linn. in Stickman Herb. Am. (1754) 19, Amoen. Acad. 4 (1759) 129, Syst. ed. 10 (1759) 1122, and all succeeding authors have followed Linnaeus, citing the Rumphian figure under either *Volkameria inermis* Linn. or *Clerodendron inerme* Gaertn.

In his 1918 work Merrill maintains *C. commersonii* (Poir.) Spreng. as distinct from *C. inerme*, with *C. neriifolium* Wall. and *C. capsulare* Blanco as synonyms of the former, noting that "This species is common along muddy shores and tidal streams throughout the Philippines. It is generally retained as a species distinct from *C. inerme* Gaertn., but, if distinct, then Poiret's specific name is the older. The type of *Volkameria commersonii* Poir. was from the Philippines (see Merrill in Philip. Journ. Sci. 7 (1912) Bot. 245." In his 1923 wprk he reunites the two taxa.

Domin (1928) adopts *C. commersonii* Spreng. as the name for the Australian population, whose natural range he gives as "von der malayischen Halbinsel über Malaya und die Philippinen nach China, Polynesien und Australien (Nord-Australien, Queensland, nördl. N. S. Wales)." "Das echte *C. inerme* Gaertn, non R. Br. (=*Volkameria inermis* L.) ist auf Ost-Indien und Ceylon beschränkt. O. Kuntze...halt aber beide für konspezifisch."

Merrill, in 1935, asserts that Loureiro's (1790) *Volkameria inermis* Linn. was based on a specimen "Habitat inculta prope Cantonem Sinarum" preserved in the Paris herbarium, and that the species "is common in suitable habitats near Canton".

Fletcher (1938) regards the type of C. *neriifolium* as from Burma. Lourteig (1966) affirms that Burman's *Jasminum glanduliferum, foetidum, Zeylanicum* is based on *P. Hermann 24*.

Fosberg, Sachet, & Oliver (1979) regard C. *commersonii* (Poir.) Spreng. and C. *nereifolium* Wall. as synonyms of C. *inerme* var. *inerme* -- as distinct from C. *inerme* var. *oceanicum* A. Gray.

*Clerodendrum ovatum* Poir. is based on a plant collected at Pondichery, Union Territory (India).

In regard to the various honomyns referred to in the synonymy of C. *inerme*, it should be noted, in passing, that *Ovieda inermis* Burm. f. (1894) and *O. inermis* Jacks. (1921) are synonyms of *Clerodendrum indicum* (L.) Kuntze; *Volkameria inermis* Blanco (1837) is a synonym of *Clerodendrum intermedium* Low; *Volkameria inermis* Reinw. ex Blume, Mus. Bot. Lugd. Bat. 1: 239 (1849) is *Geniostoma rupestre* Forst., in the *Loganiaceae*; *Volkameria inermis* Sessé & Moc. (1976) is *Clerodendrum ligustrinum* (Jacq.) R. Br.; and *Volkameria inermis* var. β Ait. is also *Clerodendrum ligustrinum* (Jacq.) R. Br.

*Clerodendron condensatum* Miq. has been regarded by some authors as another synonym of C. *inerme*, but I regard it as representing C. *bracteatum* var. *sumatranum* Ridl.

In should perhaps be pointed out here that some recent workers use the name, C. *inerme* var. *oceanicum* A. Gray for the large-leaved Pacific Oceanica population of the species, well represented by such collections as *Canfield 623, Raylerson 781,* and *Wilkes s.n.* [Tonga]. Other authors use the name, C. *nereifolium* var. *lanceolatum* Wall. for the form with narrowly lamceolate leaf-blades which are typically 7.5--10 cm. long and only 8--14 mm. wide, typified by *Wallich 1789β* from the Calcutta Botanical Garden. *Kuntze 4247* from Java is the type collection of C. *inerme* var. *latifolia* Kuntze, deposited in the Britton Herbarium at the New York Botanical Garden.

It it also worth mentioning here that the unnumbered Shivarajan collection, cited below [10.12.74] has the "leaves invariably acuminate as in this specimen. Possibly might be a different variety" according to the collector. It appears to me to be the C. *nereifolium* form of the species. The *Collector undetermined 297* collection, in the Buitenzorg herbarium, also appears to represent this same form. On the other hand, most of the Hong Kong collections cited below exhibit quite small-sized leaves and may possibly better be classified as representing f. *parvifolium* Mold., which see.

Some specimens examined by me are somewhat anomalous; for instance, C. B. *Clarke 33371β*, from the Sundarbuns [Bangladesh], exhibits very small leaves, the blades only 5--17 mm. long and 5--11 mm. wide. apically obtuse or emarginate -- it may not represent this species, at least, not in its typical form, although it is commonly considered as such. *Niering 644* shows fasciated stems; *Rodin 518a* and *Salsedo 123* have corolla-tubes 2 inches in length.

Numerous inaccuracies and errors occur in the literature of *Clerodendrum inerme*, among which may be mentioned the following. Clarke (1885) refers to Linnaeus' 1747 reference as page "231" instead of page 104 -- the reference actually is to genus no. 231 on page 104; Decaisne (1834) cites the Gaertner (1788) reference as "t. 5" instead of 57, the Rumpf 1747 reference as vol. "6" instead of 5, and the

Rheede 1685 reference as page "9" instead of 97. Fernandez Villar (1880) mis-cites the Schauer (1847) reference as page "60" instead of 660. Watt (1889) mis-cites the Clarke (1880) reference as page "586" instead of 589.

Merrill (1912, 1923) cites the Gamble (1908) work as being published in "1909" -- perhaps correctly so, but I have not as yet seen any evidence to indicate that the 1908 date, usually used, is incorrect. Merrill (1914) refers to a "*Clerodendron inerme* W. F. Wight", supposedly referred to by Safford (1905), but in the Safford publication the name of the plant described is plainly written "*Clerodendrum inerme* Gaertn."

Hallier (1918) cites the Pulle (1911) reference as "1910" and it is also so dated by Pulle himself (1914) -- on what evidence I do not know. Hallier (1918) also cites the Schumann & Lauterbach (1900) reference as "1901" -- again, on evidence not known to me. In the same 1918 work he mis-cites the Miquel (1858) reference as "1856", but pages 705--960 of the work in question were definitely not published until 1858.

Bakhuizen (1929, 1935), Babu (1977), and Varma (1981) all mis-cite the Gaertner 1788 reference as "t. 75" instead of 57. Fletcher (1938) cites the Gamble (1908) reference as "1908". Masamune (1955) cites the Maximowicz (1886) reference as "1887", but pages 12--121 of the Bulletin's Volume 31 were actually issued on April 15, 1886" and of the Mélanges Volume 12 also on that date. Varma (1981) mis-cites the Linnaeus (1753) reference as page "889" instead of 637. The Blume (1826) work is sometimes cited as part "9" instead of 14.

It is also worth mentioning here that Chamisso's work (1832) occurs on a page numbered "150". but this is obviously a typographic error for "105", as can be seen from the numbers of the preceding and succeeding pages.

The Hooker & Arnott (1837, 1838) references are often mis-cited as published in "1841", but pages 193--240 were actually issued in 1837 and pages 241--366 in 1838. Similarly, the Schumann (1887) work is often cited as "1888", the titlepage date, but the page herein referred to was actually issued on November 11, 1887.; likewise, the Baillon (1891) reference to the species herein discussed is often cited as published in "1892", the titlepage date for the entire volume. Again, the Lam (1924) reference is sometimes cited as "1925", the titlepage date for the volume -- the page that concerns us here appeared in 1924.

The Itô (1928) reference to our species is sometimes (as by Worsdell, 1941) dated "1927", but the evidence for this date is unknown to me. The Domin (1928) work is sometimes cited as "122 (89)"; the Foreman (1972) reference is sometimes mis-cited as "1971", the titlepage date.

Stone refers to the fruit of *Clerodendrum inerme* as a "4-lobed capsule", whereas it is actually a drupe.

In the list of citations (below) the following collections are cited as from cultivated material, even though their actual labels do not specifically indicate this: *Herb. Fischer s.n., Herb. Lugd.-Bat. 908.266-81, 908.266-82, 908.266-87, 909.83-95,* & *913.13-119, Herb.*

*Reichenbach f. s.n.*, *Herb. Rottböll s.n.*, *Herb. Stephan s.n.*, *Lane 627*, *Robinson s.n.*, and *Salim s.n.*; *Fosberg 33867* bears a label on which the collector questions that it may have been "planted?"

Hara (1948) lists an illustration of this species on fig. 2490 in some as yet unidentified (by me) Japanese work published in 1938.

The illustrations given by Baillon (1891) as *Ovieda inermis* and *O. foetida* do not pertain to *Clerodendrum inerme*. Obviously, they depict a species in the Subgenus *Cyclonema*, probably *Clerodendrum serratum* (L.) Moon, which see.

The illustration given by Mullan (1931) shows anatomical leaf structures for water storage.

Engler (1886) cites unnumbered collections of *C. inerme* from Timor, Viti Levu (Fiji Islands), and New Guinea; Schumann (1887) cites *Hollrung 212*, as well as unnumbered Naumann and Reedy collections, from New Guinea; Maxinowicz (1889) cites unnumbered collections by Loureiro and by Millett from Canton, by Vachell from Macao, by Hance from Whampoa, by Wright from Hong Kong, and by Hooker & Arnott and by Tanaka from the Ryukyu Islands, as well as *Oldham 392* from Taiwan. Schumann & Hollrung (1889) cite *Hollrung 42* from New Guinea. Drake del Castillo (1892) cites *Barclay s.n.* and *Seemann 253* from Fiji, *Wilkes U. S. Expl. Exped. s.n.* from Samoa, and unnumbered Harvey, Home, and Mathews collections from the Tongan Islands, ascribing the species to "les régions chaudes de l'Asie et de l'Océanie".

Hemsley (1894) cites unnumbered collections of Harvey, Lister, Mathews, and Moseley from the Tongan Islands, crediting the species also to New Caledonia, the Fiji Islands, and Navigator Islands [=Samoa], as well as it being "a common sea-side shrub in tropical Asia and Australia".

Schumann & Lauterbach (1900) cite from the Territory of New Guinea the following: *Hollrung 42* & *212*, *Lewandowsky 25*, and *Warburg s.n.*; from New Britain: *Dahl 52* and *Lauterbach 164*; from New Ireland: *Warburg s.n.*; from the Admiralty Islands: *Moseley s.n.*; from Bougainville: *Guppy s.n.*; and from the Marianna Islands: *Chamisso s.n.* and *Lesson s.n.*

Clarke (1904) cites *Schmidt 321* & *552d* from Kahdat Island, Thailand; Williams (1905) cites the same collections but adds *Schomburgk 242* & *274* from Thailand. Cooke (1905) cites unnumbered collections of Law from Konkan, Cooke, Graham, and Woodrow from Bombay Island, and Woodrow from Gujarat.

Ridley (1911) cites unnumbered collections by Curtis from Langkawi and by Keith from Perlis, where, he says, the plant is "Common in tidal swamps". Merrill (1912) cites *Gaudichaud s.n.* from Macao, *Henry, Kawakami, & Nakahara 822* from Taiwan, *Foxworthy 552* from Celebes, and *Volkens 244* from Yap.

Pulle (1914) cites *Gjellerup 292* and *Römer 18* from West Irian -- in his 1911 work he cites *Branderhorst 153* and *Versteeg 1007* & *1840* from the same area. Rechinger (1914) cites his *nos. 4098* & *4936* from Poperang and Bougainville Islands in the Solomons.

Hallier (1918) cites from Sri Lanka *König s.n.*; from Sumatra *Forbes 1802*; from Borneo *Hallier B.261* and *Korthals s.n.*; from Java *Boerlage s.n.* (Leiden Island); from Lombok *Elbert 593* & *2090*; from

Buton *Elbert 2683*; from Tukang-besi *Elbert 2539*; from Buru *DeVriese & Teijsmann s.n.*; from Ceram *DeVriese & Teijsmann s.n.*; from Little Ceram *Forsten s.n.* and *Warburg s.n.*: from Luzon *Hallier 3516a*; and from Yap *Hallier 3516b*, as well as *Raap 390* from Java. He also reports seeing the species on Cebu, Eten, Pingelap, Toloas, Leleh, Ponape, and Kusaie islands. Merrill (1918) cites his *Sp. Blanc. 813* from Luzon.

Moore (1921) cites *Compton 641* from Ouéré island, New Caledonia, where the species is said to be "abundant in littoral sand". Lam (1924) cites *Kraemer s.n.*, *Ledermann 14088*, and *Raymundus 305* from Korror, *Fritz s.n.* from Saipan, *Kraemer 3* from Truk, *Volkens 132* & *244* from Yap, *Ledermann 13660* from Ponape, *Moszkowski 466* from West Irian, *Dahl 52*, *Lauterbach 164*, and *Weber 26* from New Britain, and *Peekel 571* from New Ireland. Bakhuizen (1929) cites *Brass 853*, *1181*, & *1548* from New Guinea. Guillaumín (1932) cites his *no. 185* from Fila island in the New Hebrides, as well as *Guillaumín & Baumann 11142* from the same area; Hosokawa (1933) cites his *nos. 1812*, *1821*, & *2069* from Taiwan.

Bakhuizen (1935) cites *Kajewski 2244* from Bougainville and *2407* from Guadalcanal. Christophersen (1935) cites the following from the Samoan Islands: *Christophersen 2783* & *2868*, *Christophersen & Hume 2006*, *2381*, & *2453*, and *Stehlin s.n.* from Savaii; *Garber 584* & *694* from Tau; *Diefenderfer 14*, *Garber 963*, and *Wilder 74* from Tutuila; and *Christophersen 478*, *Eames 1*, and *Wilder 428* from Upolu.

Fletcher (1938) cites from Thailand as *Clerodendrum inerme*: *Bourke s.n.*, *Collins 1440*, *Kerr 3672*, *16133*, & *17037*, *Marcan 2456*, *Put 1538* & *1701*, and *Smith 928*, and as C. *neriifolium*: *Collins 96*, *Curtis s.n.*, *Kerr 2039*, *2127*, & *11693*, and *Vanpruk 839*. He gives the distribution of the former as India, Sri Lanka, Burma, Indochina, and Malaya, and of the latter as Burma, Indochina, Malaya, China, Australia, and Polynesia.

Lam & Meeuse (1945) cite *Lam 2683* from Karakalang island in the Palau group of islands, while Taylor (1950) cites his *nos. 46-1073*, *46-1137*, *46-1173*, *46-1367*, *46-1400*, *46-1480*, & *46-1493* from Rongelap and Bikini Atolls in the northern Marshall Islands. Masamune (1955) cites unnumbered collections by himself and by Kudo, Simada, and Suzuki from the Ryukyu Islands of Amamiosima, Daitozima, Iheyazima, Iriomote, Komi, Minamidaitozima, Okinawa, Takarazima, Tanegashima, and Yonasuni. Yuncker (1959) cites *Moseley s.n.* and *Yuncker 15018* & *15170* from Tongatapu, *Lister s.n.* and *Yuncker 15526* from Eua, *Yuncker 15844* from Nomuka, *Yuncker 15760* from Lifuka, and *Crosby s.n.* and *Harvey s.n.* from Vavau in the Tongan Islands; Van Royen (1960) cites his *no. 4823* from New Guinea. Li (1963) cites from Taiwan: *Faurie 257* *373*, *Henry s.n.*, *Huang 2330*, *Kawakami 7174*, *Kudo & Sizuki s.n.*, *Morimoto 29l*, *Nagasawa 89*, *Oldham 392* & *397*, *Playfair 46*, *Tanaka & Shimada 11030*, and *Wilson 9867*.

Maheshwari (1963) cites *Maheshwari 413*, *1173*, & *1285* from Delhi, India; Hatusima (1966) cites his *no. 28506*. Sebastine & Elliot (1967) cite *Sebastine 10644* from Madras; Majumdar (1969) cites unnumbered Nair and Nair & Malhutra collections from Rajasthan.

Stone (1970) cites his *nos. 3849*, *4921*, & *5078* from Guam, where, he says, it is common "along the coasts or a little way inland". Foreman (1972) cites *Kajewski 2244*, *Rechinger 4098* & *4936*, *N.G.F. 31175* & *31762*, *Craven & Schodde 499*, and *Schodde & Craven 3844* from Bougainville island; Stoddart & Fosberg (1972) cite *Fosberg 51247* and *Stoddart 1553* & *1615* from Manauli and New islands in the South Indian Sand Cays; Altschul (1973) cites *Kajewski 2407*; Fosberg, Falanruw, & Sachet (1975) cite *Moore 317* from Pagan and *Falanruw 1730* from Sarigan in the Mariana Islands.

Walker (1976) cites from the Ryukyu Islands *Wright s.n.* and specifically from Okinawa: *Hatusima 7242* & *22854*, *Moran 4995* & *5055*, *SIRI 7133*, and *Walker 7578*; from Miyako: *Fosberg 38478*; from Irabu & Shimaji: *Okuhara & Sunagawa 109*; from Ishigaki: *Fosberg 37604*; from Iriomote: *Fosberg 37769*, *Koidzumi s.n.*, *SIRI 6554*, and *Tagewa & Iwatsuki 4634*; and from Yonaguni: *Hatusima 24579*. Babu (1977) cites *Babu 33292* from Dehra Dun, India.

St. John (1977) cites *Hürliman 359* and *Kirch 306* from Niuetoptapu island in the Tongan Islands. From Taiwan Hsiao (1978) cites *Faurie 257*, *Kawakami 7174*, *Morimoto 291*, *Playfair 46*, *Tanaka & Shimada 11030*, and *Wilson 9867*; Varma (1981) cites *Varma 210* from Bhagalpur, India, while Paliwal & Singh (1982) cite their *no. 184* from Uttar Pradesh. Reis & Lipp (1982) cite *Fosberg 26733* from the Marshall Islands, *25396* from the Mariana Islands, and *47648* from the Caroline Islands. Jafri & Ghafoor, in a personal communication to me, cite unnumbered collections of Ali, Jafri, and Stewart from cultivation in Pakistan.

Herbarium material of *Clerodendrum inerme* has been misidentified and distributed in some herbaria as *Aegiphila* sp., *Clerodendron sagraei* Schau., *Glossocarya linnaei* (Thw.) Benth., *Gmelina villosa* Roxb., *Lagerstroemia indica* L., *Volkameria capitata* Willd., and *Rubiaceae*.

On the other hand, the *Meebold 3831*, distributed as *Clerodendrum inerme*, actually is C. *aculeatum* (L.) Schlecht., while *Thorel 219* is C. *cochinchinense* Dop, *Kanehira 313* is C. *cyrtophyllum* Turcz., *Clemens 42729*, *Herb. Prager 18686*, *Holtze s.n.*, and *Kreutzpointner s.n.* [H. B. Monac, 13 Oct. 1859] are C. *floribundum* R. Br., *Hardy s.n.* and *White 12401* are C. *heterophyllum* (Poir.) R. Br., *Clemens 42078* and *Sivarajan 1228* are C. *heterophyllum* f. *angustifolium* Mold., *Baymann-Bodenheimer 5072*, *Bernardi 15300*, *Burmann 10*, *Clemens & Clemens 3364*, *Comanor 896*, *Cooray 68054016R*, *Escritor Herb. Philip. Bur. Sci. 21080*, *Fosberg & al. 51218* & *53627*, *Franc 1384* & *2233*, *Guillaumin 8545*, *Herb.* Cooke *s.n.* [College Bot. Gard., Poona], *Hohenacker 78*, *Jayasuriya 1352*, *Kuntze 3683* & *3800*, *Kuriakose s.n.* [Korealam, 13-1-33], *Lohen 4425*, *St. John 24063*, *Simpson 7917*, *Sumithraarachchi & Sumithraarachchi DBS.794*, *Viellard 1049*, *Wirawan 683*, *Wright s.n.*, *Yeshoda 215* (and possibly also *Chun 1032*, *Hu 12159*, and *Woo 198*) are C. *inerme* f. *parvifolium* Mold., *Khoo & Ming N.K.002* is C. *laevifolium* Blume, *Susuki 4398* is *Ligustrum* sp., and *Meebold 17029* is not verbenaceous.

Citations: VIRGIN ISLANDS: St. Croix: *Schouw s.n.* (Cp). BRAZIL: Guanabara: *Glaziou 14164* (B, Br, N, P, P); *Strang s.n.* [Herb. Brad. 45715] (Mu). Rio de Janeiro: *Araujo 3268* [Herb. FEEMA 15460] (Ld), *4098* [Herb. FEEMA 18157] (Lc); *Araujo & Maciel 4300* [Herb. FEEMA 18970] (Fe); *Sampaio 8738* (Ja--44980, Ja, Ja). EGYPT: *Fawzi s.n.* [26.12.1952] (Gz). ZAIRE: *Vanderyst 13539* (Br). MASCARENE ISLANDS: Mauritius: *Herb. Mus. Paris s.n.* (W--2494639). PAKISTAN: Sind: *Gul s.n.* [8.10.67] (Kh); *Iqbal s.n.* [5.8.1957] (Kh). INDIA: Andhra Pradesh: *Shanta 150* (Hi--209671); *Wagh 4645* (Xa). Gujarat: *Hohrzki s.n.* [Cutch] (W--74535). Karnataka: *Bélanger 249* (L); *Saldanha 15340* (W--2653637); *Shepherd s.n.* [Mysore] (L). Kerala: *Meebold 12613* (S); *Stocks, Law, Etc. s.n.* [Malabar, Concan] (L); *R. Willis s.n.* [X.94] (Gz). Madhya Pradesh: *Nafday 124* (Ba). Maharashtra: *Ezekiel 30397* (Xa); *Herb. Blatter 19* (Xa), *20* (Xa), *68* (Xa), *15481* (Xa), *17218* (Xa); *Patel s.n.* (Xa); *Randeria 280* (Xa), *433* (Xa); *Santapau 142.13* (Xa), *142,19* (Xa), *9850* (Xa), *21320* (Xa); *Sedgwick & Bell 3947* (Xa); *Shah 6659* (Xa), *7506* (Xa); *Shenay 140* (Xa), *5211* (Xa). Tamil Nadu: *Collector undetermined s.n.* [1850] (L); *Kuriakose s.n.* [18-1-33] (N, N); *Wallich 1788F* (L); *R. Wight 2318* (L, Mu--1402, S); *Yeshoda 215* (N). Union Territory: *Collector undetermined s.n.* [Pondichery, Juillet 1803] (L). Uttar Pradesh: *Wallich 1789/4* (L). West Bengal: *C. B. Clarke 8481* (L), *21667* (W--802815), *33371b* (X); *Collector undetermined 297* (Bz--19670, Bz--19671); *Heinig & Gammie s.n.* [Bengal] (Na--10124); *Jenkins s.n.* [Bengal] (Ac); *S. Kurz s.n.* [Mutlah] (Bz--19669, W--261276). State undetermined: *Collector undetermined s.n.* (S); *Herb. Schumacher s.n.* (L); *Herb. Vahl s.n.* (Cp); *Heyne s.n.* (L); *Hohenacker 78* (X); *König s.n.* (Le, S); *Minby s.n.* (X); *Sparrman 14* (S); *Wallich 1788/3* (L). SOUTH INDIAN SAND CAYS: Juhu: *Acland 962* (Xa). Manauli: *Fosberg 51247* (W--2669637); *Stoddart 1553* (W--2625050) New: *Stoddart 1615* (W--2625114). SALSETTE ISLAND: *Acland 963* (Xa). MALDIVE ISLANDS: Malé: *Fosberg 36825* (N, W--2431011); *Haly s.n.* [1892] (Pd); *Willis 118* (Pd). SRI LANKA: *Amaratunga 332* (Pd), *1890* (Pd); *Cooray 69092807R* (Ld, Pd, W--2612072); *L. H. Cramer 3362* (W--2760846); *Davidse 7773* (Ld, W--2803431); *Dubuy s.n.* [Aug. 27, 1860] (L); *Fosberg & Balakrishnan 53455* (Ac, W--2750170); *Fosberg, Mueller-Dombois, Wirawan, Cooray, & Balakrishnan 50907* (W--2676594); *Gardner s.n.* [Thwaites C.P. 1949] (Br, L, X), *s.n.* [C.P. 1949, Galle] (Pd), *s.n.* [C.P. 1949, Jaffna] (Pd), *s.n.* [C.P. 1949, Negumbo] (Pd, Pd); *Grupe 103* (Pd, W--2611852), *120* (W--2611846); *Herb. Linnaeus 809/2* (Ls, N--photo), *809/3* (Ls--type, N--photo of type), *809/4* (Ls, N--photo); *Moldenke, Moldenke, & Jayasuriya 28272* (Ac, Gz, Kh, Ld, Pd, Tu, W--2764528); *Moldenke, Moldenke, Jayasuriya, & Sumithraarachchi 28119* (Ac, E, Gz, Kh, Ld, Pd, Tu, W--2764564); *Mueller-Dombois 68042002* (Ac, Pd, W--2612074); *Mueller-Dombois & Cooray 67121033* (Pd, W--26121076), *67121057* (Pd, W--2612075); *Waas 732* (W--2803432); *Wirawan, Cooray, & Balakrishnan 951* (Ac, N, Pd, W--2656636); *Worthington 3805* (K), *4166* (K), *4896* (K), *5143* (K). BANGLADESH: *Collector undetermined 25* (W--261277); *Hooker f. & Thomson s.n.* [Sunderbunds] (L); *T. Thomson s.n.* [Sunderbunds] (L). BURMA: Tenasserim: *Helfer 6056* (L, Mu--1459); *Malgrano s.n.* (Pd); *Wallich 1788/2* (L), *1789/1* (L). Upper Burma: *Griffith 6057/1* (L, Ut--11493, V); *S. Kurz 1044* (W--261275). ANDAMAN ISLANDS: South Andaman: *King's Collector s.n.* [28/6/90] (Pd), *s.n.* [20-10-1895] (Bz--19672). CHINA: Fukien: *Chung 2004* (Bz--19690); *En 2102* (Bz--19689); *Ging 15737* (Ws); *Po 12117* (Ur), *12961* (Um--153);

*A. N. Steward 3092* (Ca--44734); *Tai 11790* (Ur). Kwangtung: *Dahlström 348* (S); *Ekeberg s.n.* (S); *C. O. Levine s.n.* [Herb. Canton Chr. Coll. 914] (W--1091692); *McClure 625* (I), *1161* [Herb. Canton Chr. Coll. 13102] (Bz--19688, I); *Ping 1836* [Herb. Canton Chr. Coll. 13661] (Ca--287554); *Ting & Shih 1462* (Ac); *W. T. Tsang A.687* [Herb. Lingnan Univ. 19091] (N), *s.n.* [Herb. Lingnan Univ. 16650] (I); *Y. Tsiang 2077* (Bz--19686, N); *Ying 447* (Du--250188, N), *864* (Du--200927). CHINESE COASTAL ISLANDS: Hainan: *Lau 275* (B, Bi, Ca--525025, Mi, N, S, W--1629147), *3912* (N); *Lei 1080* (I), *1124* (I), *1351* (Ba); *Liang 36591* (S), *62887* (Go, N, W--1670945), *62947* (Mu, N), *66591* (N); *Tso 23038* (N); *Wang 33829* (N), *34861* (N); *Wu 1090* (Du--250183). Honam: *C. O. Levine Herb. Canton Chr. Coll. 202* (W--778578), *1126* (Ka--62837, W--778578, W--874849, W--877405, W--1010305). Lantau: *Chun 4876* (Ws); *McClure Herb. Lingnan Univ. 13102* (S); *Tak 161* [Herb. Canton Chr. Coll. 16650] (Du--250179). HONG KONG: Honk Kong Island: *Bowring & Andersson s.n.* (S); *Champion s.n.* (K); *Chan 1032* (Mi); *Dahlström 36* (S); *C. Ford s.n.* (N); *Hu 8057* (W--2697445), *8329* (W--2711244), *12065* (W--2732341); *Taam 1341* (Ba, Ca--82498, Mi, N, W--2063693); *Weiss 1589* (Bz--19691); *P. W. Woo 198* (Mi); *Woo & Woo 425* (Mi); *C. Wright s.n.* (W--44909); *Ying 2937* (N). Kowloon: *Setchell s. n.* [April 30, 1929] (Ca--383578). HONG KONG OFFSHORE ISLANDS: Central: *Hu 12159* (Mi, W--2731041). Tamon: *Hu 11970* (W--2730635). THAILAND: *Collins 1440* (W--1701227); *Cuniff 53* (Ws); *Hansen & Smitinand 12256* (Cp, Ld), *12367* (Cp, Ld); *Herb. Roy. Forest Serv. 6563* (Mi); *Larsen & Larsen 33773* (Ac, Ld); *Larsen, Smitinand, & Warncke 1216* (Ac, Ld), *1248* (Ld); *J. Schmidt 552d* (Mu--4180); *Schomburgk 242* (Pd); *Sørensen, Larsen, & Hansen 2525* (Cp); *Vanpruk 839* (Bk--13823); *F. K. Ward 37471* (Bz--19665). KOH CHANG ISLAND: *Sørensen, Larsen, & Hansen 7104* (Cp). MALAYA: Johore: *B. C. Stone 8682* (Kl--10672, Ne--33491). Malacca: *Carrick 715* (Kl--3685); *W. Griffith s.n.* [Malacca, 1845] (Br). Pahang: *Burkill & Haniff 17334* (Ca--251291); *M. R. Henderson 18499* (Bz--19666). Perak: *Scortechini 1382* (S); *Seimund s.n.* [20th Nov. 1925] (Bz--19668), *s.n.* [30th Nov. 1925] (Bz--19667). Selangor: *Collector undetermined 4634* (Kl--4635). Singapore: *Collector undetermined s.n.* (Bz--19673); *Ridley s.n.* [1896] (Bz--19674); *B. C. Stone 6240* (Kl--5162); *Togashi 6221222* (W--2594187); *Wallich 1788/1* (L, Pd). State undetermined: *Riedel s.n.* (K). MALAYAN ISLANDS: Langkawi: *B. C. Stone 10989* (Kl--17109); *Students 5A* (Kl--13703), *110* (Kl--13678); *Turnau 748* (Kl--2748); *Yap SK.320* (Kl--17650). Tioman: *Yean s.n.* (Ne--118287). VIETNAM: Annam: *Pételot 1402* (Ca--223766, W--1717018); *C. B. Robinson 1143* (N); *Squires 371* (Bz--19687, Ca--307207, Gg--159496, L, La, Mi, N, Pd, W--1425817); *E. H. Walker 8056* (W--2395314). Cochinchina: *Pierre 186* (B, Ca--53744), *886* (S); *Thorel 219* (B, Bz--72837, Bz--72838, Ca--54955, N, S). Pulau Condor Island: *Perry 186* in part (Ca--53973). RYUKYU ISLAND ARCHIPELAGO: Amanioshima: *Kimura & Hurusawa 23* (W--2126200), *33* (W--2126208). Iriomote: *Fosberg 37769* (W--2647368); *Walker & Tawada 6554* (W--2093836). Miyako: *Fosberg 38479* (W--2647398). Okinawa: *Beauchamp 924b* (W--2620675); *W. V. Brown 1600* (Au--165926); *Hatusima 17242* (W--2243140); *Herb. Boehmer & Co. 165* (N); *Koyama, Fukuoka, & Kato 566* [Fl. Jap. Exsicc. 315] (Mu, N); *R. Moran 4995* (W--2186505), *5055* (Ca--78640, W--2186552); *Naito s.n.* [March 19, 1927] (W--2071224); *Nakamine & Moran 4995* (Bi, Ca--78457); *A. R. Phillips 47* (W--2187039), *48* (W--2187040); *E. H. Walker 7578* (W--2129644); *Walker, Sonohara, Tawada, & Amano 7133* (N). Oshima: *Faurie 3986* (V--5502). Shimoji: *Okuhara & Sunagawa 109* (W--2647397). Taketomi: *Fosberg 37604* (W--2647396). Island undetermined: *C. Wright s.n.* [Loo-Choo Islands] (T, W--66964). TAIWAN: *A. Henry s.n.* [Takow] (W--455116); *Oldham 399* (T); *Tanaka & Shimada 11030* (B, B, Go, La, Mi, Mu, N, S, W--1577466); *E. H. Wilson 9867* (W--1052110); *Yamamoto 1058* (N). PHILIPPINE ISLANDS: Balabac: *Ramos & Edaño, Herb. Philip. Bur. Sci. 49654* (Ca--359140), *49674* (Ca--359144, Mi). Batan: *M. Ramos, Philip. Bur. Sci. 80192* (Bz--19598, Mi). Cuyo: *Celestino, Herb. Philip. Bur. Sci. 10874* (Cm). Leyte: *Glassman 807* (Ur). Luzon: *Ahern's Collector s.n.* [Merrill Dec. Philip. Fl. 146] (Du--9530, It, Mi, N, Os, W--1584129); *Bacani, Herb. Philip. For. Bur. 16688* (L); *M. S. Clemens 17299* (Ca--304012), *s.n.* [Olongapo, Mar. 1924] (Ca--247186); *H. M. Curran, Herb. Philip. For. Bur. 6357* (Br), *16587* (L); *Curran & Merritt, Herb. Philip. For. Bur. 8402* (Bz--19603); *Elmer 8121* (L); *Gröndahl s.n.* [Manilla] (Ld--photo, N--photo, S); *Lete 277* (Du--250180); *Loher s.n.* [Rizal Prov., June 1913] (Ca--229194); *E. D. Merrill 275* (Mu--4179, Ut--22407, W--1178288), *324* (W--435309), *Sp. Blanc. 813* (Bz--19602, N, W--904495); *M. Ramos, Herb. Philip. Bur. Sci. 7444* (L), *27654* (Bz--19601, W--1376047); *Rothdauscher s.n.* [Manilla 1879] (Mu--1614, Mu--1615); *J. V. Santos 4333* (W--2246154); *Udasco, Herb. Philip. For. Bur. 27298* (Bz--19600); *R. S. Williams 321* (N, W--706937). Mindanao: *DeVore & Hoover 157* (W--449646); *Née 7* (Q); *Wilkes, U. S. Expl. Exped. s.n.* (T); *R. S. Williams 3066* (N). Mindoro: *Conklin, Philip. Nat. Herb. 18728* (W--2214847); *M. T. Cruz 210* (Ur); *E. D. Merrill 1233* (W--436203), *2392* (W--437348). Palmas: *Mearns s.n.* [Jan. 21, 1906] (W--1238342). Panay: *E. B. Copeland 124* (W--850283); *Ramos & Edaño, Herb. Philip. Bur. Sci. 31505* (Bz--19599); *Serviñas, Herb. Philip. Bur. Sci. 20669* (N, W--1238376). Papahag: *S. Olsen 877* (Ac, Cp). Polillo: *Salvoza 210* [Herb. Philip. For. Bur. 29662] (Ca--256973). Sulu: *Herre 1246* in part (Ca--498212). Tumidao: *Herre 1246* in part (Du--253260, Du--381305). Island undetermined: *Née 4* (Q), *9* (Q), *10* (Q), *12* (Q), *20* (Q). MARIANA ISLANDS: Guam: *D. Anderson 21* (Bi, N, W--2333169), *s.n.* [Nov. 1852] (S, S); *R. H. Baker s.n.* [May 6, 1945] (W--1863950); *E. H. Bryan 1212* (Bi, Bi); *M. Evans 215* (N, W--2633830, W--2633831), *1459* (N, W--2684560), *1556* (N, W--2684559), *1746* (W--2684558), *1817*(W--2684556); *Fosberg 25396* (Bi, N, W--2332928), *43423* (W--2638407); *Glassman 213* (Ur); *J. Guerrero 708* (Bi); *Hosaka 3137* (Bi, W--2333216); *R. D. Knox 847* (Mi, W--1864823); *Mc Gregor 463* (W--713124); *G. C. Moore 177* (W--1863320), *188* (Mi), *835* (W--2876301); *R. V. Moran 4367* (Bl, Ca--51846, Mi, W--2276368), *4550* (Bi, Ca--51954, Mi, W--2276435); *W. L. Necker 31* (Bi), *38* (Ca--745140, W--1863967), *184* (Mi), *218* (W--1864025); *P. Nelson 30* (Bi), *427* (N); *Rodin 518a* (Ca--789472); *Safford & Seale 1010* (W--516012), *1076* (W--516078); *R. L. Steere 43* (Mi, W--1864182), *123* (Mi, W--1864225); *B. C. Stone 5078* (Kl--5292); *Swezey s.n.* [June 16, 1936] (Bi); *J. B. Thompson 141* (W--712638), *432* (N, W--712866). Pagan: *Lamoureux 4867* (W--2784920); *Raylerson 781* (W--2996833), *1066* (W--2925425). Rota: *M.*

*Evans 1925* (N, W--2684557); *Fosberg 24954* (Bi, W--2332902), *25126* (Bi, N, W--2332914). Saipan: *Courage 68* (W--2638548); *Fosberg 25270* (Bi, N, W--2332922); *Hosaka 2988* (Bi, W--2333214); *Kanehira 914* (Bi); *W. H. Lange 21* (Bi); *H. A. Stephens 56* (Ws). Sarigan: *Falanruw 1730* (W--2684555). Tinian: *Hosaka 2870* (Bi, N, W--2333208); *Schubel 46* (Ur). PALAU ISLANDS: Anguar: *Fosberg 25934* (Bi, N, W--2332956); *St. John 21501* (Bi, W--2064511). Arakabesan: *Takamatsu 1260* (Bi). Babelthuap: *Emmons 78* (W--2684554); *Fosberg 32387* (Bi, N, W--2333093); *Salsedo 123* (N, W--2684552). Koror: *Canfield 623* (W--2878764). Palau: *Herre 45* (Bi, Du--336919, N); *Kanehira 1991* (N). Peleliu: *Canfield 427* (W--2839193); *Fosberg 47648* (N). Ulithi: *Lessa 21* (Bi). Yap: *Cushing 417* (W--2684556), *441* (Kl--8383, W--2684549), *468* (W--2684548); *Cushing & Mitag 546* (W--2684551); *Fosberg 25570* (Bi, N, W--2332948); *Hosokawa 8952* (Bi); *Kanehira 1252* (Bz--19681); *Takamatsu 1871* (Bi, Ca--805769); *Wong 521* (Bi, W--2092282). GREATER SUNDA ISLANDS: Amsterdam: *Hoogerwerf 24* (Bz--19504). Babi: *Boerlage s.n.* (Bz--19484, Bz--19485). Bangko: *Backer 29229* (Bz--19536). Batu: *Raup 94* (Bz--19642), *689* (Bz--19641). Bintan: *Blinnemeijer 6110a* (Bz-19658), *6245* (Bz--19661), *6342* (Bz--19660). Celebes: *Kaudern 201* (N); *Kjellberg 66* (Bz--19622, S), *71* (Bz--19621, S); *Koorders 19504b* [3648] (Bz--19619, Bz), *19505b* [2069] (Bz--19618), *19506b* [2796] (Bz-19617), *19512b* [284] (Bz--19615, Bz--19616); *Lam 2683* (Ut--2409A); *Meijer 10114* (W--2995311); *Noerkas 403* (Bz--19612, Bz--19613), *409* (Bz--19610, Bz--19611); *Posthumus 2664* [664] (Bz--19605); *Rachmat 179* (Bz--19606, Bz--19607), *342* (Bz--19608. Bz--19609), *809* (Bz--19620); *Teijsmann 12108* (Bz--19614). Dapoer: *Van Steenis 4467* (Bz--19489). Doerian: *Raihmet 37* (Bz--19659). Edam: *Backer 30948* (Bz--19493), *32009* (Bz--19490, Bz--19491); *Boschma 28* (Bz--19477), *33* (Bz--19476), *91* (Bz--19478), *224* (Bz--19479). Gelean: *Karta 348* (Bz--19542). Haarlem: *Van Steenis 6810* (Bz--19511). Java: *N. J. Andersson s.n.* [Febr. 1853] (S, S); *Backer 1453* (Bz--19494), *3904* (Bz--19515), *4567* (Bz--19497), *4689* (Bz--19495), *7204* (Bz--19465), *7584* (Bz--19513), *11789* (Bz--19502), *12958* (Bz--19512), *15523* (Bz--19499), *16347* (Bz--19500), *16713* (Bz--19501), *17797* (Bz--19514), *23328* (Bz--19498), *24382* (Bz--19518), *24653* (Bz--19516, Bz--19517), *32934* (Bz--19466), *32935* (Bz--19467, Bz--19468); *Bakhuizen 2028* (Bz--19473), *2369* (Bz--24887a); *Bijouwer 192* (Bz--19480); *Boerlage 7** (Bz--19481); *Buwalda 7174* (Bz--72902); *Collector undetermined s.n.* (Bz--26323); *Decaisne s.n.* [1816] (Du--166598); *Dorgelo 85* (Bz--19529); *Hallier 145* (Bz--19472), *s.n.* [22.IV.1895] (Bz--19469, Bz--19470), *s.n.* [15.II.96] (Bz--19471); *Hochreutiner 1136* (Ca--41362), *2089* (Ca--41423); *Hoed 23* (Bz--19461); *Hoogerwerf 30* (Bz--19460), *34* (Bz--19462), *s.n.* [2.8-1936] (Bz--19464); *Kollmann s.n.* (X); *Koorders 20648b* [1103*] (Bz--19527), *22068b* (Bz--19519), *22112b* [106*] (Bz--19522), *27519b* [504*] (Bz--19523), *29050b* [1197*] (Bz--19526), *29969b* [1753*] (Bz--19528), *36603b* (Bz--19520), *36853b* [1109*] (Bz--19521), *s.n.* [10.I.86] (Bz--19507); *Kuntze 4247* (N); *Leeuwen-Reijnvaan s.n.* [10 Aug. 1909] (Bz--19506); *Lörzing 570* (Bz--19509); *Rant 1077* (Bz--19474); *Slooten 2040* (Bz--19463), *2450* (Bz--19496), *2684* (Bz--19503); *Teijsmann 2918* (Ut--43907), *s.n.* (Ut--43908); *Ultee 206* (Bz--19488); *Valeton s.n.* [28 Jan. 1905] (Bz--19482); *Van Steenis 547* (Bz--19505 in part), *577* (Bz-

19505 in part); *Wanman s.n.* (S); *Wolff von Wülfing W.61* (Bz--19510); *Zollinger 2891* (X). Kalimantan: *Dunselman 163* (Bz--19437); *Hallier B.261* (Bz--19439); *Mol 152* (Bz--19438). Kambangan: *Berger 290* (Bz--19508). Kangean: *Backer 26783* (Bz--19532), *27651* (Bz--19535), *28025* (Bz--19531). Karakalang: *Lam 2683* (Bz--19623, Bz--19624). Karimandjawa: *Karta 316* (Bz--19544); *Koorders 40697b* [110] (Bz--19525), *41127b* (Bz--19524). Karimata: *Mondi 140* (Bz--19440, Bz--19441, N, Ut--34074A). Kamoedjan: *Karta 397* (Bz--19543). Klein Kombuis: *Backer 31040* (Bz--19492); *Lam 2179* (Bz--19475). Krakatoa: *Amdjah 50* (Bz-19649, Bz--19650, Bz--19651); *Backer 35395* (Bz--19647), *35397* (Bz--19646); *Beumee A.204* (Bz--19644); *Fosberg 44561* (W--2681696); *Leeuwen-Reijnvaan 3529* (Bz--19643). Labuan: *Baker & Baker s.n.* [Jan. 28, 1915] (Gg--32040). Lang: *Greshoff s.n.* (Bz--19483). Lingga: *Bünnemeijer 7020* (Bz--19654, Bz--19655). Madura: *Backer 19095* (Bz--19546), *19195* (Bz--19547); *Hofstee 87* (Bz--19545). Mamboerit: *Backer 27278* (Bz--19538, Bz--19539). Paliat: *Backer 29477* (Bz--19537). Paniki: *J. J. Smith 13* (Bz--19486, Bz--19487). Prinsen: *Borssum Waalkes 665* (Ba, N, Ng--16873). Sabah: *Baker & Baker s.n.* [Jan. 26, '15] (Gg--32039). Saboenting: *Backer 29738* (Bz--19530). Saoebi: *Backer 28262* (Bz--19534). Sarawak: *W. M. A. Brooke 8101* (W--2319574); *Carrick & Enoch JC.320* (Kl--3303); *Native Collector 1175* (Ph), *2208* (Ph). Saseel: *Backer 28698* (Bz--19540, Bz--19541). Sebangka: *Bünnemeijer 7480* (Bz--19652). Sedanau: *Van Steenis 1078* (Bz--19657). Sepapan: *Backer 28465* (Bz--19533). Simalur: *Achmad 246* (Bz--19663, Ut--52475), *826* (Bz--19662). Singkep: *Bünnemeijer 7243* (Bz--19653). Sumatra: *Forbes 1802* (Vu); *Hamel & Toroes 1302* (Mi); *Leeuwen-Reijnvaan 3140a* (Bz--19625); *Lörzing 3236* (Bz--19626), *3832* (Bz--19627), *9288* (Bz--19628); *Meer Mohr 9* (Bz--19629); *Van Steenis 35* (Bz--19631); *Voogd 1107* (Bz--19632); *Yates 936* (Ca--234095, Mi), *937* (Ca--234078), *1115* (Bz--19633, Bz--19634, L, Mi). Temaja: *M. R. Henderson 20299* (Bz--19656). Verlaten: *Backer 35396* (Bz--19648); *Boedijn 2953* (Bz--19645). LESSER SUNDA ISLANDS: Bali: *Van Steenis 7586a* (Bz--19548); *Voogd 1684* (Bz--19549). Banka: *Bünnemeijer 1478* (Bz--19637), *1937* (Bz--19636), *2466* (Bz--19635, Bz--25517). Lombok: *Wallace s.n.* [1856] (F--404441). Savoe: *Bloenbergen 3288* (Bz--72639). Sebesi: *Leeuwen-Reijnvaan 5193* (Bz--19630). Sumbawa: *Bloembergen 3078* (Bz--72638); *Posthumus 3020* (Bz--19550). Timor: *Herb. Torrey s.n.* (T). MOLUCCA ISLANDS: Amboina: *Binnendyk s.n.* [Ambon] (Bz--19558, Bz--19559); *Boerlage 139* (Bz--19560, Bz--19561), *375* (Bz--19553, Bz--19554), *562* (Bz--19555, Bz--19556); *Rant 282* (Bz--19551), *508a* (Bz--19557); *C. B. Robinson 297* (Bz--19552, N, W--654615); *Teijsmann s.n.* [Ema, June] (Bz--19564, Bz--19565); *Treub 361* (Bz--19562, Bz--19563). Ceram: *Buwalda 6033* (Bz--72949); *Kornassi 440* (Bz--19566, Ut--80826), *769* (Bz--19569, Ca-265972, Ut--80824), *901* (Bz--19567, Bz--19568, Ca--236049, Ut--80825); *Teijsmann 5020 H.B.* (Bz--19570). Halmahera: *Anang 416* (Bz--72993), *573* (Bz--72992). Jamdena: *Buwalda 4454* (Bz--72574); *Pleyte 160* (Ba). Key: *Jaheri 196* (Bz--19571, Bz--19572). Mysole: *Teijsmann s.n.* [Mysoli waigama] (Bz--19591). Sanana: *Bloembergen 4390* (Bz--19573). Ternate: *Beguin 934* (Bz--19576), *1659* (Bz--19574), (Bz--19575). AROE ISLANDS: Kobroör: *Buwalda 4982* (Bz--72738). CAROLINE ISLANDS: Corol: *Kanehira 150* (Bi). Dublon: *Fosberg 24545* (Bi, N, W--2332881); *Takamatsu 148* (Bi). Falalis: *Alkire 91* (W--2669075). Hare: *Fosberg 26078* (Bi, W--2332964); *Hosaka 3439* (Bi, W--2333224). Ifaluk: *Abbott & Bates 25* (Bi). Kaujema: *Hosaka 3463* (Bi, N, W--2333227). Kusaie: *Takamatsu 374* (Bi). Kutu: *D. Anderson 1206* (Bi, N, W--2242643). Lamotrek: *Fosberg & Evans 46797* (N, W--2717851). Lukunor: *D. Anderson 2187* (Bi, N, W--2242733). Moch: *D. Anderson 973* (Bi, N, W--2242534). Moen: *D. Anderson 725* (Bi, N, W--2333190); *Hosaka 2774* (Bi, N, W--2333203). Narlap: *Hosaka 3569* (N, W--2333230). Nukuoro: *Carroll 27* (W--2684380), *84* (W--2684370). Nunakita: *Fosberg 26141* (Bi, N, W--2332968). Peleliu: *Fosberg 25999* (Bi, N, W--2332959) *47648* (W--2684505). Pingelap: *St. John 21472* (Bi). Pis: *M. Evans 815* (W--2684683); *Fosberg 24646* (Bi, N, W--2332886). Ponape: *Fosberg 26326* (Bi, N, W--2332974); *Glassman 2464* (Bi, W); *Hosaka 3569* (Bi); *Riesenberg 61* (Bi); *Salomon, George, & George 16* (W--2633741). Satawal: *Fosberg 46852* (W--2684503). Sinukutai: *Fosberg 26171* (Bi, N, W-2332971). Sonsorol: *P. T. Berry 63* (W--2684553). Ta: *D. Anderson 1075* (Bi, N, W--2242604). Tol: *Hosaka 2730* (Bi, N, W--2333199); *Takamatsu 28* (Bi). Truk: *Hosokawa 6544* (Bi); *Pelzer 25* (W--2432050), *50* (W--2431386); *Spence 435* (W--2963758); *Wong 119* (Bi, W--2608458). Uoala: *H. F. Moore 121* (W--419856). Utagel: *Wong 6* (Bi, N). Wattahai: *Fosberg 47074* (W--2684504). Woleai: *Wong 6* (W--2333231). MARSHALL ISLANDS: Ailuk: *Fosberg 33945* (Bi, N, W--2212037). Bikajle: *Fosberg 26803* (Bi, N, W--2332993). Bikini: *W. R. Taylor 46-1073* (Bi, Ca--909264, Mi, S, W--1864437), *46-1137* (Ca--909221, Mi, S, W--2063929), *46-1172* (Ca--909265, Mi, N, S, W--2063942). Dalap: *Fosberg 26904* (Bi, N, W--2332999). Ebeye: *Fosberg 31213* (Bi, N, W--2333016). Eniwetok: *W. R. Taylor 46-1367* (Ca--909284, Go, Mi, S, W--2063982), *46-1480* (Go). Imruj: *Fosberg 26733* (Bi, N, W--2332988). Ine: *D. Anderson 3617* (Ba, Bi, N, W--2242776); *Hatheway 775* (Bi, W--2243018); *E. L. Stone 1009* (W--2242908). Jemo: *Fosberg 33867* (Bi, W--2211980). Kwajalein: *Fosberg 26468* (Bi, W--2332977). Lado: *Fosberg 33846* (Bi, N). Lae: *Fosberg 34067* (Ba, Bi, W--2212107). Likiep: *Fosberg 27008* (Bi, N, W--2333006), *33846* (W--2211977). Mellu: *W. R. Taylor 46-1493* (Mi, S, W--1864546). Rongelap: *W. R. Taylor 46-1400* (Bi, Ca--909295, Mi, Mi, S, W--2063989), *46-1480* (Mi, W--1864540). Sifo: *Fosberg 36697* (Bi, W--2399787). Ujelang: *Fosberg 34186* (W--2212165). Utirik: *Fosberg 33673* (Ba, Bi, N, W--2211893). Wotho: *Fosberg 34229* (Bi, W--2399665). KAPINGAMARANGI ISLANDS: Werua: *Niering 540* (W--2585244A), *579* (W--2585173A), *644* (W--2575089A), *645* (W--2575087A). GILBERT ISLANDS: Aonteuma: *Moul 8080* (N). Bikenibeu: *Herbst & Allerton 2691* (W--2685486). Butaritari: *Herbst & Allerton 2740* (W--2685516). Tabiteuea: *Luomala 16* (Bi, Bi). NAURU ISLAND: *Fosberg 58664* (W--2882942) PHOENIX ISLANDS: Canton: *Fosberg & Stoddart 54776* (W--2680453). NEW GUINEA: Papua: *Brass 853* (Bz--19579), *1181* (Bz--19578), *1548* (Bz--19577), *21711* (Ng--17097), *21834* (Ng--17094, W--2364155); *Chalmers s.n.* [S.E. New Guinea 1878] (Mb), *s.n.* [New Guinea 1880] (Mb); *J. W. R. Koch s.n.* (Bz--19584, Bz--19585); *W. MacGregor s.n.* [near Dutch boundary 1890] (Mb), *s.n.* [1890] (Mb); *F. Mueller 8* (Mb), *46* (Mb), *s.n.* [Fly River 1890] (Mb); *Schodde & Craven 4474* (W--2896056); *Womersley & Simmonds 5049* (Ng--16923). Territory of New Guinea: *Hartley TGH.9741* (Mi); *Henty & Frodin NGF.27267* (N); *Hollrung 42* (Bz--19590, L, Mb). West Irian: *Aet 613* (Bz--72950); *Boldingh 153* (Bz--19581); *Boschproefstation 20* (Bz--19592); *Brandenhorst 153* (Bz--25516, Bz--25518, Ut--13805); *Feuilletau des Bruyn 272* (Bz--19595), *337* (Bz--19594); *Gjellerup 292* (Bz--19596 in part, Bz--85749), *292a* (Bz--19596 in part); *Jaheri s.n.* [11-4-1901] (Bz--19588), *s.n.* (Bz--19589); *Janowski 485* (Bz--19587), *526* (Bz--19586); *McKee 1682* (Ng--16857), *1683* (Ng--16877), *1685* (Ng--16876); *Peekel 30* (Bz--19593); *Pleyte 364* (Bz--72863, Bz--72864, Ng--16848); *Römer 18* (Bz--19597); *Royen 3355* (Ng--20220); *Versteeg 1007* (Bz--19580), *1840* (Bz--19582, Bz--19583, Ut--13810). NEW GUINEAN ISLANDS: Los Negros: *Streiman & Stone LAE. 53607* (Kl--14614). Misima: *Brass 27592* (S, W--2408712). Radack: *Chomipod s.n.* [Jan. 1817] (L); *Eschscholtz s.n.* (L). Saibai: *C. Stewart s.n.* (Mb). Sudest: *Brass 28113* (W--2409054). Uramu: *Gray & Floyd 8008* (Ng--16890). Yule: *F. Mueller 22* (Mb). BISMARK ARCHIPELAGO: Mussau: *Købie & Olsen 1668* (Ac, Cp). New Britain: *Croft & Katik NGF.15529* (Mu); *Dissing 2591* (Ac, C, Cp); *Floyd 6455* (Ng--16971). SOLOMON ISLANDS: Bougainville: *Kajewski 2244* (Bi, Bz--19675, Bz--19677). Guadalcanal: *Kajewski 2407* (Bi, Bz--19676, Bz--19678). New Georgia: *Maunu'u s.n.* [Brit. Solom. Isl. Prot. 6111] (W--2578577). Island undetermined: *Kusche s.n.* [Nov. 1--Dec. 28, 1920] (Gg--34496). NEW HEBRIDES: Efate: *Kajewski 185* (N). NEW CALEDONIAN ISLANDS: Maitre: *MacDaniels 2152* (Ba). New Caledonia: *Balansa 413* (B, Ca--54164); *Deplanche 1049* (L); *Franc 1122* (S), *s.n.* [Prony] (Ca--314426, W--1372313); *McKee 2110* (W--2187227); *Pancher s.n.* [1870] (L); *Schlechter 15289* [Herb. Hort. Then. I.6401] (Br). FIJI ISLANDS: Fulanga: *A. C. Smith 1187* (Bi, Ca--601469, N, S, W--1676772). Kambara: *H. F. Moore 21* (W--419762). Kandavu: *A. C. Smith 318* (Bi, Ca--601028, N, S, W--1676583). Koro: *A. C. Smith 1091* (Bi, Ca--602117, N, S, W--1676738). Moala: *E. H. Bryan 338* (Bi). Ongea Levu: *E. H. Bryan 432* (Bi). Ovalau: *J. W. Gillespie 4492* (Bi, Bi, Ca--448748, N); *A. C. Smith 8092* (Ld). Vanua Levu: *Degener & Ordonez 14154* (Bi, Ca--16722, N, N, S, Vi), *14191* (Bi, Ca--16708, N, N, S, Vi); *A. C. Smith 6611* (Bi, N, N, S). Vanua Mbalevu: *A. C. Smith 1433* (Bi, N). Viti Levu: *E. H. Bryan 192* (Bi); *O. Degener 14958* (Bi, N, N); *J. W. Gillespie 2068* (B, Bi, Ca--447704, W--159956); *W. H. Harvey s.n.* (K); *MacDaniels 445* (Ba), *1009* (Bi); *Meebold 8235* (Mu), *16496* (Mu); *Seemann 353* (Lu); *A. C. Smith 9506* (Hk); *Tothill & Tothill 670* (Bi); *J. M. Valentine 9* (Bi). TONGAN ISLANDS: Eua: *Yuncker 15526* (Bi, Ss, W--2129351, Yu). Lifuka: *Yuncker 15760* (Bi, Ss, W--2129445, Yu). Nomuka: *Yuncker 15844* (Bi, Ss, W--2129483, Yu). Tongapatu: *Banks & Solander 1769* (W--1276793); *McKern 102* (Bi); *Setchell & Parks 15201* (Ca--297669), *15246* (Ca--297661), *15253* (Bi, Ca--296885, W--1550481), *15154* (Ca--296859), *15256* (Ca--296888), *15333* (Ca--296838), *15337* (Ca--297535), *15342* (Ca--296985), *15570* (Ca--297153); *Wilkes, U. S. Expl. Exped. s.n.* [Friendly Islands] (N, W--75175); *Yuncker 15018* (Bi, Ss, W--2129148, Yu), *15170* (Bi, Ss, W--2157592, Yu). AUSTRALIA: New South Wales: *Herb. Prager 18680* (Gg--32011). Northern Territory: *Holtze 91* (L), *s.n.* [Herb. Prager 18686] (Gg--32015), *s.n.* (Cm); *F. Schultz 520* (L); *Specht 945* (W--2125059), *1193* (W--2125239). Queensland: *Bowman s.n.* (Sg--16048); *R. Brown s.n.* (L); *Brass 2347* (B, Bi); *Du Rietz 4437* (Go, S); *Flecker 988* (Qu); *Michael 584* (Bz--19683); *F. R. Morris*

*8709* (Qu); Storr 12973 (Go). GREAT BARRIER REEF: Coombe: Stoddart 4019 (W--2759667). Eagle: Stoddart 4806 [Queensl. Herb. AQ0014729] (W--2759564). East Hope: Stoddart 4441 (W--2759715). Green: Cummings s.n. [17/1/1937] (Go); Stoddart 4237 (W--2759908). Green Ant: Stoddart 4334 (W--2759508). Lizard: Fosberg 54986 (W--2759998), 54994 (W--2739044). Morris: Stoddart 4965 (W--2744186). Newton: Stoddart 4129 (W--2759772). Palm: Bancroft s.n. (Bz--19682). Pipon: Stoddart 4890 [Queensl. Herb. AQ0014771] (W--2744028). Saunders: Stoddart 5077 [Queensl. Herb. AQ0014893] (W--2744226). Three Isles: Stoddart 4507 (W--2759898). Two Isles: Stoddart 4645 [Queensl. Herb. AQ0014834] (W--2759834). HAWAIIAN ISLANDS: Oahu: *Grenzell s.n.* [Honolulu, June 1927] (S). SAMOAN ISLANDS: Namua: *Whistler W.1882* (W--2728144). Ofu: *Yuncker 9562* (Bi, Dp--28987). Savaii: *Bristol 2343* (W--2675676); *E. Christophersen 2783* (B, Bi, Ca--592215, Ca--948912, N), *2868* (Bi, W--1967870); *Christophersen & Hume 2006* (B, Bi, Bz--19679, Ca--592214, N, W--1655718), *2381* (Bi), *2453* (Bi), *2496* (Bi); *Vaupel 99* (Bi, Ca--882454, Mu, W--1378558); *A. K. Walker s.n.* [31-XII-1968] (W--2659994). Tau: *D. W. Garber 584* (Bi, Ca--592217), *694* (Bi, N, N); *Whistler W.1332* (W--2728235); *Yuncker 9096* (Bi, Dp--28988). Tomenua: *C. Weber s.n.* (Mu--1616). Totuila: *Diefenderfer 14* (Bi); *D. W. Garber 963* (Bi); *Herb. Crooke s.n.* (N); *Kuntze 23014* (N); *Meebold 26583* (Mu); *Seale s.n.* [May 20, 1929] (Gg--176104); *W. A. Setchell 97* (Bi, Ca--216013), *292* (Ca--216014. W--1271154); *Whistler W.2836* (W--2996142); *Wilder 74* (Bi); *Wisner 22* (Bi); *Yuncker 9369* (Bi, Dp--28991). Upolu: *Bristol 1997* (Kl--10581, W--2675819), *2383* (W--2675690); *E. Christophersen 478* (Bi, Bz--19680, W--1704028); *Eames l* (B, Bi, Ca--592216, N, W--1704027); *Rechinger & Rechinger 1278* (W--1718743); *Reinecke 174* (Bi, X), *547* (Bi, Bz--19684, X); *Wilder 428* (Bi). NIUE: *Yuncker 9733* (Bi, Dp--28982, Mi), *9814* (Bi, Dp--28981), *10042* (Bi, Dp--28983, W--1968002), *10218* (Bi, Ca--948851, Dp--28985). LINE ISLANDS: Christmas: *C. R. Long 3487* (W--2659710). Fanning: *C. R. Long 3546* (W--2659709), *3570* (W--2659711). Hull: *C. R. Long 2008* (W--2659719). Sydney: *C. R. Long 2592* (W--2659718). Washington: *Herms & Kirby s.n.* [May--Sept. 1924] (Ca--237706); *C. R. Long 1866* (W--2659708). CULTIVATED: Austria: *Boos s.n.* (V, V); *Herb. Endlicher s.n.* (V); *Herb. Hort. Bot. Schönbrunn s.n.* (V); *Herb. Portenschlag s. n.* (V); *Herb. Reichenbach f. s.n.* (V, V, V, V); *Herb. Trattinnek s.n.* (V); *Herb. Univ. Ludw. Maximil. s.n.* (Mu--805). Barbados: *Lane 627* (Ed). Belgium: *Herb. Martius s.n.* [H. B.] (Br); *Herb. Pollart de Canidri s.n.* (Br); *Lejeune s.n.* (Br); *Nyst s.n.* (Br). Brazil: *Glaziou 14163* (Cb, Cb, Cp, K, L, Ld--photo, N, N--photo); *Rudio 133* (N). Canton Island: *Fosberg 55720* (W--2785010). Cape of Good Hope: *Herb. Capetown Bot. Gard. 34* (S). Cuba: *C. Wright s.n.* [Herb. Sauvalle 1780 in part] (Hv, Hv), *s.n.* [Herb. Sauvalle 1781½] (Hv), *s.n.* [cult.] (G). Denmark: *Herb. Liebmann s.n.* (Cp); *Herb. Rottböll s.n.* (Cp). Egypt: *Boulos s.n.* [July 1952] (Gz), *s.n.* [25/9/1952] (Gz), *s.n.* [Doqqi] (Gz); *Mahdi s.n.* [12/7/1964] (Gz, Gz, Gz, Gz); *V. Täckholm s. n.* [31/7/1959] (Gz), *s.n.* [22/9/1959] (Gz), *s.n.* [29/10/1959] (Gz), *s.n.* [30/10/1959] (Gz). England: *Herb. Hort. Kew s.n.* [Jun3 1888] (K, K). Fanning Island: *Fosberg 11000* (W--2645426). Florida: *R. A. Young s.n.* [F.H.B.39192; S.P.L.52421] (Ar--3292, Ar--19836). France:

*Dunn s.n.* [Hort. Monsp.] (L); *Herb. Hort. Bot. Paris s.n.* [1846] (Cb), *s.n.* (Br, Cb, K, Ld--photo, N--photo, S); *Herb. Hort. Monspel. s.n.* [Aug. 1847] (Br), *s.n.* (K); *Herb. Jard. Bot. de Cels s.n.* [20 Sept. 1818] (K); *Herb. Jard. des Plantes s.n.*[7 Sept. 1822] (K); *Mühlenbeck s.n.* [Hort. Baumann 1834] (M); *Perrottet s.n.* [Jard. des Plant. Paris 1818] (Cb); *Robert s.n.* [Hort. Telon. 1807] (L). Germany: *Herb. Bernhardi s.n.* [H. Erf.] (B); *Herb. Braun s.n.* (L); *Herb. Hort. Bot. Berol. s.n.* [Juni 1904] (B), *s.n.* [1804] (Le), *s.n.* (B, B); *Herb. Hort. Bot. Monac. s.n.* [6.VIII.1849] (Mu--806); *Herb. Reichenbach f. s.n.* [H. B. Berol. 1803] (V); *Herb. Sprengel s.n.* (B); *Herb. Zuccarini s.n.* [H. B. Monac. 1824] (Mu--808); *Hiendlmayr s.n.* [ex horto Breiteriano] (Mu--1403); *Kreuzpointner s.n.* [Hort. Bot. Monac. 13 Oct. 1859] (Mu--807); *Rühlmann 1794* (B); *Schreber s.n.* (Mu--804); *Wahlberg s.n.* [Ludwigsburg] (S). Gilbert Islands: *Moul 8298* (Bi, W--2245977). Guam: *M. Evans 1697* (W--2684561). Hawaiian Islands: *Wawra 2503* (V). India: *Gamble 17633* (K), *21790* (K); *Herb. T. Cooke s.n.* [College Bot. Gard. Poona, Aug. '92] (Mi, Pa); *Herb. Hort. Bot. Calcutt. s.n.* (K, K, Le, Le, Mu--811, Mu--1150, N, W--2497129); *Herb. Hort. Bot. Seramp. s.n.* (Cp); *Herb. Pierre s.n.* [Cult. in Hort. Bot. Calcut.] (B); *Shah 6524* (Xa); *Shivarajan s.n.* [10.12.74] (Ld); *T. Thomson 216* (K); *Wallich 818* in part (Bm, Cp), *1788/D* (B), *1789/3* (K, L), *s.n.* (Cp). Italy: *Paperini s.n.* [Pisa 1814] (Ld--photo, N--photo, S). Jamaica: *March 1732* (K). Java: *Herb. Hort. Bot. Bogor. 198* (Bz--19457), *18615* (Bz--19442), *19664* (Bz), *II.Q.C.10* (Bz--25755), *X.F.10* (Bz--19446, Bz--25511, Bz--25512), *10a* (Bz--19444, Bz--19445), *X.F.18* (Bz--25556), *X.F.20* (Bz--19447, Bz--19448, Bz--25513), *X.F.21* (Bz--19449, Bz--19450, Bz--19451, Bz--19452, Bz--25514, Bz--25557), *XI.G.71a* (Bz--19453, Bz--19454, Bz--25515), *XI.G.90a* (Bz--25794, Bz--26537), *XI.G.93a* (Bz--25797, Bz--25798, Bz--26594), *XV.F.15* (Bz--26316, Bz--26317), *XV.F.15a* (Bz--19443), *XV.F.16* (Bz--19459), *XV.F.16a* (Bz--19458), *XV.F.17* (Bz--26321), *XV.F.18* (Bz--26322), *XV.F.18a* (Bz), *XV.F.28* (Bz--26336, Bz--26342, Bz), *s.n.* (Bz--19455, Bz--19456); *Teijsmann s.n.* [Hort. Bot. Bogor. 1860] (Le), *s.n.* [Hort. Bot. Bogor. 1867] (Le, Le). Martinique: *Duss 4444* (B). Natal: *J. M. Wood s.n.* (Na--9890). Netherlands: *Herb. Mus. Bot. Acad. Rheno-Traiect. s.n.* (Ut); *Herb. Lugd.-Bat. 908.266-81*(Le), *908.266-82* (Le), *908.266-87* (Le), *908.266-88* (Le), *913.13-119* (Le). New York: *Eftyhethes, N. Y. Bot. Gard. Cult. Pl. 14737* (N); *Hartling, N. Y. Bot. Gard. Cult. Pl. 14737* (Ur, Ur); *N. Taylor, N. Y. Bot. Gard. Cult. Pl. 14737* (N). Pakistan: *Hussain s.n.* [18.10.1957] (Kh); *Qureshi s.n.* [14.11.1965] (Kh); *Salim s.n.* [Peshawar, 5/6/71] (Mu); *Zaidi s.n.* [15.1.1958] (Kh). Réunion: *Boivin s.n.* [15 Avril 1847] (P). Russia: *Collector undetermined s.n.* [C.1859] (L); *F. Fischer s.n.* (S); *Herb. Fischer s.n.* (L, L); *Herb. Hort. Bot. Imp. Pet. Mag. s.n.* [1835] (L), *s.n.* (L); *Herb. Stephan 802* (L); *C. A. Meyer s.n.* (L). Saudi Arabia: *M. L. Grant 16824* (E--2144214); *R. S. Mathews s.n.* [Daharan, November 9, 1954] (Hk), Scotland: *R. Brown s.n.* [Edinb. Bot. Gard.] (Br); *Herb. Roy. Bot. Gard. Edinb. s.n.* (L). Sri Lanka: *Moldenke, Moldenke, & Jayasuriya 28171* (W--2764430). Switzerland: *Collector undetermined s.n.* (X); *Delessert s.n.* [Jard. 1 Juillet] (Dc); *Herb. Hort. Valde Grace s.n.* (Du). Taiwan: *Faurie 28* (V). Thailand: *Sørensen, Larsen,*

*& Hansen 7297* (Cp). Torrutz Island [Marshall Islands]: *E. H. Bryan s.n.* [Aug. 14, 1944] (Bi). LOCALITY OF COLLECTION UNDETERMINED: *N. J. Andersson s.n.* [Ocean. (Fona)] (S, S); *Collector undetermined 273* [Kerepuna] (Mb), *s.n.* [B.G.K. 29.7.50] (S), *s.n.* [East Indies] (Cp); *Gardner 21* [Minikoi] (Pd); *Garrigues s.n.* (Mi); *Herb. Mertens s.n.* [1801] (L); *Herb. Osbeck s.n.* (S, S); *Herb. Schrader s.n.* (L); *Herb. Swartz s.n.* (S); *Herb. J. Torrey s.n.* (T); *Heyne s.n.* [2nd March '98] (L); *Née 6* (Q), *8* (Q), *21* (Q); *Osbeck s.n.* [East Indies] (S); *Sparrman 14* (S). MOUNTED ILLUSTRATIONS & CLIPPINGS: Arachi, Pict. Present. Indian Fl. 160, fig. 162. 1968 (Ld); Arulchelvam, Ceyl. Forester, ser. 2, 8: 83. 1968 (Ld); Corner & Watanabe, Illust. Guide Trop. Pl. 755. 1969 (Ld); Duke & Ayensu, Med. Pl. China 2: 637. 1985 (Ld); M. R. Henderson, Malay. Wild Fls. Dicot., imp. 2, 385, fig. 356 A & B. 1974 (Ld); Hsiao, Fl. Taiwan 4: 422, pl. 1058. 1978 (Ld); Itô, Taiwan Shokubutu Dzusetu pl. 602. 1928 (Ld); Jacq., Collect. Suppl. pl. 4, fig. 1. 1796 (Ld); Walden, Wild Fls. S. China pl. 43, fig. 111. 1984 (Ld); E. H. Walker, Fl. Okin. South. Ryuk. 892. 1976 (Ld).

*CLERODENDRUM INERME* var. *MACROCARPUM* (Wall.) Mold., Phytologia 22: 6. 1971.

Synonymy: *Clerodendron neriifolium* var. *macrocarpa* Wall. ex C. B. Clarke in Hook. f. Fl. Brit. India 4: 589. 1885.

Bibliography: C. B. Clarke in Hook. f., Fl. Brit. India 4: 589. 1885; Anon., Kew Rec. Tax. Lit. 1971: 270. 1971; Mold., Fifth Summ. 2: 867, 969, & 971--972. 1971; Mold., Phytologia 22: 6. 1971; Hocking, Excerpt. Bot. A.21: 30. 1972; Mold., Biol. Abstr. 54: 6295. 1972; Mold., Phytol. Mem. 2: 272, 387, & 538. 1980; Brenan, Ind. Kew. Suppl. 16: 71. 1981; H. N. & A. L. Mold. in Dassan. & Fosb., Rev. Handb. Fl. Ceyl. 4: 451. 1983.

This variety differs from the typical form of the species chiefly in its mature fruits being about 3.2 cm. long and 1.9 cm. wide, rather than 1--1.8 cm. long and 6--8 mm. wide as in the typical form.

The original description given by Clarke (1885) is: "Var. *macrocarpa*, Wall. ms.; drupe 1¼ by 3/4 in. -- Martaban; Wallich. Rangoon; McLelland." Both these localities are in Burma and the variety seems to be endemic there, although some authors imply that the larger fruit is characteristic of all of the material included under the name *C. neriifolium* Wall., but this is definitely contradicted both by Wallich and by Clarke.

Nothing is known to me about his variety beyond what is here stated.

*CLERODENDRUM INERME* f. *PARVIFOLIUM* Mold., Phytologia 32: 46. 1975.

Synonymy: *Volkameria buxifolia* Willd., Enum. Pl. Hort. Berol. 2: 658. 1809. *Volkameria ligustrina* var. *rotundifolia* Gmel. ex Steud., Nom. Bot. Phan., ed. 1, 889 in syn. 1821. *Clerodendron buxifolium* (Willd.) Spreng. in L., Syst. Veg., ed. 16, 2: 758. 1825. *Clerodendrum buxifolium* Spreng. ex Sweet, Hort. Brit., ed. 1, 322. 1826. *Clerodendrum buxifolium* Sm. ex Loud., Hort. Brit., ed. 1, 247. 1830. *Clerodendron buxifolium* Spreng. apud Schau. in A. DC., Prodr. 11:

660 in syn. 1847. *Clerodendron emarginatum* Briq., Bull. Herb. Boiss., ser. 1, 4: 348. 1896. *Clerodendrum buxifolium* (Willd.) Spreng. ex Mold., Prelim. Alph. List Inv. Names 19. 1940. *Clerodendrum emarginatum* Briq. ex Mold., Suppl. List Inv. Names 2 in syn. 1941. *Citharexylum emarginatum* Briq. ex Mold., Suppl. List Inv. Names 2 in syn. 1941 [not *Citharexylum emarginatum* Vahl, 1940]. *Citharexylum emarginatum* (Willd.) Spreng. ex Mold., Suppl. List Inv. Names 2 sphalm. 1941. *Citharexylum buxifolium* (Willd.) Spreng. ex Mold., Suppl. List Inv. Names 2. 1941. *Clerodendron buxifolia* Willd. ex Mold., Résumé 261 in syn. 1959.

Bibliography: Willd., Enum. Pl. Hort. Berol. 2: 658. 1809; Steud., Nom. Bot. Phan., ed. 1, 889 & 890. 1821; Link, Enum. Hort. Berol. 2: 127. 1822; Spreng. in L., Syst. Veg., ed. 16, 2: 758. 1825; Sweet, Hort. Brit., ed. 1, 1: 322. 1826; Loud., Encycl. Pl. 522. 1829; Loud., Hort. Brit., ed. 1, 247. 1830; Sweet, Hort. Brit., ed. 2, 415. 1830; Loud., Hort. Brit., ed. 2, 247. 1832; G. Don in Loud., Hort. Brit., ed. 3, 247. 1839; G. Don in Sweet, Hort. Brit., ed. 3, 550. 1834; Steud., Nom. Bot. Phan., ed. 2, 1: 382. 1840; D. Dietr., Syn. Pl. 3: 615. 1843; Walp., Repert. Bot. Syst. 4: 100 & 112. 1845; Schau. in A. DC., Prodr. 11: 660. 1847; Buek, Gen. Spec. Syn. Candoll. 3: 105 & 502. 1858; Seem., Fl. Vit. 188. 1866; Jacks. in Hook. f. & Jacks., Ind. Kew., imp. 1, 1: 560 (1893) and imp. 1, 2: 1219. 1895; Briq., Bull. Herb. Boiss., ser. 1, 4: 348. 1896; H. J. Lam, Verbenac. Malay. Arch. 320 & 363. 1919; Bakh. in Lam & Bakh., Bull. Jard. Bot. Buitenz., ser. 3, 3: 77, 108, & viii. 1921; Mold., Geogr. Distrib. Avicenn. 14, 23, & 37. 1939; Mold., Prelim. Alph. List Inv. Names 19. 1940; Mold., Suppl. List Inv. Names 2. 1941; Mold., Alph. List Inv. Names 17 & 21. 1942; Mold., Known Geogr. Distrib. Verbenac., ed. 1, 16, 34, 72, 80, & 89. 1942; Mold., Alph. List Cit. 2: 336, 487, & 561 (1948) and 3: 692 & 881. 1949; Mold., Known Geogr. Distrib. Verbenac., ed. 2, 29, 72, 158, & 180. 1949; Mold., Résumé 35, 82, 215, 255, 256, 261, 262, 272, & 448. 1959; J. F. Macbr., Field Mus. Publ. Bot. 13 (5): 698 & 699. 1960; Mold., Résumé Suppl. 4: 7. 1962; Langman, Select. Guide Lit. Flow. Pl. Mex. 160 & 1010. 1964; Gibson, Fieldiana Bot. 24 (9): 195. 1970; Mold., Fifth Summ. 1: 69, 140, 272, 358, 432, 433, 441, 443, & 461 (1971) and 2: 732, 863, & 969. 1971; Mold., Phytologia 32: 46. 1975; Anon., Biol. Abstr. 61: AC1.581. 1976; Hocking, Excerpt. Bot. A.28: 171. 1976; Mold., Phytologia 34: 262--264 & 266--269. 1976; Mold., Phytol. Mem. 2: 259, 267, 269, 270, 291, 306, 324, 325, 331, 349, 381, 382, 384, 385, 390, 391, 461, 462, & 538. 1980; Brenan, Ind. Kew. Suppl. 16: 71. 1981; Mold., Phytologia 50: 255. 1982; H. N. & A. L. Mold. in Dassan. & Fosb., Rev. Handb. Fl. Ceyl. 4: 411 & 454--456. 1983.

This form differs from the typical form of the species in having its leaf-blades on the flowering and/or fruiting branches or branchlets uniformly smaller, usually only 2--4 cm. long and 1--2 cm.wide, narrowly elliptic to obovate or rotund, apically mostly obtuse to rounded or even emarginate, basally acute or attenuate.

This form appears to occur sporadically in Pakistan, India, Sri Lanka, Indochina, the Philippine Islands, Papua, and the Phoenix Islands and its taxonomic status is uncertain. [to be continued]

# UNA NUEVA ESPECIE DE ACOURTIA (ASTERACEAE-MUTISIEAE) DE DURANGO, MEXICO *

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ABSTRACT: *Acourtia acevedoi* of Durango state, is described as new especies.

*Acourtia acevedoi* M. González Elizondo, sp. nov.

Herba perennis, usque 80 cm alta; folia sessilia, anguste elliptica vel lenceolata, usque 15 cm longa et 4 cm lata, spinuloso-dentata, basi cordata et amplexicaulia, apice acutus vel brevis acuminatis crebro conduplicata; capitula solitaria, terminalia vel aggregata in inflorescentiis thyrsiformibus disposita, usque 70 flora; involucrum campanulatum vel turbinatum, 23 - 45 mm altum, phyllariis lanceolatis vel subulatis; corolla alba vel pallide rosea, 18 - 25 mm longa, labio exteriore 6 - 8 mm longo; achaenium anguste cylindricum, (5-) 6 - 9 mm longum, glanduloso-hirsutum; pappus albidus, 14 - 18 mm longus.

Planta herbácea perenne, con base rizomatosa provista de lana color café claro, de la cual parten numerosas raíces fibrosas rígidas; tallo por lo general simple, a veces ramificado en la parte superior, frecuentemente purpúreo, hasta de 80 cm de altura y 5 mm de diametro; hojas coriáceas, sésiles, angostamente elípticas o lanceoladas, desigualmente espinuloso dentadas en el margen, de tamaño muy variable, hasta de 15 cm de largo por 4 cm de ancho, conduplicadas, glabras en ambas caras, a veces cilioladas en el margen, cordadas y abrazadoras en la base, agudas a cortamente acuminadas en el ápice; hojas de las ramas florales mucho mas reducidas, a veces recurveadas y bracteiformes, conduplicadas; cabezuelas solitarias en el ápice del tallo, algunas veces formando conjuntos tirsoideos o paniculados foliosos; involucro variando de campanulado a marcadamente turbinado, de 2.3 a 4.5 cm de largo por 2 - 3 cm de ancho, con 60 a 90 filarias ciliadas, distribuidas en 6 a 10 series, rígidas, erectas, lanceoladas a subuladas, con ápices purpúreos, las exteriores y las intermedias de 3 a 4 mm de ancho, las interiores un poco mas angostas; flores 55 a 65 (-70) por cabezuela; corolas de 18 a 25 mm de largo, blancas o a veces rosadas, glabras, el labio exterior tridentado, de (6-) 7 a 8 mm de largo por 1.7 a 2 mm de ancho, los lóbulos interiores lineares de (5-) 6 a 7 mm de largo por 0.3 a 0.5 mm de ancho; aquenio angostamente cilíndrico, de (5-) 6 a 9 mm de longitud, densamente hispiduloso

* Trabajo parcialmente subvencionado por el CONACyT en el marco del proyecto Flora de Durango.

** Becaria de la COFAA del Instituto Politécnico Nacional.

glandular, vilano formado por 70 a 85 cerdas blancas, de 14 a 18 mm de longitud.

Tipo: MEXICO, DURANGO: Rincón de Las Mulas, a 3 Km al SW de San Isidro, municipio de Vicente Guerrero, alt. 2180 m, ladera pedregosa con Bosque abierto de *Quercus* con *Opuntia* y *Dasylirion*. 16.II.1985, S. Acevedo 163 (CIIDIR).

Material adicional examinado: DURANGO, Rancho "El Tabaco", municipio de Súchil, cañada pedregosa con *Otatea*, *Juniperus* y *Quercus* en ladera con Bosque abierto de *Quercus*. 14.III.1984. M. González con S. Acevedo 1326 (CIIDIR).

*A. acevedoi* parece estar relacionada con *A. longifolia* (Blake) Reveal & King, especie conocida de Jalisco y Nayarit. Las principales diferencias entre ambas especies son las siguientes:

| | *A. acevedoi* | *A. longifolia* |
|---|---|---|
| Talla | Hasta 80 cm | (0.6-) 1 - 1.5 m o más |
| Hojas | 15 cm de largo o menos, glabras o diminutamente puberulentas sobre las nervaduras. | 15 - 30 cm de largo, asperamente puberulentas. |
| Cabezuelas | Solitarias o agrupadas por varias en el ápice del tallo, a veces formando conjuntos tirsoideos o paniculados foliosos. | Solitarias en el ápice del tallo, o con 1 a 3 cabezuelas adicionales. |
| Filarias | 60 - 90, 3 - 4 mm de ancho. | 100 - 150 o más, 4 - 6 mm de ancho. |
| Flores | Blancas, a veces rosadas. | Lavanda o Lavanda rosado. |
| Labio exterior de la corola | 6 - 8 mm | 9 - 10 mm |
| Labios interiores de la corola | 5 - 7 mm | 9 - 10 mm |

Los ejemplares con involucro marcadamente turbinado, en general son los que presentan los lobulos de la corola mas pequeños, lo que hace pensar que podría tratarse de una variante de la misma especie.

El nombre de la especie está dedicado al Sr. Saturnino Acevedo S., colector del Tipo y entusiasta colaborador en el trabajo de campo.

CHROMOSOME COUNTS OF ANGIOSPERMS
OF WESTERN NORTH AMERICA

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This report contains chromosome counts from 132 populations of angiosperms mainly from southwestern North America, including first counts for one genus, 12 species, and 4 subspecies. New counts for taxa are marked with (**) and new ploidy-level reports are marked with (++) preceding the relevant epithet. It also contains reports on 3 cytologically variable, or taxonomically difficult, taxa, namely *Dalea formosa*, *Leucelene ericoides*, and the genus *Solidago*. The other entries in this compilation confirm earlier published chromosome count determinations from elsewhere in those taxa's ranges. Methods used are described in Ward (1983). Vouchers are at NMC with some duplicates at NY, RSA, TEX, and MO. The following codes for principal collectors are used in the listing: RJS = Robert Soreng, RWS = Richard Spellenberg, W = Darrell Ward.

**AMARANTHACEAE:** *Amaranthus* (**)*fimbriatus* (Torr.) Benth. n=17. NM, Dona Ana Co., 8 km E of Las Cruces, *RWS 7865*.

**APIACEAE:** *Pseudocymopterus montanus* (Gray) Coult. & Rose. n=11. AZ, Cochise Co., Chiricahua Mts., Victorio Campgrd., W *83-063*; NM, Lincoln Co., White Mts., 6 km WNW of Alto, *W 81-152*; Sierra Co., Black Range, Diamond Cr., *W 81-177*.

**ASTERACEAE:** *Artemisia campestris* L. subsp. (**)*pacifica* (Nutt.) H. & C. n=9. NM, Valencia Co., E edge of Grant Malpais, *W 81-507*. Previous chromosome counts reported for this species are n = 9 and n = 18, but none specifically indicate this variety.

*Artemisia frigida* Willd. n=9. NM, Lincoln Co., Sacramento Mts., NM-24, 12 km E of Cloudcroft, W *81-462*.

*Artemisia ludoviciana* Nutt. subsp. *mexicana* (Willd.) Keck. n=9. NM, Lincoln Co., White Mts., Eagle Cr., *W 81-527*.

*Aster* (++)*commutatus* (T & G) Gray var. *commutatus*. n=10. NM, Otero Co., E edge of High Rolls, W *84-033*. Morphological variation in this widespread species of western North America may be better understood after considerable cytological study. Ward (1983) reports n = 15 for this variety from extreme northwestern New Mexico. Keil and Pinkava (1976) report n = 5 for the variety *polycephalus* (Rydb.) Blake from Gila Co., AZ.

*Brickellia grandiflora* (Hook.) Nutt. var. *grandiflora*. n=9. NM, Otero Co., Sacramento Mts., 8 km S of Cloudcroft, *W 81-412*.

Centaurea melitensis L. n = 12. TX, Hudspeth Co., US-62/180, 25 km S of Del City, W 85-003.
Chaetopappa (**)hersheyi Blake. n=8. TX, Guadalupe Mts. Nat. Park, Pine Springs Canyon, RWS 6476.
Erigeron divergens T & G. 2n=ca. 27. NM, Hidalgo Co., Peloncillo Mts., Clanton Draw on USFS-63, W 83-069. Since only Metaphase I meiotic configurations were seen in this cytological material, it must be assumed that this is a triploid count similar to the counts reported in Keil and Pinkava (1976), Pinkava and Keil (1977), Keil (1981) and other publications.
Erigeron oreophilus Greenm. n=9. AZ, Cochise Co., Chiricahua Mts., Barfoot Peak, W 83-053.
Erigeron (**)rhizomatus Cronq. n=9. NM, McKinley Co., Zuni Mts., 13 km S of I-40 on NM-400, RWS 7135.
Erigeron rybius Nesom. n=9. NM, Otero Co, Sacramento Mts., 8 km S of Cloudcroft, W 81-413.
Erigeron superbus Greene ex. Rydb. n=9. NM, McKinley Co., NM-400, 3 km S of Ft. Wingate, W 81-500.
Galinsoga semicalva (Gray) St. John & White. n=16. AZ, Cochise Co., Chiricahua Mts., Victorio Campgrd., W 83-065.
Heliopsis helianthoides (L.) Sweet subsp. occidentalis. n=14. NM, Otero Co., 2.5 km S of Cloudcroft, W 81-408.
Leucelene ericoides (Torr.) Greene. n=8 and n=16 as follows: n=8. AZ, Apache Co., 8 km N of Ft. Defiance, RWS 7134; TX, Culberson Co., TX-54, 38 km S of intersection with US-62/180, W 85-004; n=16. AZ, Cochise Co., 0.8 km E of Pima county line, S of IH-10, RWS 7011; NM, Bernalillo Co., Albuquerque, W base of Sandia Mts., RWS 7077; Chaves Co., US-82, 25 km W of Eddy Co. line, W 84-002b; Colfax Co., 3 km N of Springer, RWS 7019; Curry Co., US-60, Clovis, W 84-006; Dona Ana Co., 16 km NNW of Las Cruces, Robledo Mt., W 83-015; Eddy Co., Guadalupe Mts. Nat. Park, Pine Canyon Campgrd., RWS 7004; S edge of Carlsbad, US-285, RWS 7005; Grant Co., City of Rocks State Park, 30 km NW of Deming, RJS 2153; Grant Co., 2 km W of Luna Co. line on IH-10, RWS 7014; Lincoln Co., US-54, 2 km SW of Corona, W 84-020; Rio Arriba Co., 1 km N of Medanales, RWS 7751; Roosevelt Co., US-70, 9 km E of Kenna, W 84-005; San Juan Co., Navajo Coal Mine, RWS 7078; Union Co., US-56, 32 km W of Clayton, RWS 7049; Valencia Co., I-25, 6 km S of Bernalillo Co. line, RWS 7018; Mt. Taylor, Coal Mine Canyon Campgrd., 17 km N of Grants, RWS 7141; TX, Carson Co., TX-152, 2 km SE of Skellytown, W 84-012; Culberson Co., US-90, 2 km S of Van Horn, W 85-006; El Paso Co., Hueco Tanks, 30 km E of El Paso, W 85-001; Hansford Co., 10 km N of 2.5 km W of Spearman, Palo Duro Cr., W 84-016; Hudspeth Co., US-180, 80 km E of El Paso, RWS 7006; Jeff Davis Co., US-90, 8 km S of Culberson Co. line, W 85-007; 40 km W of Ft. Davis, intersection of TX-166 and TX-505, W 85-009; Ochiltree Co., US-83, 15 km S of Perryton, W 84-015; Parmer Co., US-60, 8 km NE of Bovina, W 84-007; Randall Co., Buffalo Lake Wildlife Refuge, W 84-009; Roberts Co., US-60, Miami, W 84-013; Sherman Co., US-54, 3 km SW of Stratford, W 84-018; MEXICO, Chihuahua, 45 km NW of Cd. Guerrero, 1

km W of Matachic on road to Tonasachic, RWS 7673; Hwy-45 16 km S of El Sueco, RWS 7728; 15 km SE of Cd. Guerrero, 5 km SW of La Junta, RWS 7702.

This information indicates that nearly all of the occurrences of this species in the United States north of the Mexican are polyploid. Information is still needed from populations in southwesten New Mexico, Mexico and the rest of the western third of this plant's distribution.

Machaeranthera bigelovii (Gray) Greene. n=4. NM, Sierra Co., Black Range, Emory Pass on NM-90, W 83-083.

Machaeranthera gracilis (Nutt.) Shinners. n=2. AZ, Cochise Co., Chiricahua Mts., Cave Cr. Campgrd., W 83-031.

Machaeranthera tanacetifolia (H.B.K.) Nees. n=4. NM, Valencia Co., NM-117, Grant Malpais, W 81-512.

Pericome caudata Gray var. caudata. n=18. AZ, Cochise Co., Chiricahua Mts., Barfoot Peak, W 83-045. The count of 2n = 26 referenced in Bolkhoviskikh, et al. (1969) is a typographical error, misrepresenting the count of n = 18 reported in Turner and Flyr (1966).

Solidago canadensis L. var. canadensis. n=9 + 4b and n=9 as follows: n=9 + 4b. KS, Wyandotte Co., W Kansas City, KS, W 81-598; n=9. WY, Sublette Co., 8 km WSW of Moran, RJS 1239.

Solidago canadensis L. var. salebrosa (Piper) Jones. n=9. MEXICO, Nuevo Leon, 11 km S of Montemorelos, W 80-057. A previous count is listed in Bolkhovskikh, et al. (1969) as . elongata.

Solidago canadensis L. var. scabra T & G. n=27. NM, Dona Ana Co., 3 km N of Dona Ana, W 83-081; Eddy Co, Guadalupe Mts., Rattlesnake Springs, W 84-027; Otero Co, Tularosa, W 81-208. Many reports of n = 27 for this taxon have been published as Solidago altissima.

Solidago missouriensis Nutt. var. (**)extraria Gray. n=18. WY, Dark Co., Rockefeller Memorial Hwy near Ashton, ID, RWS 5742. Diploid and tetraploid counts for S. missouriensis are in Morton (1981). However, there are no varieties specified.

Solidago missouriensis Nutt. var. fasciculata Holz. n=9. NM, Grant Co., 2 km N of Silver City, W 80-043.

Solidago multiradiata Ait. var. scopulorum Gray. n=18. WY, Sublette Co., 43 air km N of Pinedale, RWS 5779; MT, Deer Lodge Co., 24 air km SW of Anaconda, RWS 5723.

Solidago parryi (Gray) Greene. n=9. CO, Colfax Co., US-50, 8 km E of Monarch Pass, RWS 5804. Similar counts for this species have been previously reported as Haplopappus parryi Gray. This author, however, agrees with the discussion in Anderson, et al. (1974) suggesting that this plant has closer affinities to the genus Solidago than to the woodier species of Haplopappus, both with a base chromosome number of n = 9.

Solidago spathulata DC. var. neomexicana (Gray) Cronq. n=9. NM, Lincoln Co., 1 km NE of Capitan, RJS 1493; Taos Co., Wheeler Peak, RWS 5822.

Solidago ulmifolia Muhl. var. ulmifolia. n=9. MO, Jackson Co., Swope Park, S Kansas City, W 81-595.

*Solidago velutina* DC. var. *nevadensis* (Gray) C. & J. Taylor (=*S. sparsiflora* Gray). n=9 and n=18 as follows: n=9. AZ, Cochise Co., Chiricahua Mts., 8 km SW of Portal, *W 83-027*; Peloncillo Mts., 3 km E of NM border, USFS-63 (Geronimo Trail Road), *W 83-067*; CO, Garfield Co., CO-13, 18 km NW of Rifle, *RWS 5798*; Pitkin Co., US-82, 5 km SE of Aspen, *RWS 5802*; NM, Grant Co., 13 km NW of Silver City, *W 80-013*; 11 km NNE of Bayard, *W 81-586*; 10 air km SW of Emory Pass, *W 80-023*; NM-61, 11 km S of Catron Co. line, *W 80-047*; 21 km N of Silver City, *W 80-045*; Hidalgo Co., Peloncillo Mts., Skeleton Canyon, *RWS 6312b*; McKinley Co., NM-400, 3 km S of Ft. Wingate, *W 81-492*; Otero Co., NM-37, 2 km N of Ruidoso, *W 80-033*; Karr Canyon, 3 km SE of High Rolls, *W 81-576*; San Juan Co., 6 km N of La Plata, *W 83-083*; MEXICO, San Luis Potosi, MEX-49, 75 and 76 km NW of Cd. San Luis Potosi, *W 80-059* and *W 80-060*; Zacatecas, road to Fresnillo, 5 km E of MEX-45, *W 80-061*; n=18. NM, Grant Co., Mimbres Mts., Emory Pass, *W 80-028*; Lincoln Co., Jicarilla Mts., 4 km SSE of Jicarilla, *W 81-585*; Gallinas Peak, 11 km N of Corona, *W 81-581*.

In Anderson, et al. (1974), both diploid and tetraploid counts are reported as *Solidago sparsiflora* Gray. Use of *S. velutina* instead of the name *S. sparsiflora* is suggested by Taylor and Taylor (1983).

*Solidago wrightii* Gray var. (**)*adenophora* Blake. n=9. AZ, Cochise Co., Chiricahua Mts., 8 km SW of Portal, *W 83-026*; Peloncillo Mts., Skeleton Canyon, *W 81-569*; NM, Grant Co., NM-90, 1 km W of Emory Pass, *W 80-025*; Luna Co., Florida Mts., above Mahoney Park, *RWS 6231*; Cooke Range, E base of Cooke Peak, *W 81-555*.

There are many counts that have been published for *S. wrightii*, nearly all of which have not specified a varietal epithet. Some question has been expressed about the morphological definition of varieties in this species. In Taylor and Taylor (1983), a novel recognition of inflorescence characters instead of glandularity would make previous reports to the varietal level questionable, anyway. Both of these varieties have probably been counted, regardless of the interpretation.

*Solidago wrightii* var. *wrightii*. n=9. NM, Grant Co., 17 km NNE of Silver City, *W 80-044*; Bear Mt., 8 air km NW of Silver City, *W 80-042*; Hidalgo Co., Peloncillo Mts., Clanton Draw, *W 83-070*; TX, Jeff Davis Co., center of Davis Mts., *W 81-290*.

*Tagetes micrantha* Cav. n=12. NM, Peloncillo Mts., Clanton Draw, *W 83-078*.

CAPPARACEAE: *Cleome* (**)*multicaulis* Sesse & Moq. n=20. CO, Alamosa Co., 16 km E of Mosca, *RWS 7850*.

*Polanisia trachysperma* T. & G. var. *trachysperma*. n=10. TX, Jeff Davis Co., Davis Mts., *W 81-296*.

FABACEAE: *Astragalus lentigenosus* Doug. ex Hook. var. *diphysus* (Gray) Jones. n=11. NM, San Juan Co., 6 km N of La Plata, 1 km E of NM-17, *RWS 6166*.

Astragalus racemosus Pursh var. (**)longisetus Jones. n=11. NM, Mora Co., NM-120, 10 km E of Wagon Mound, W 81-270. CORRECTION: This was incorrectly reported in Ward, 1984 as A. praelongus. The proper identification was provided by R. Barneby.

Dalea formosa Torr. n=7 and n=21 as follows: n=7. AZ, Cochise Co., Tombstone, RWS 7016, 7997; TX, Hutchinson Co., Lake Meredith, N of Amarillo, W 84-010; n=21. NM, Harding Co., near junction of NM-39 and NM-65, RWS 7070; OK, Cimarron Co., 9 km N of Kenton, RWS 7054. Spellenberg (1981) reported on the distribution of the ploidy levels in this species, and predicted through stepwise discriminant analysis (SDA) the ploidy levels of specimens from throughout the range of the species. Voucher 7054 comes from very near the northern-most populations known for this species. 7070 is from an area in northeastern New Mexico for which no specimens were then available. The former contradicts the SDA prediction of 2n for the northernmost specimens; the latter helps clarify a situation since plants to the south were predicted to be 6n, but those the west were predicted to be 2n. The 6n races were considered to be a Chihuahuan element of the Madro-Tertiary flora, and Weber(1980) proposed that this element is expanding northward into the southern Rocky Mts. In this region the 6n races apparently form the northern-most populations in this morphologically variable but taxonomically monotypic species. 7054 also reiterates the need for cytological study of the eastern populations of the plant where 2n and 6n races are in contact. 84-010 supports the 2n prediction for the eastern range of the species.

Dalea grayi (Vail) L.O. Wms. n=7. AZ, Cochise Co., Peloncillo Mts., Skeleton Canyon, W 81-565.

Desmodium (**)ambiguum Hemsl. n=11. MEXICO, Jalisco, ca. 24 km S of Puerta Vallarta, RWS 6442.

Lupinus (**)laetus Watson. n=24. NM, Otero Co., Tularosa Canyon, 10 km S of Mescalero, W 83-024.

LAMIACEAE: Salvia (**)subincisa Benth. n=9. NM, Valencia Co., E edge of Grant Malpais, W 81-511.

LILIACEAE: Asphodelus fistulosus L. n=28, 28 + fragment. NM, Luna Co., IH-10, 34 km W of Deming, RWS 5975.

NYCTAGINACEAE: Mirabilis (++)linearis (Pursh) Heim. n=20. NM, San Juan Co., 8 km N of La Plata, 5 km E of NM-17, RWS 6169. Taylor and Brockman (1966) report a chromosome complement of 26 bivalents with normal meiosis for this widespread and morphologically variable species and propose a base number of 13 for the genus. They note, however, earlier reports of n = 29. Clear meiotic configurations in the Nyctaginaceae are often very difficult to obtain. The chromosomes are small and sticky with the homologues not remaining in tightly associated bivalents prior to metaphase I, even though anaphase is usually regular. This difficulty is exacerbated by the low number of pollen mother cells that are produced, and counts reported, therefore, are probably 'best estimates'. Spellenberg (pers. obs.) notes that Mirabilis species which have been placed in the genus Oxybaphus are commonly self-pollinating and quite likely autogamous. Low, spindly phena of M. linearis and M. oblongifolia (see following) in New Mexico are commonly cleistogamous. Such a breeding system may facilitate the fixation of various chromosome numbers throughout the range of the species. A similar situation is also apparently present in tropical, perennial Boerhavia.

Mirabilis (**)oblongifolia (Gray) Heimerl. n=ca.25. AZ, Cochise Co., Chiricahua Mts., Barfoot Peak, Victorio Campgrd., W 83-052.

POACEAE: Bothriochloa saccharoides (Schwartz) Rydb. var. torreyana (Steud.) Gould. n=30. NM, San Miguel Co., 2.5 km E of Variadero, W 81-218.

Poa bigelovii Vasey & Scribn. n=14. NM, Dona Ana Co., Robledo Mt., 19 km NNW of Las Cruces, W 83-005.

POLEMONIACEAE: Gilia flavocincta A. Nels. subsp. australis (A. & V. Grant) Day and V. Grant. n=9. AZ, Pima Co., IH-10, 1 km W of Cochise Co. line, RWS 7012.

Gilia (**)haydenii A. Gray. n=8. NM, Sandoval Co., 18 km E of Cuba, RWS 8184.

Gilia mexicana A. & V. Grant. n=9. AZ, Cochise Co., IH-10, 19 km E of Benson, RWS 7013.

Gilia rigidula Benth. subsp. acerosa (Gray) Wherry. n=9. NM, Dona Ana Co., Robledo Mountain, 16 km NNW of Las Cruces, W 83-013.

POLYGONACEAE: Eriogonum (**)scabrellum Reveal. n=20. NM, San Juan Co., 32 km SW of Fruitland, RWS 7587.

PORTULACEAE: Talinum parviflorum Nutt. n=24. NM, Valencia Co, E edge of Grant Malpais, 15 km S of I-40, W 81-508; Harding Co., Kiowa Nat. Grasslands, 8 km W of Mills, W 81-260.

Talinum (**)pulchellum Wooton & Standl. n=12. NM, Harding Co., 16 km NNW of Mills, RWS 6036.

RANUNCULACEAE: Clematis (**)drummondii T. & G. n=8. NM, Dona Ana Co., 6 km N of Organ, W 86-001.

Clematis ligusticifolia Nutt. n=8. NM, Otero Co., Sacramento Mts., 2 km SE of High Rolls, W 81-480.

Ranunculus cymbalaria Pursh var. saximontanus Fern. n=8. NM, Otero Co., Tularosa Canyon, 15 km S of Mescalero, W 83-023.

ROSACEAE: (**)Petrophytum caespitosum (Nutt.) Rydb. n=9. NM, Eddy Co., Guadalupe Mts., Slaughter Canyon, W 84-022. This apparently represents the first chromosome report for this small genus, the number being consistent with that of closely allied genera (as reviewed by Henrickson, 1985).

Potentilla norvegica L. n=28. NM, Lincoln Co., White Mts., Eagle Cr. Canyon, 5.5 km WNW of Alto, W 81-206.

SCROPHULARIACEAE: Castilleja patriotica Fern. n=12. AZ, Cochise Co., Chiricahua Mts., Barfoot Peak, Victorio Campgrd., W 83-040.

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CONTRIBUCIONES AL ESTUDIO DE LAS MIRTACEAS MEXICANAS. I*

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*Eugenia mozomboensis* P.E. Sánchez V. *sp. nov.*

*Frutex glaber, 1-2.5 metralis; ramulis flavo-griseus, diminuto-fissuratus. Folia glabra, elliptica vel ovata, l.4-4.5 cm longa, apicem acuta, basim acuta vel cuneata, costa supra elevatus subtus prominens, lamina supra atroviride subtus subviride, glandulosa; petioli 1.5-2.5 mm longi, 1 mm crassi. Flores solitarius vel 2-3 ad nodus; pedunculi 1.4-3-2 mm longi; bracteolae 2, connatae, 0.7-1.2 mm longae; hipanthium infundibuliformis; calycis lobi 4, ovati vel triangulari, 3-3.7 mm longi, 2-2.5 mm lati; discus 2.2-3 mm latus vix pilosi; ovarium biloculare; ovula in quoque loculo 2-4; stylus 4.5-7 mm longus. Fructus globosus, 1-82.7 cm longus et diametro; semina 1, embryo homogeneus.*

Arbusto muy ramificado desde la base, usualmente de 1-2.5 m de altura, glabro, excepto por los cilios de las bracteolas, los lóbulos del cáliz y algunos pelos en el disco estaminal; corteza verde-grisácea, fisurada, exfoliándose en placas delgadas y grisáceas, exponiendo una corteza café-amarillenta; corteza interna rojiza o rosada; ramas gris-amarillentas, diminutamente fisuradas; ramitas jóvenes de gris-amarillentas a café-rojizas, costilladas. Hojas pecioladas, de ovadas a elípticas, algunas ovado-elípticas, l.4-4.5 cm de largo, (0.7-)l-2.4 cm de ancho, ápice generalmente agudo, algunas veces obtuso-redondeado, base de aguda a cuneiforme, con frecuencia los márgenes decurrentes sobre el pecíolo, margen algo revoluto, nervio central elevado, usualmente aplanándose hacia la base y el ápice en la haz, prominente en el envés, nervios laterales 7-l0 en cada lado, escasamente visibles y pálidos en la haz, prominentes en el envés, ascendiendo en un ángulo de 40-50$^{o}$, nervio marginal arqueado entre los laterales e igual de prominente que estos, l-l.5 mm del márgen, lámina verde y ópaca, generalmente con manchas pálidas en la haz, verde-claro o amarillentas en el envés, glabras, coriáceas, con glándulas cóncavas muy abundantes principalmente en el envés; pecíolo acanalado, glanduloso-rugoso, glabro, l.5-2.5 mm de largo, l mm de espesor. Flores axilares, algunas veces en los entrenudos o en las axilas de las yemas vegetativas en los brotes jóvenes, solitarias o en pares en cada axila o en grupos de tres en cada nudo; pedúnculo de l.4-3.2 mm de largo, 0.5-0.8 mm de ancho, glabro, algo glanduloso; bracteolas 2, connadas en la base, formando una especie de involucro, de ovadas a lanceoladas, 0.7-l.2 mm de largo, hasta de 0.5 mm de ancho en la base, ciliadas, algo pubescentes en el ápice; hipanto infundibuliforme, l.7-2.5 mm de largo, glabro, algo glanduloso; lóbulos del cáliz 4, de ovados a triangulares, 3-3.7 mm de largo, 2-2.5 mm de ancho, cóncavos, subcoriáceos, externamente con glándulas cóncavas, ciliados; pétalos 4, blancos, de redondeados a elípticos, 3.5-4.7 mm de largo, 3.5-3.9 mm de ancho, ciliados; estambres 60-l00, de 5-6 mm de largo; anteras hasta de 0.7 mm de largo; disco de 2.2-3 mm de ancho, esparcidamente piloso; ovario bilocular; óvulos 2-4 en cada lóculo; estilo 4.5-7 mm de largo, glabro. Fruto de verde a rojo al madurar, globoso, glabro, el ápice coronado con los lóbulos del cáliz; pedúnculo de 0.7-2 mm de largo; semilla l, de redondeada a oblada, l-l.3 cm de largo, l.4-l.6 cm de ancho; embrión homogéneo, radícula adnata a los cotiledones.

TIPO: MEXICO: Veracruz: Municipio de Actopan, El Comun (Sierra Manuel Díaz)-Mozomboa, 50 m.s.n.m., *R. Acosta et al. 33.* (Hototipo XAL; isotipos CR, MEXU, F, MO, NY).

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*Eugenia mozomboensis* (Fig. 1), se caracteriza principalmente, por poseer frutos muy grandes en comparación con el tamaño de sus hojas, sus flores solitarias y su forma arbustiva. Está cercanamente relacionada con *E. liebmannii* Standl., pero ambas pueden diferenciarse por el tamaño de las hojas y lo diminutamente hispiduloso-puberulento de las ramas, pecíolo e inflorescencia en *E. liebmanni.*

Se distribuye principalmente en la Selva Baja Caducifolia. Su floración ha sido observada durante enero y febrero; su fructificación principalmente en octubre.

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## CONTRIBUCIONES AL ESTUDIO DE LAS MIRTACEAS MEXICANAS. II.

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Como resultado de mi actual revisión de la familia Myrtaceae en el Estado de Veracruz, ha resultado el descubrimiento de un nuevo taxa del género *Eugenia* L., el cual describo a continuación.

*Eugenia inirebensis* P.E. Sánchez V. *sp. nov.*

*Arbor glabra, 7-10 metralis, ramulis juvenilibus teretibus, glandulosus, glabris. Folia glabra, elliptica vel oblongo-ovata interdum elliptico-lanceolata, 6.9-13.7 cm longa, apicem obtusus vel brevi-acuminatus, basim acuta vel cuneata, costa inmersa subtus prominens, nervi laterales utrinque 17-26, subtus prominens; petioli 5-10 mm longi. Racemus 2-7 mm longus, flores 3-8; bracteolae 2, connatae, 0.7-1.7 mm longae; pedicelli 0.6-2 cm longi, glandulosi; hipanthium campanulatum; calycis lobi rotundati, inaequales, 2.7-3.7 mm longi, 2.5-3.5 mm lati, glandulosi; discus 2.8-3.5 mm latus, puberulus; ovarium biloculare, ovula in quoque loculo 4-13; stylus 8 mm longus. Fructus ovoideus, l.5-2 cm longus; semina 1; enbryo homogeneus (pseudomonocotyledon auct.).*

Arbol hasta de 7-10 m de altura, 5-20 cm de d.a.p; corteza externa gris-verdosa, algo fisurada, exfoliándose en placas pequeñas; corteza interna rojizo-amarillenta, glabro, excepto el anillo estaminal y por algunos cilios que posee en las brácteas, bracteolas y pétalos; ramas café-grisáceas, diminutamente fisuradas, glabras; ramitas jóvenes cilíndricas, café-amarillentas o café-claro, glandulo-sas, glabras. Hojas pecioladas, de elípticas a oblongo-ovadas, algunas elíptico-lanceoladas, 6.9-13.7 cm de largo, 2.5-6.6 cm de ancho, ápice agudo o corto acuminado, ápice del acumen redondeado, base de aguda a cuneiforme, los márgenes algunas veces decurrentes sobre el pecíolo, margen ondulado, lo cual lo hace aparecer como diminutamente sinuado, algo revoluto, nervio central amarillento, inmerso en la haz, usualmente haciéndose plano de la mitad hacia el ápice de la lámina, muy prominente en el envéz, nervios laterales 17-26 de cada lado, incluyendo algunos intermedios, pálidos en la haz, prominentes en el envés, ascendiendo en un ángulo de 30-40°, nervio marginal arqueado entre los laterales, 2-6 mm del margen e igual de prominente que los laterales, lámina rigidamente coriácea, verde-opaca en la haz, verde-pálida en el envés, glabra, pelúcido-punteada; pecíolo recto, acanalado, glanduloso, diminutamente fisurado, de 5-10 mm de largo, hasta de 1.5 mm de ancho. Inflorescencia racemosa, con los ejes no elongados, por lo cual muchas veces las flores parecen como solitarias, axilar, algunas ramifloras, con frecuencia 2 en las axilas de los brotes jóvenes, el eje central de 2-7 mm de largo, con 3-8 flores; pedúnculo de 0.5-1 mm de largo, glabro; brácteas ovadas, raramente lanceoladas, cóncavas, 1-1.7 mm de largo, hasta de 0.6 mm de ancho en la base, endurecidas, ciliadas; bracteolas 2, persistentes, connadas en la base, formando una especie de involucro, de lanceoladas a triangulares, 0.7-1.7 mm de largo, hasta de 0.6 mm de ancho en la base, cóncavas, subcoriáceas, glandulosas, ciliadas; yemas globosas, de 3-5.2 mm de largo, hasta de 5 mm de ancho, glandulosas; pedicelos de 0.6-2 cm de largo, hasta de 0.6 mm de ancho, glabros, muy glandulosos; hipanto campanulado, de 1-1.7 mm de largo, glabro, glanduloso; lóbulos del cáliz 4, desiguales, de ovados a redondeados, o elípticos, de 5-7.2 mm de largo, 3-4.7 mm de ancho, glandulosos, ciliados; estambres 70-80, de 4.5-6.5 mm de largo, glabros; disco de 2.8-3.5 mm de ancho, pubescente, pelos blanco-plateados; anteras hasta de 1 mm de largo; ovario bilocular; óvulos 4-13 en cada lóculo; estilo hasta de 8 mm de largo, glabro. Fruto de amarillo a rojo o negro al madurar, ovoide, de 1.5-2 cm de largo, 1.1-1.3 cm de ancho, glabro, glanduloso, el ápice coronado con los lóbulos del cáliz; pedúnculo hasta de 2 cm de largo, glanduloso; semilla 1, ovoide; embrión homogéneo (seudomonocotiledóneo), la radícula adnata a los cotiledones.

TIPO: MEXICO: Veracruz: Municipio de Atoyac, 1.5 Kms. atrás de la Cantera de Atoyac, 600 m.s.n.m. *R. Acevedo & Acosta 830* (Holotipo XAL; isotipos CR, F, MO, NY, US).

*Eugenia inirebensis* (Fig. 2) está cercanamente relacionada con *E. mexicana* Steud; que también es endémica de Veracruz, pero se diferencia de ésta por poseer los pedicelos más largos, frutos ovados, el disco estaminal muy pubescente y además sus partes florales y vegetativas son muy glandulosas. Se distribuye principalmente en selva mediana subperennifolia. Su floración y fructificación son principalmente de marzo a junio.

El nombre del taxón ha sido nombrado en honor de Instituto Nacional de Investigaciones sobre Recursos Bióticos (INIREB), ya que con su financiamiento y facilidades, me es posible realizar el trabajo de campo y descriptivo.

Agradecimientos:

Al Consejo Nacional de Investigaciones Científicas y Tecnológicas (Costa Rica); al Consejo Nacional de Ciencia y Tecnología (México), sin cuyo aporte económico no sería posible el presente trabajo; a la Sra. Ana Ma. Zumaya R. y a la Srita. Hortensia Gómez L. por su desinteresada colaboración en la mecanografía.

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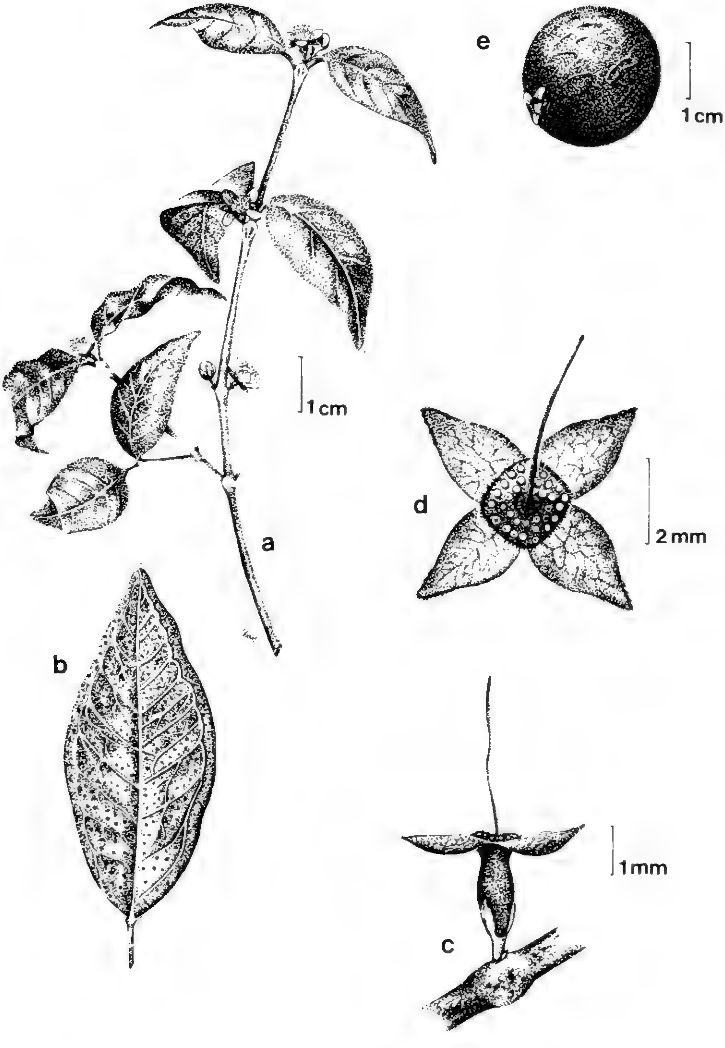


Fig. 1. *Eugenia mozomboensis*, a. hábito; b. hoja; c. flor después de la antesis; d. flor vista por arriba luego de que los pétalos y estambres han caído; e. fruto. Ilustración por José Chan, basado en el ejemplar *R. Acosta et al 33*.

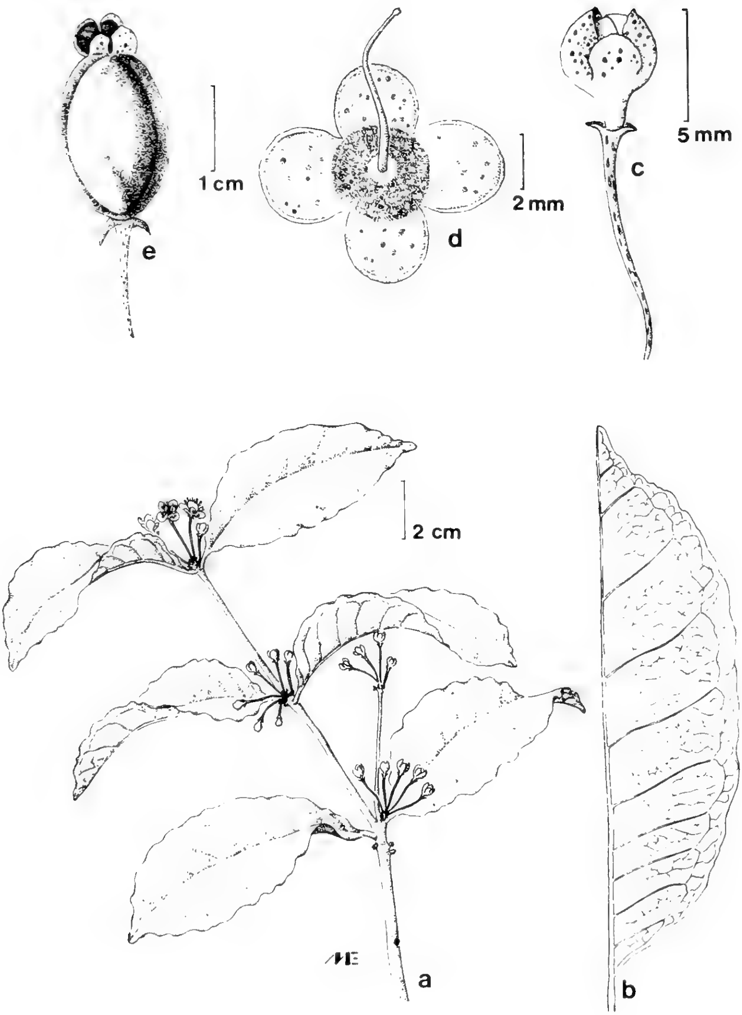


Fig. 2. *Eugenia inirebensis*, a. hábito; b. hoja; c. yema floral; d. flor vista por arriba luego de que los pétalos y los estambres han caído; e. fruto mostrando semilla. Ilustración por Manuel Escamilla, basado en los ejemplares *R. Acevedo & Acosta 830, R. Acevedo & Vázquez 342.*

## BOOK REVIEWS

Alma L. Moldenke

"VEGETATION OF THE EARTH and Ecological Systems of the Geo-biosphere" Third, Revised and Enlarged Edition by Heinrich Walter, xvi & 318 pp., 161 b/w fig. of draw., photos & maps, & 16 tab. Springer-Verlag, Heidelberg, Berlin & New York, N. Y. 10010. 1985. $17.00 paperbound.

This is the "third, revised and enlarged edition translated from the fifth, revised German edition by Owen Muise". It is a very important work on a worldwide basis to have updated, enriched and available in English for college and university classes, researchers, field naturalists, and ecological technicians over much of the world. The many excellent illustrations inform effectively in universal language. The introduction gives classification and definitions of ecological systems on a worldwide scope that are described and explained in the subsequent chapters. "More than 99% of the earth's biomass is phytomass" with amounts and kinds "distinctly related to vegetational zones". The final chapter is personally oriented as a warning to all who will read. The octogenarian author and his wife, both brilliant, wonderful human beings and cogent ecologists, warn of the excessive technological developments in the industrialized cities of high cement blocks and parking lots with the rest of the environment poisoned and of the underdeveloped areas where the mouths exceed the food supplies. They stress the quality of life rather than the so-called standard of living of things after the essentials are met. It is a pity that the printers of this outstanding book did not take the time to correct a batch of misspellings.

"ATLAS OF THE PACIFIC NORTHWEST" Seventh Edition edited by A. Jon Kimerling & Philip L. Jackson, iv & 136 pp., 167 color maps & graphs, & 50+ b/w photos. Oregon State University Press, Corvallis, Oregon 97331. 1985. $25.00 hardcover & $13.95 paperbound.

For over 30 years the editions of this helpful, well compiled and attractive sourcebook have been very useful for all level schools, travel and products information, interested residents, neighbors and visitors, and historical background. This new edition has its 20 articles authoritatively written by university faculty members. Over half of the maps and graphs have been redone in more modern and attractive form and, of course, include more recent data. Besides new chapters on land use and energy resources and distribution there are such others as on geology, climate, vegetation, water sources, timberlands, agriculture, commercial and recreational saltwater and freshwater fishing for the states of Oregon, Washington and Idaho.

"PESTS AND PARASITES AS MIGRANTS" edited by A. J. Gibbs & H. R. C. Meischke, xiii & 192 pp., 53 b/w fig. incl. 28 photos. & 12 maps, & 17 tab. Cambridge University Press, Cambridge, London & New York, N. Y. 10022. 1986. $39.50 clothbound; also available paperbound.

Because of Australia's unique country-island-continent status, with aborigines who had no plant cultivation or animal husbandry and with early settlers who were knowledgeable freemen and convict Britishers 200 years ago, early migrant pests and parasites were the few that were able to survive the long sea voyages. "Australia still remains one of the most disease-free countries in the world and it is this particular situation that has given our agriculture and livestock industries the special advantages of lower production costs and preferred access in international trade." There are 32 succintly written papers by several authors on such topics as exotic human, animal and plant diseases, plans for control of exotic disease outbreaks by quarantine, preparatory viral pathogen importation, AIDS, blue tongue, myxomatosis, and beneficial use of an exotic phytopathogen. This is another book with important content for many scientific and student readers, but also with at least a dozen misspelled words that were not editorially checked.

"AMERICAN INSECTS - A Handbook of the Insects of America North of Mexico" by Ross H. Arnett, xiv & 850 pp., 1,200+ b/w photos. & draw., & 1 map. Van Nostrand Reinhold, New York, N. Y. 10003. 1985. $79.50.

Nearly four decades ago in some open countryside we and our young son were enjoying the lovely growing season and were collecting some plant specimens. A nearby nature-enjoying family was collecting insects. Our son would have liked to switch to that Ross Arnett caravan then and now will be glad to have our copy of this amazingly well arranged, detailed, well illustrated and comprehensive text. It has an effectively number-styled and positioned format directing readers to the 7,500 species living in the continental Unites States and Canada. The text uses common names with the scientific names given in back since this book is prepared primarily for state and county agricultural extension agents, pest control operators, pest management field scouts, teachers, horticulturalists, amateur insect collectors, and ecologists, as well as the professional entomologists of universities, colleges and laboratories. The taxonomy used is recent. At the beginning of each order a descriptive survey provides very interesting material not part of the keys such as, for instance "Aphids are the most numerous and the most injurious of insects". Unfortunately this book was rushed to the printing presses before a batch of misspellings were checked - still it is well worth its price.

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# PHYTOLOGIA

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# A PROPOSED SUBSPECIFIC CLASSIFICATION FOR *CUCURBITA PEPO*

Harry S. Paris

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*Cucurbita pepo* L., a species which includes squashes, pumpkins, and gourds, contains a remarkable degree of variability in fruit characteristics. The edible immature fruits are known as summer squash in North America and marrows in the United Kingdom. The edible mature fruits are known as pumpkins and winter squashes. Fruit forms that are unpalatable and not consumed are known as gourds. As far as has been determined, all forms of *C. pepo* intercross freely.

The bewildering array of forms of *C. pepo* and the lack of barriers to gene exchange among them have hampered recognition of genetic affinities and resulted in no completely satisfactory subspecific botanical, horticultural, or vernacular classification scheme. To quote L.H. Bailey (1929, p. 91): "I hope we may find a way to use the English names with discrimination, and to this end I am in sympathy with the attempt to harmonize them." My objective is to propose a classification of the extant *C. pepo* cultivars grown for culinary purposes (squashes and pumpkins) that would simultaneously reflect genetic affinities and be consistent with both professional and popular terminology.

## Fruit shape as the basis for subspecific classification

Quantitatively inherited characteristics are better indicators of genetic affinities than simply inherited characteristics. Characteristics which are constant throughout development and over a wide range of environmental conditions and cultural practices are more useful as tools for classification than characteristics which change during development or whose expression is strongly influenced by environmental or cultural factors. In addition, characteristics useful for classification must be those which are easily observed by those for whom the classification is intended. Fruit shape is the only characteristic of *C. pepo* that combines these features; it is quantitatively inherited (Sinnott, 1935, 1936), is relatively constant over a wide range of conditions and during development (Sinnott, 1932, 1936; Sinnott & Kaiser, 1934), and is easily observed by all those concerned with *C. pepo*, horticulturists and other scientists, growers, produce marketers and the general public alike. Other characteristics, such as fruit size, fruit color, fruit quality, foliage characteristics and allozyme variation, while often associated with particular fruit shapes and of some aid in understanding genetic relationships, are not well suited for a universally acceptable classification scheme, as they are either simply inherited, strongly influenced by non-genetic variation or developmental age, or not readily observable.

History of subspecific classification within Cucurbita pepo

Historically, fruit shape has been one of several characteristics considered for assigning subspecific groupings within Cucurbita pepo.

Duchesne (Lamarck, 1786) was the first to correctly recognize among the huge variety of Cucurbita cultigens the boundary separating C. pepo from other species. He recognized within C. pepo five groups of cultivars, three groups of ornamental gourds and two groups having fruits used for culinary purposes. The latter two were those having fruits with a length to width ratio about equal to or exceeding 1.0, i.e. pumpkins, the "Giraumons" and "Citrouilles", the former said to be distinguished from the latter by a paler, fine-grained pulp, and those having fruits with a length to width ratio decidedly less than 1.0, i.e. scallops, the "Patissons".

Naudin (1856) recognized the validity of the species boundaries within Cucurbita set by Duchesne and elaborated on his treatment of the edible C. pepo as follows: (1) "Courgerons" (Pumpkins) having spherical or oblate fruits, (2) "Citrouilles" (Pumpkins) having oval fruits, that is, longitudinal to equatorial diameter ratio ranging from 1.0 to 2.0, (3) "Giraumons" having fruits with a polar diameter to equatorial diameter ratio exceeding 2.0, mentioned specifically were cocozelle, vegetable marrow, zucchini, crookneck and some elongate gourds, (4) "Patissons" (Scallops) having flattened fruits, and (5) Gourds, four distinct groups being described.

Alefeld (1866) was the first to ascribe formal subspecific nomenclature to C. pepo, and this was based mainly on the treatment of Naudin. Hence the subspecific groups of C. pepo became var. melopepo, var. citrullina, var. giromontia and var. clypeata for the edible forms and var. pomiformis, var. pyriformis, var. ovifera and var. verrucosa for the gourd forms. The various cultivars of the groups were also assigned Latin names, there being 66 in all.

Bailey (1929) condensed the formal treatment of Alefeld into three subspecific groups: C. pepo var. ovifera (gourds), C. pepo type subspecies (pumpkins, acorns, vegetable marrows), and C. pepo var. melopepo, including var. melopepo clypeiformis (scallops), var. melopepo torticollis (crooknecks) and var. melopepo varia (cocozelles and others).

A North American horticultural treatment was presented by Castetter (1925) who recognized as separate groups the Field and Pie Pumpkins, Scallop, Summer Crookneck, Vegetable Marrow (into these were included Cocozelle and Zucchini), Fordhook (a group characterized by fruits that were "short club-shaped and longitudinally grooved") and Table Queen. This treatment has gained some acceptance (Whitaker & Davis, 1962). However, events which ensued relatively soon after this treatment quickly rendered it out of date. The first of these events was the decline and near disappearance of the Fordhook group (Tapley et al. 1937). Other events were the quick rise of new groups, such as the Zucchini. Even as early as 1937 in the U.S.A., Tapley et al.

considered the zucchini cultivars to constitute a group distinct from the vegetable marrows. More recently, in the U.S.D.A. standards for grading of summer squash, first published in 1945 (U.S.D.A., 1967), five summer squash types were listed: Zucchini, Cocozelle, Crookneck, Straightneck, and Scallop. A total of six summer squash types, these five plus the Vegetable Marrow, were recognized in a U.S.D.A. guide to growers (U.S.D.A., 1969). The increase in number of recognized types of summer squash and the decline of the Fordhook group indicate that Castetter's grouping is no longer an adequate representation of the *C. pepo* forms presently in commerce.

## Cultivar groupings and subspecific designations

Following are the proposed modern horticultural groups of edible *Cucurbita pepo* based on fruit shape, with a description of the fruit shape characteristics and an accompanying illustration for each group (Figure 1). One or more non-hybrid cultivars have been chosen as typifying each group, not necessarily the oldest or most widely used cultivars but rather homogeneous cultivars still in commerce with which the author has been familiar for several growing seasons. In addition, I will hazard formal botanical subspecific designations, following the subspecific classifications of Alefeld (1866) and Bailey (1929) which relate to fruit shape, with new designations where necessary. No attempt will be made at classifying the gourds, except to suggest that some breakdown of the var. *ovifera* as treated by Bailey should be desirable as some forms, such as "Spoon" and "Crown of Thorns", have distinct and unusual shapes.

1. *Pumpkin*. Fruits spherical, oblate or oval, round or flattened at ends. Cultivars include: Connecticut Field, Jack O'Lantern, Small Sugar, Spookie. *C. pepo* L. var. *pepo* Bailey. This group represents the type subspecies, for the botanical reasons given by Bailey (1929). The designation is quite fortunate as this group is probably the oldest and most diverse, and because the English word "pumpkin" is derived from the word "*pepo*".

2. *Scallop (syn. Patty Pan)*. Fruits flattened, almost disc-shaped, with wavy equatorial or nearly equatorial margins. Cultivars include: Benning's Green Tint, Golden Bush Scallop, White Bush Scallop. *C. pepo* L. var. *clypeata* Alefeld.

3. *Acorn (syn. Table Queen)*. Fruits shaped like a top, broad at stem end and coming to a point at blossom end, deeply furrowed. Cultivars include: Table Queen, Table King, Mammoth Table Queen, Royal Acorn, Ebony, Jersey Golden Acorn. *C. pepo* L. var. *turbinata* ssp. nov. (new subspecific designation) for the top-shaped fruits.

4. *Crookneck*. Fruits elongate with slim, long, slightly to very curved neck, distal half of fruit broad. Cultivars include: Early Yellow Crookneck, Golden Summer Crookneck. *C. pepo* L. var. *torticollis* Alefeld.

5. *Straightneck*. Fruits cylindrical, with short, slightly constricted neck near stem end and distal half of fruit broad. Cultivars include: Early Prolific Straightneck. *C. pepo* L. var.

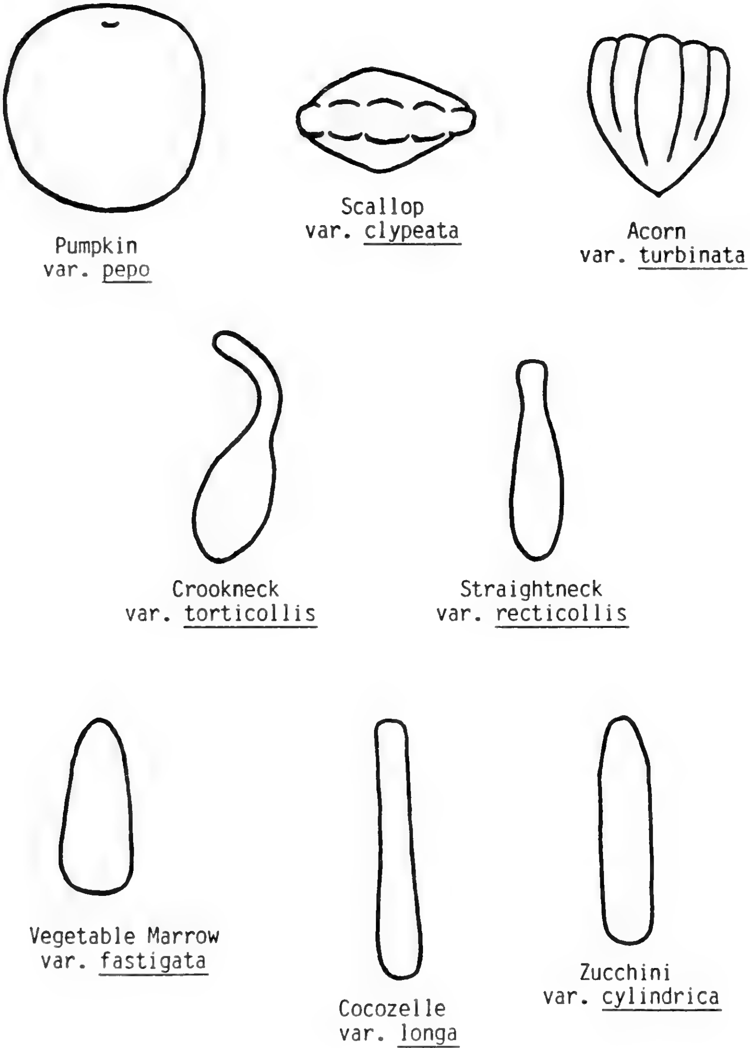


Figure 1. Fruit shape of each of the eight cultivar groups of *Cucurbita pepo*. Proximal (stem) end is at top, distal (blossom) end at bottom.

recticollis ssp. nov.

6. Vegetable Marrow. Fruits of short, tapered, cylindrical shape. Gradual taper from narrow at peduncle end to broad at stem end, ratio of length to broadest width ranging from 2.0 to 3.0. Cultivars include: Beirut, Sihi Lavan. *C. pepo* L. var. *fastigata* ssp. nov. for the tapered shape of the fruits.

7. Cocozelle. Fruits of long, tapered, cylindrical shape, bulbous near blossom end. Length to broadest width ratio approximating or exceeding 3.5. Cultivars include: Cocozelle. *C. pepo* L. var. *longa* ssp. nov.

8. Zucchini (syn. Courgette). Fruits long, cylindrical, with little or no taper, ratio of length to width approximating or exceeding 3.5. Cultivars include: Black Beauty, Black Zucchini, Fordhook Zucchini. *C. pepo* L. var. *cylindrica* ssp. nov.

Other fruit shapes exist in *C. pepo* which cannot readily be included in any one of the above groups. Some of these are intermediate forms, such as the many so-called zucchini hybrids which have long but noticeably tapered fruits. Such hybrids are in reality $F_1$s between vegetable marrows and zucchinis and thus their intermediate appearance. Other forms are more or less unique. For example, cv. Delicata is perhaps the sole survivor of the Fordhook group of Castetter (1925).

## Age of the cultivar groups

Each of the eight cultivar groups appears to have a history dating back at least several hundred years. Pumpkins, scallops and acorns are richly represented in European herbals, notably those of Gerard and Johnson (1636), Bauhin (1651) and Tabernaemontani (1664). Incipient forms of cocozelle, zucchini and vegetable marrow were described by Bauhin (Icon III, p. 219; *Zucha major longa*, p. 220; *Cucurbita turbinata majores albae*, pp. 222-223; *Cucurbita indica minor*, p. 227) and an incipient form of straightneck appears in Tournefort (1700). If the interpretation of funerary vases from Peru as being modeled after *C. pepo* fruits (Erwin & Haber, 1929) is correct, the crookneck form is over 1000 years old. Refined forms of all groups except the straightneck were described by Naudin (1856) with at least one commercial straightneck cultivar having been introduced before the close of the 19th century (Tapley *et al.* 1937).

## Summary

An attempt has been made at grouping the extant culinary forms of *Cucurbita pepo* in such a manner as to permit a unified classification for usage by professionals as well as the general public which would also be reflective of genetic affinities. It has been concluded that fruit shape is the only criterion amenable to such a unified subspecific classification. On this basis, the culinary forms of *C. pepo* have been divided into eight cultivar groups. Botanical designations have been suggested for the groups along with the common names.

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Contribution No. 1851-E, 1986 series, from the Agricultural Research Organization, Bet Dagan, Israel.

# CONTRIBUCIONES AL ESTUDIO DE LAS MIRTACEAS MEXICANAS. III.

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México

*Eugenia sotoesparzae* P. E. Sánchez V. *sp. nov.*

*Arbor glabra usque ad 7 metralis, cauliflorous. Folia glabra, elliptica vel ovata, 4.1-10.4 cm longa, (2.1-) 3.1-6.4 cm lata, apicem obtusum vel rotundatum interdum retusus, costa supra concavus subtus prominens, glandulosa, glabra, costulae 10-20 jugatae, angulo 40-50°, obliquae; petioli anguste alatus, 4-9 mm longi. Inflorescentia umbelliformis, flores 2-8; bracteolae 2, separatae, 0.5-1.3 mm longae; pedicelli 4-10 mm longi, glabri; hipanthium campanulatum; calycis lobi 4, inaequales, rotundati, 1.5-3 mm longi, 4-6 mm lati, glandulosi; discus 3.5-5.2 mm latus, puberulus; ovarium biloculare; ovula in quoque loculo 12-16; stylus 10.2 mm longus. Fructus 1.3-4.4 cm longus; semina 1, embryo homogeneus.*

Arbol hasta de 7 m de altura y 30 cm de d.a.p; corteza externa grisácea, exfoliándose en placas, exponiendo una corteza rojiza; madera rojiza que al estrujarse produce una savia rojiza; ramas grisáceas, exfoliándose en placas pequeñas, glabras, algo fisuradas; ramitas jóvenes de café-rojizas a café-amarillentas, comprimidas, glabras. Hojas pecioladas, de elípticas a ovadas, 4.1-10.4 cm de largo, (2.1-) 3.1-6.4 cm de ancho, en hojas juveniles hasta de 14.2 cm de largo y 9.1 cm de ancho, ápice de obtuso a redondeado o agudo, algunas veces retuso, base redondeada, decurrente sobre el pecíolo, lo que le da la apariencia alada, nervio central con un surco central en forma de V, entre dos lomos prominentes, continuándose a lo largo del pecíolo en la haz, prominente en el envés, glabro, glanduloso, nervios laterales 10-20 de cada lado, incluyendo algunos intermedios, prominentes tanto en la haz como en el envés, muy separados, ascendiendo en un ángulo de 30-40°, nervio marginal arqueado entre los secundarios, 2-10 mm del margen, igual de prominente que los laterales, a partir de este la unión de los nervios terciarios forma un nervio submarginal muy evidente, 1-3 mm del margen; lámina rígidamente coríacea, algo suculenta en material vivo, verde y opaca en la haz, verde-claro en el envés (café-rojizas en material seco), glabras, glandulosas; pecíolo recto, 4-9 mm de largo, 1.5-2 mm de ancho, aplanado en la parte superior, glabro, angostamente alado. Inflorescencias en grupos umbeliformes o fasciculados, formando grupos muy numerosos en los nudos de las ramas viejas, más abajo de las ramas foliosas (caulifioría), con 2-8 flores por inflorescencia, la gran cantidad de inflorescencias por nudo, hacen que éstos generalmente formen nudos abultados y deformes muy característicos de la especie; pedúnculo muy reducido o ausente; brácteas 2, rendondeadas, de 0.3-0.5 mm de largo y 0.7-1.1 mm de ancho, ciliadas, cóncavas, persistentes; bracteolas 2, libres, de truncadas a redondeadas, 0.5-1.3 mm de largo, 1.5-2.2 mm de ancho en la base, muy cercanas al hipanto, ciliadas, cóncavas, glandulosas, endurecidas, persistentes; yemas globosas, 5-6 mm de largo, 4.7-6.5 mm de ancho; pedicelos de 4-10 mm de largo, 0.6-1.5 mm de ancho; hipanto campanulado, 2-4 mm de largo, 0.6-2 mm de ancho, glabro; lóbulos del cáliz 4, desiguales, redondeados, 1.5-3 mm de largo, 4-6 mm de ancho en la base, glandulosos, cóncavos, ciliados, subcoríaceos; pétalos 4, blancos, de ovados a redondeados, algunos elípticos, 4.7-6.7 mm de largo, 4.2-5 mm de ancho, cóncavos, glandulosos, caducos; estambres 150-180, hasta de 7 mm de largo; anteras hasta de 1 mm de largo; disco de 3.5-5.2 mm de ancho, algo piloso; ovario bilocular; óvulos 12-16 por lóculo; estilo hasta de 10.2 mm de largo, glabro. Frutos de rojos a negros al madurar, de redondeados a elipsoidales 1.3-4 cm de largo, 0.9-2.3 cm de ancho, coronado con los restos florales; pedúnculo robusto, algo fisurado, hasta de 1.3 cm de largo y 2.5 cm de ancho, semilla 1, ovada, embrión homogéneo.

*Parcialmente financiado por CONICYT (Costa Rica) y CONACYT (México).

TIPO: MEXICO: Veracruz, Cerro el Vigía, Estación de Biología Tropical "Los Tuxtlas", San Andrés Tuxtla, 500 m.s.n.m. *M. Cházaro 419* (XAL).

PARATIPOS: MEXICO: Veracruz, Playa Escondida. *J.I. Calzada 752* (XAL); Playa Escondida, 5 km de la desviación de la carretera La Palma-Balzapote, Municipio Catemaco, nivel del mar, *J.I. Calzada 7782* (XAL); Playa Peña Hermosa, al N.E. del Ejido La Valentina, Mpio. Mecayapan, *J.I. Calzada, F. Ramírez & H. Perales 11335* (CR; MEXU; ENCB; F; MO.); Playa Escondida, Municipio Catemaco, 50 m.s.n.m. *Castillo & Dorantes 2621* (XAL); Playa Escondida, Municipio Catemaco, *P.E. Sánchez & Castillo 1244* (CR.).

*Eugenia sotoesparzae* se caracteriza por la forma ovada y elíptica, textura y consistencia algo suculenta de sus hojas; nervio marginal y submarginal muy evidentes y separados del margen; la producción de flores en las ramas gruesas y adultas; el pedúnculo reducido o ausente de las inflorescencias y la presencia de nudos aberrados por la producción de grandes cantidades de inflorescencias y además de la presencia de savia rojiza y frutos alargados y elipsoidales (caulinares), no característicos de ninguna especie centroamericana descrita hasta la fecha, McVaugh (1963), Amshoff (1958).

Está muy cercanamente relacionada con *E. Winzerlingii* Standley, pero ésta difiere de *E. sotoesparzae* por poseer hojas en su mayoría redondeado-obovadas; nervios laterales evidentemente más ascendentes (50-55°); pecíolos abultados; pedicelos filiformes, además de flores y frutos más pequeños.

Hasta la fecha endémica para el estado de Veracruz, donde se distribuye principalmente en las selvas costeras, con vegetación típica de Selva Alta Perennifolia y Dunas. Su floración se produce principalmente de marzo a abril y algunas esporádicas en julio; su fructificación en mayo y agosto.

Etimología:

El nombre de la especie, ha sido dedicado a la Dra. Margarita Soto Esparza, como una humilde forma de agradecimiento por su ayuda y desinteresada colaboración durante mis estudios de posgrado en el Instituto Nacional de Investigaciones sobre Recursos Bióticos.

Agradecimientos:

Al programa Flora de Veracruz del INIREB (México) por su apoyo económico para el trabajo de campo y a la Srita. Hortensia Gómez L. por el mecanografiado del manuscrito final.

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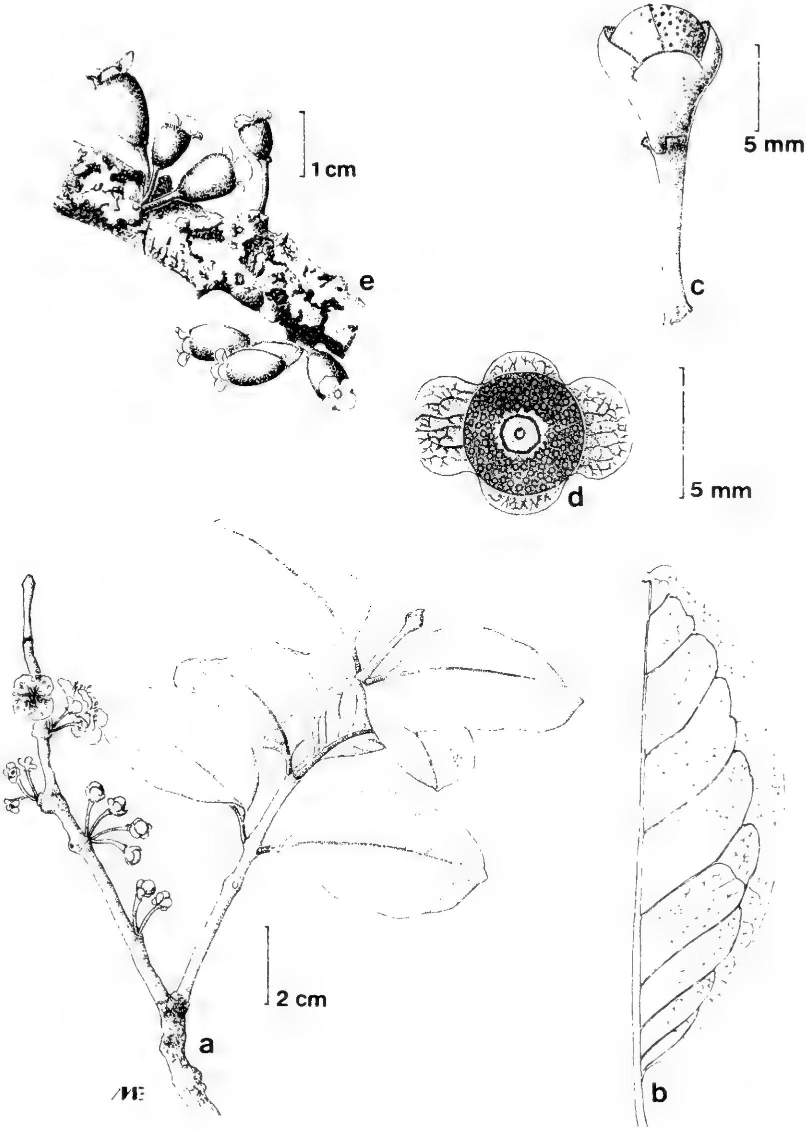


*Eugenia sotoesparzae*, a. hábito; b. hoja; c. yema floral; d. flor vista por arriba luego de que los pétalos y estambres han caído; e. rama con frutos. Ilustración por Manuel Escamilla, basado en ejemplares *Cházaro 419, Calzada 11335.*

# PAEDERIA FOETIDA L., COIX LACRYMA-JOBI L., AND HEDYCHIUM CORONATUM KOENIG FROM IBERIA PARISH, LOUISIANA

R. Dale Thomas and John W. McCoy, The Herbarium, Department of Biology, Northeast Louisiana University, Monroe, LA. 71209-0502.

On June 22, 1983 the authors spent several hours rambling around on the grounds of the Jungle Botanical Gardens on the McIlhenny Estate on Avery Island in Iberia Parish, Louisiana. Although this once lush botanical garden shows many signs of neglect and lack of planned maintenance, many interesting populations of native and introduced plants occur there. There are several large populations of as yet unidentified bamboos in the woods throughout the gardens.

The authors saw large populations of a foul-smelling tropical vine, *Paederia foetida* L. in the Rubiaceae (*Thomas 84494*). It was sprawling over vegetation in much the same manner as *Lonicera japonica* and *Lygodium japonicum*. Its white to pink to purplish campanulate flowers are quite showy. Small (1933) reported it from "thickets and fence-rows, peninsular Florida. Native of West Indies." This is the first collection of *Paederia* reported from Louisiana and was not included in Thomas and Allen (1982) or MacRoberts (1984). The authors have also seen it growing in the shrubs near a building on the campus of the University of Southwestern Louisiana in Lafayette in Lafayette Parish.

*Coix lacryma-jobi* L., Job's Tears, is a cultivated grass that is also a widespread escaped plant on Avery Island. *Hedychium coronatum* Koenig, a cultivated ginger, also is a self-reproducing escaped cultivar in the area. These two species were included in Thomas and Allen (1984) based on the escapes in Jungle Gardens.

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# REDUCTION OF MACHAERANTHERA ARIDA TO VARIETAL STATUS UNDER M. COULTERI (ASTERACEAE-ASTEREAE)

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Turner and Horne (1964) in their treatment of Machaeranthera sect. Psilactis proposed M. arida to accomodate a widespread variable group of lavender-rayed annuals that occurred in the desert regions from northeastern Sonora, Mexico, adjacent southern California, southwestern Arizona and extending northward into southernmost Nevada. At the time of this treatment they knew M. coulteri A. Gray from only a few collections, all from the vicinity of the type locality near Guaymas, Mexico. These few plants were largely glabrous, procumbent perennials which were related to, but quite distinct, from the supposedly annual, pubescent, M. arida. Over the past two decades numerous new collections of these two taxa have accumulated in herbaria and these show that collections of M. coulteri from the vicinity of Guaymas are quite variable as to habit. Thus Powell and Sikes (1684, TEX) describe M. coulteri as "tap-rooted perennials 1-2 feet tall" while Felger (86-60, TEX) describe the taxon as "annual or long-lived annual". Inded, as portrayed on herbarium sheets, M. coulteri may be a delicate annual (Felger et al.86-61, TEX), weak perennial (Felger 86-72, TEX) or robust perennial as noted by Powell and Sikes (above). Whatever the habit, such plants are clearly what we accepted in our 1964 treatment as M. coulteri.

The latter taxon can be distinguished from M. arida by its mostly glabrous mid-stems, but northward the two taxa appear to intergrade (e.g., Hartman et al. 3516, TEX; 35 mi NW of Guaymas) and the numerous new collections of both taxa from Northwestern Sonora now strongly suggest that the two are but varietally distinct (i.e., allopatric entities that differ in only a few characters which tend to intergrade in regions of contact).

It should also be noted here that Reveal (1970) has bestowed the name M. ammophila upon populations from Nevada that we called M. arida. In addition, Jackson and Johnson (1967) have given the name M. arizonica to populations of M. arida from the Organ Pipe Cactus National monument that have somewhat larger heads than is typical of the species elsewhere. The latter collections are said to be perennial and more-or-less intermediate to M. arida and M. crispa, but habit in both of the latter taxa varies from annual to seemingly perennial. In any case, as I view the types of M. arizonica, they readily fall under the variation pattern of M. arida.

I have recently reviewed (in prep.) the species and infrageneric categories of Machaeranthera (sensu lato) and have no hesitation in reducing M. arida to varietal status under M.

coulteri, as follows: Machaeranthera coulteri A. Gray var. arida (Turner & Horne) Turner, comb. nov. - based upon M. arida Turner & Horne, Brittonia 16: 324. 1964.

In my opinion the following are synonyms of this variety. This view has been independently expressed by Hartman (1976).

Machaeranthera arizonica Jackson & Johnson, Rhodora 69: 476. 1967.

Machaeranthera ammophila Reveal, Bull. Torr. Bot. Club 97: 172. 1970.

Hartman (1976) recognized four species (M. arida, M. coulteri, M. crispa and M. parviflora) in his treatment of the sect. Arida of Machaeranthera, which he separates from the sect. Psilactis (where these were positioned by Turner & Horne, 1964), largely by base chromosome number (x=5), flavonoid chemistry and seed morphology. I agree with this phyletic partitioning. In a more recent treatment of this group by Hartman and Lane (pers. comm.) they maintain M. arida and also place M. riparia (Kunth) Jones in the section. Based on my knowledge of the group I would exclude the latter species. Jackson (1978) has also described a new species of the sect. Arida (M. turneri), which I would also accept. Altogether, 5 or 6 taxa now makeup the section Arida. The following key will identify these taxa (except for M. riparia which is readily distinguished by its flattened, obovoid achenes with biseriate pappus and shorter triangular anther appendages).

Key to described taxa recognized in sect. Arida

1. Receptacle 9-11 mm across; disk florets mostly 100-250; plants of Chihuahua ...................... M. turneri

1. Receptacle 2-6 mm across; disk florets mostly 20-150.

   2. Ray florets mostly without pappus (i.e., only occasional individuals possess a pappus on the ray florets); plants of Baja Calif, NW Sonora and the adjacent SW U.S.A. (Western Arizona, S Calif and southernmost Nevada).

      3. Mid-stems densely glandular-pubescent with mostly short trichomes; heads (excluding rays) 1.0-1.5 cm across; plants of central Baja California.. M. crispa

      3. Mid-stems either glabrous or sparsely glandular-pubescent, the latter nearly always interspersed with longer, crisp, non-glandular hairs; head mostly 0.4-1.0(1.3) mm

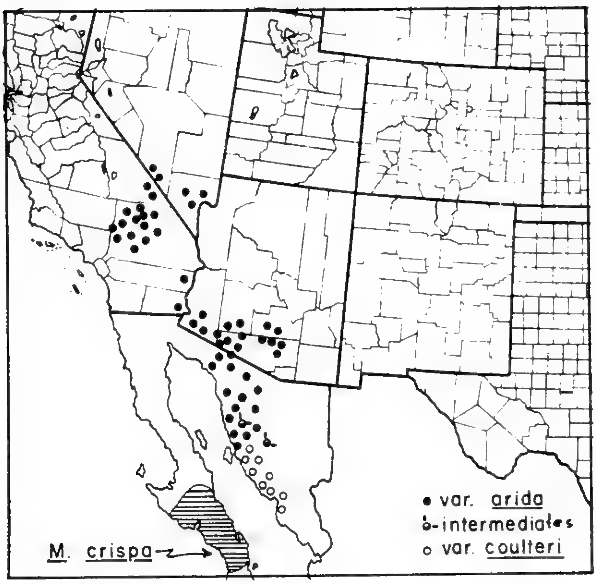
across (excluding rays); plants of NE Sonora, Mexico and adjacent regions of the U.S.A.

4. Mid-stems glabrous or sparsely glandular (intergrades with var. arida) .......... ...................... M. coulteri var. coulteri

4. Mid-stems rather densely glandular-pubescent, nearly always with a few crisp eglandular hairs...M. coulteri var. arida

2. Ray florets pappose; mid-stems glabrous or nearly so; plants of northcentral Mexico northward to E Arizona, SE Utah, SW Colorado and trans-Pecos Texas ................................ M. parviflora

The geographical relationship of the above five taxa are shown below.



## ACKNOWLEDGEMENTS

I am grateful to Dr. Ron Hartman for providing information relating to his forth-coming views on the group and to Dr. Raymond Jackson for his loan of the type of M. turneri (including colored slides of living material!).

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FLORA POLINICA DEL BOSQUE TROPICAL CADUCIFOLIO DE CHAMELA, JALISCO, MEXICO. PRESENTACION.

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Delfina Ramos-Zamora
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El bosque tropical caducifolio se distribuye ampliamente en tierras bajas tropicales de México (Rzedowski 1978), es la vegetación predominante en la vertiente del Pacifico desde Nayarit, México, hasta Costa Rica. Una reserva representativa, hasta ahora única tanto en la intensidad de estudios biológicos como en el grado de protección, es la Estación de Biología Chamela de la Universidad Nacional Autónoma de México, ubicada en la costa de Jalisco, municipio de la Huerta, entre altitudes de 60 y 500 m.s.n.m. (Fig. 1). Se ha mostrado la riqueza florística de este bosque (Lott et al. 1986) y su flora se ha estudiado en detalle (Lott 1985). Entre las 107 familias actualmente enlistadas, destacan por su diversidad las Leguminosae, Euphorbiaceae, Compositae, Convolvulaceae, Rubiaceae, Bromeliaceae, Malvaceae y Acanthaceae.

Se han encontrado especies nuevas para la ciencia (cerca 25) y endemismos con respecto a la costa del sur de México (aprox. el 15 %; E.J. Lott com. pers.)

El estudio florístico ha facilitado el desarrollo del conocimiento sobre la biología floral (Bullock 1985) y sobre la polinización y los polinizadores. Se considera valioso, entonces, estudiar y colaborar paralelamente con la palinología de los taxa en el listado florístico, proyecto que proporcionará apoyo a otros más como son los taxonómicos o ecológicos. Se puede esperar que el polen de la mayoría de estas especies no haya sido descrito anteriormente, pero en todo caso nos basamos en colectas locales para evitar que reajustes taxonómicos afecten seriamente a la flora polínica y a la vez contribuir en ciertas interpretaciones taxonómicas (por ej. Lott 1986). Además se están haciendo estudios sobre la lluvia de polen actual en la región (Palacios 1985) y se llevará a cabo la identificación de los granos de polen encontrados en murciélagos, lepidópteros e himenópteros de la región.

Para la Flora Polínica de Chamela se elaborarán descripciones morfológicas y claves dicotómicas, ilustradas con fotomicrografías, inicialmente a nivel de géneros o familias y finalmente para la flora en general. Así, su publicación avanzará según se complete el muestreo y su estudio. Las preparaciones se harán por duplicado para depositarlas en las colecciones del Lab. - de Palinología de la E.N.C.B. y en la del museo de la Estación. Los ejemplares de herbario que respaldan estos estudios se depositarán principalmente en el Herbario Nacional del Instituto de Biología, U.N.A.M., y en el museo de la Estación de Biología de Chamela.

Los granos de polen serán acetolizados según la técnica de - Erdtman (1943) con leves modificaciones. El montaje se hará en gelatina glicerinada. Las descripciones morfológicas del polen se harán fundamentalmente en base a la secuencia descriptiva - de Hyde & Adams (1958). La terminología utilizada será básicamente la de Erdtman (1966) y la de Faegri e Iversen (1964). - Todas las descripciones se ilustrarán con fotomicrografías en blanco y negro al miscroscopio de luz con excepción de aquellos taxa que no se puedan diferenciar a estos aumentos, entonces se recurrirá al microscopio electrónico de barrido.

RESUMEN

La investigación palinológica con bases florísticas es iniciada para el bosque tropical caducifolio cerca de Chamela Jalisco, México. Estos estudios descriptivos y las colecciones están encaminadas a complementar la investigación en taxonomía, ecología de la polinización y lluvias de polen moderno. La metodología y presentación del proyecto se mencionan aquí.

SUMMARY

Palynological research on a floristic basis is being initiated for the tropical deciduous forest near Chamela, Jalisco, México. These descriptive studies and the associated collections are - intended to complement research in taxonomy, pollination ecology and modern pollen rains. Standards of methods and presentation are outlined here.

AGRADECIMIENTOS.

El inicio del proyecto fué impulsado por Stephen H. Bullock - de la Estación Chamela, quién realiza el envio de muestras de - las colectas de él mismo y de J.A. Solis Magallanes, E.J. Lott, M.G. Ayala y L.A. Pérez Jiménez, determinadas en su mayoría por E.J. Lott.

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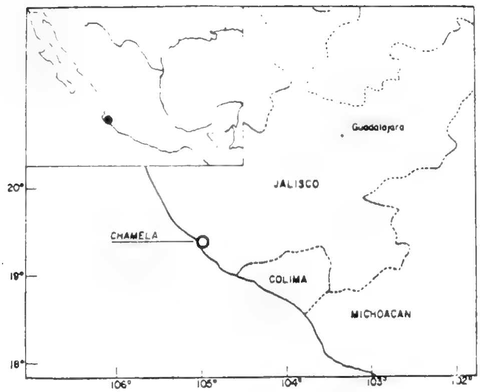


Fig. 1 Esquema del lugar donde se localiza la Estacion de Biologia de Chamela, Jal. de la UNAM

MORFOLOGIA DE LOS GRANOS DE POLEN DEL GENERO *ERYTHROXYLUM* (ERYTHROXYLACEAE) DE CHAMELA, JALISCO. NO. 1*

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## INTRODUCCION

La familia Erythroxylaceae a nivel mundial esta representada por tres géneros ampliamente distribuidos en las zonas tropicales de America, desde Cuba y México hasta Sudamérica, con pocos taxa en Africa.

El género *Erythroxylum* consta de 200 especies, que pueden ser pequeños árboles o arbustos según Lawrence (1969), distribuidos principalmente en los trópicos y subtrópicos de Madagascar y América del Sur. Para México se citan siete especies (Standley,1920), tres de las cuales se encuentran en el bosque tropical caducifolio de la Estación Biológica de Chamela, Jal. perteneciente a la Universidad Autónoma de México.

## ANTECEDENTES

Entre los autores que han estudiado el polen de *Erythroxylum* se encuentra a Erdtman (1966) quien describe el de *E. emarginatum* como tricolporado, casi zonorado, subprolato a prolato y con la ornamentación reticulada y el de *E. coca* con polen más pequeño, con la abertura ± circular. Huang (1972) hace una descripción más detallada del de *E. coca* con las siguientes características: polen tricolporado, prolato-esferoidal a subprolato, con colpos largos con una abertura circular y superficialmente con la ornamentación finamente reticulado.

Markgraf y D'Antoni (1978) describen el polen de *E. argentinum* y el de *E. coca* como tricolporado, per-reticulado, prolato esferoidal y con poros circulares.

* Trabajo parcialmente subsidiado por CONACYT PCECBNA-030184

** Becarios de COFAA.

MATERIALES Y METODOS

El material floral para este estudio, fué proporcionado por el Dr. S.H. Bullock, investigador de dicha Estación de Biología y el tratamiento que se les dió a los granos de polen, para observaciones al ML fue el de la acetolísis de Erdtman (1943) y para observaciones al MEB se utilizaron granos de polen sin acetolizar y fueron cubiertos con Au, utilizando un microscopio JEOL modelo JSM35.

DESCRIPCION DE LOS GRANOS DE POLEN
DE LAS ESPECIES DE ERYTHROXYLUM

*Erythroxylum havanense* Jacq.

Chamela, Jal.
S.H. Bullock 1345 (MEXU)
Lams. I y II, Figs. 1-4 y 14-16

Polen tricolporado, tectado, esferoidal de 33(36.7)41 micras X 33 (36.9) 39 micras. Indice P/E = 0.99. Vista polar circular de 33 (35.4) 37.7 micras de diámetro. Exina de 2.6 micras de grosor, con la sexina de igual espesor que la nexina, superficialmente al MEB la ornamentación se observa foveolada, fosulada y punteada y al ML se observa con un patrón reticulado con lúmenes mayores de 1 micra. Colpos de 28(30.1) 35.1 micras de largo X 3 micras. Con las membranas escabrosas y con terminaciones agudas. Colpos transversales de 10(10.6) 13 micras de largo X 4 micras con las membranas lisas y con terminaciones redondas. Indice del área polar 0.17 pequeña.

*Erythroxylum mexicanum* HBK

Chamela, Jal.
S.H. Bullock 1358 (MEXU)
Láms. I Y III, Figs. 5 - 9 y 17 - 19

Polen tricolporado, tectado, subprolato de 28(31.8) 33.8 micras X 22 (27.5) 29.9 micras. Indice P/E = 1.1. Vista polar circular de 27 (28.7) 29.9 micras de diámetro. Exina de 2 micras de grosor, con la sexina ligeramente más gruesa que la nexina, superficialmente al MEB la ornamentación se observa foveolada fosulada y punteada con un patrón finamente reticulado con lúmenes menores de 1 micra. Colpos de 23(25.2) 27.3 micras de largo X 3 micras con las membranas escabrosas y con terminaciones agudas. Colpos transversales de 6(7.6) 9.1 micras de largo X 2.6 micras, con las membranas lisas y con terminaciones redondeadas. Indice del área polar 0.20 pequeña.

Erythroxylum rotundifolium Lunam

Chamela, Jal.
J.A. Solis 3689 (MEXU)
Láms. 1 y IV figs. 10-13 y 20-22

Polen tricolporado, tectado suboblato de 27(28.7) 31.2 X 28.6 (32.8) 35.1 micras. Indice P/E = 0.87. Vista polar inter-hexagonal de 26(27.9) 33.8 micras de diámetro. Exina de 2.6 micras de grosor, con la sexina de igual espesor que la nexina, superficialmente al MEB la ornamentación se observa foveolada, fosulada y punteada y al ML con un patrón reticulado con lúmenes mayores de 1 micra. Colpos de 20.8 (23.4) 26 micras de largo X 3.6 micras con las membranas escabrosas y con las terminaciones agudas. Colpos transversales de 13 (13.7) 16.9 micras de largo X 2 micras. Indice del área polar 0.14 pequeña.

## DISCUSION Y CONCLUSIONES

De acuerdo con las observaciones que aqui se hacen se puede inferir, que el polen de E. mexicanum al ML presenta un patrón reticulado más fino que el de E. havanense y E. rotundifolium. Al MEB la ornamentación se observa foveolada, fosulada y punteada con pocas diferencias en el polen de las tres especies Schulz (1959) divide al género Erythroxylum en 18 secciones de las cuales E. havanense y E. mexicanum pertenecen a la sección Archerythroxylum y E. rotundifolium a la sección Heterogyne pero desde el punto de vista palinológico no se encontraron grandes diferencias que apoyen la separación de estas dos secciones.

## RESUMEN

Con este trabajo se estudia al ML y al MEB los granos de polen de tres especies del género Erythroxylum, E. havanense, E. mexicanum y E. rotundifolium, del bosque tropical caducifolio de la Estación de Biología de Chamela, Jalisco de la Universidad Nacional Autónoma de México.

Pocas son las diferencias que presentan las microsporas de estos taxa, en observaciones al ML, estas resultaron ser tricolporadas, con surcos transversos y la ornamentación con un patrón reticulado, que en E. mexicanum es más fino y al MEB se observa foveolada, fosulada y punteada en el polen de las tres especies estudiadas.

SUMMARY

In this paper is studied at LM and SEM, pollen grains of - three species of Erythroxylum genera, E. havanense, E. mexicanum E. rotundifolium from tropical decidous forest of Estación de Biología Chamela, Jalisco de la Universidad Nacional Autónoma de México.

Few differences show the microspores these taxa, at LM are observed tricolporate, with transversal furrows and with reticulate ornamentation, only Pollen of E. mexicanum show a finely reticulate, with the SEM pollen grains of the three species are observed, foveolate, fossulate and punctate.

AGRADECIMIENTOS

Los autores de este trabajo reiteran su más sincero agradecimiento a la Biól. Yolanda Hornelas del Instituto de Ciencias del Mar y Limnología de la Universidad Nacional Autónoma de - México por el trabajo realizado con el microscopio electrónico de barrido, asimismo al Dr. S.H. Bullock investigador de la Estación de Biología Chamela, Jal. del Instituto de Biología de la UNAM quien nos proporciono el material floral ya identificado de la vegetación de dicha Estación.

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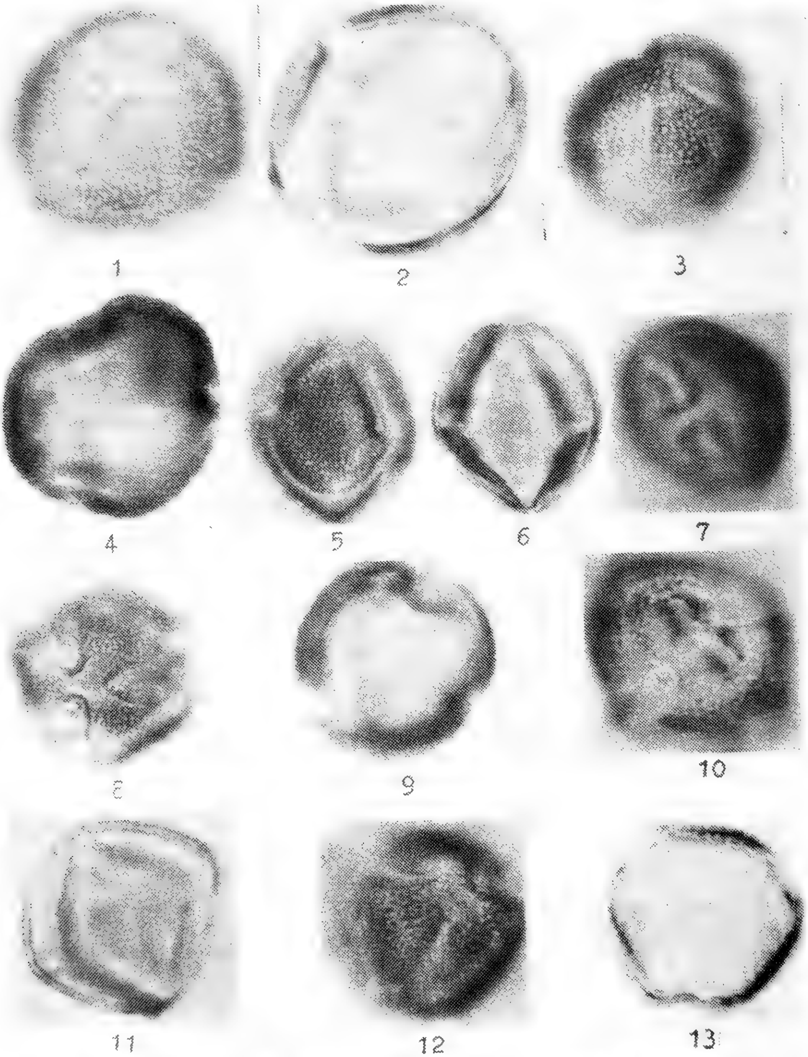
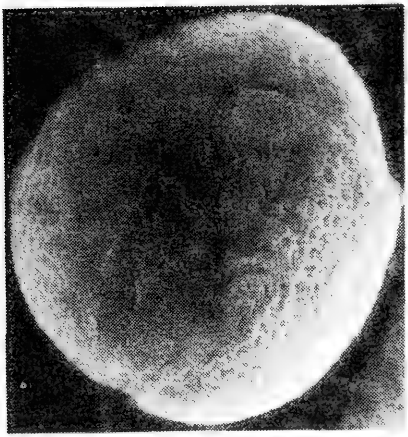



Lam. I. Erythroxylum havanense. 1) Vista ecuatorial superfi - cial. 2) corte óptico. 3) vista polar superficial. 4) corte óptico. E. mexicanum. 5) vista ecuatorial superficial. 6) cor te óptico. 7) aberturas. 8) vista polar superficial. 9) vis- ta polar corte óptico. E. rotundifolium 10) vista ecuatorial superficial. 11) corte óptico. 12) vista polar superficial. 13) vista polar corte óptico. Aumentos X 1200 en todas las fotomicrografias.



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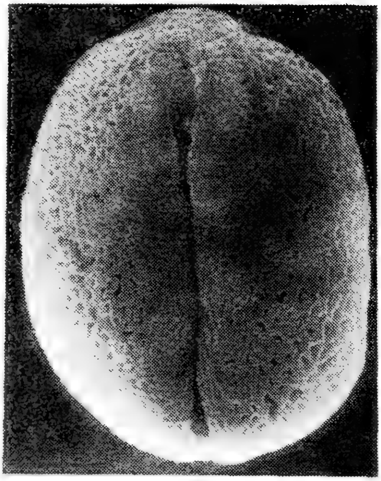

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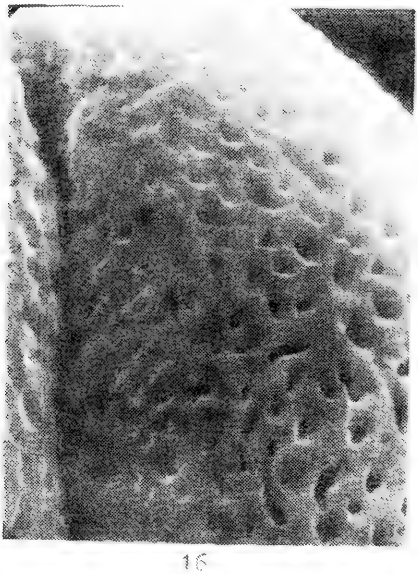

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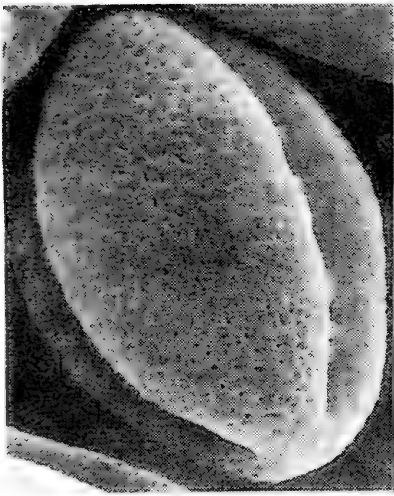
Lam, II Erythroxylum havanense. Observaciones al MEB. 14) vista polar superficial X 3000. 15) Vista ecuatorial superficial X 3200. 16) acercamiento óptico superficial mostrando la ornamentación foveolada, fosulada y punteada X 5400.



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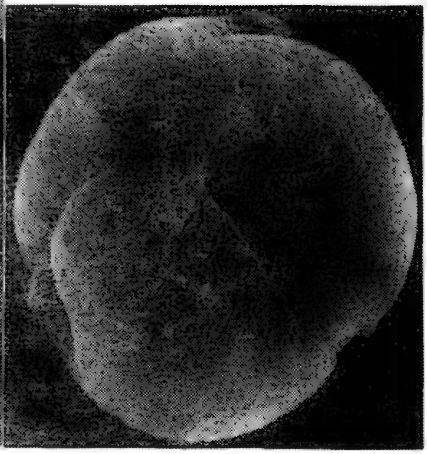

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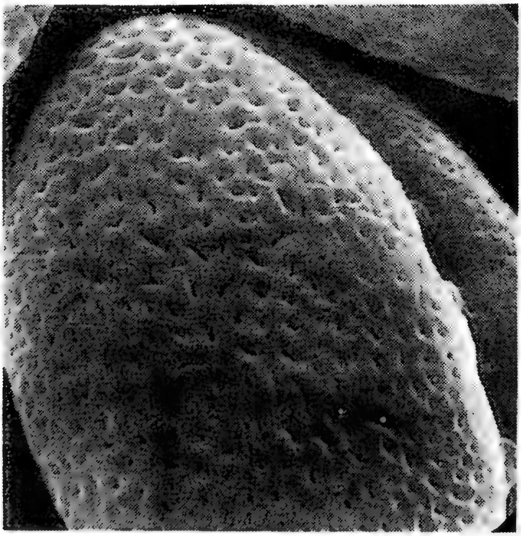

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Lam. III. Erythroxylum mexicanum. Observaciones al MEB. 17) vista ecuatorial superficial X 3200. 18) vista polar superficial X 3000. 19) acercamiento óptico mostrando la ornamentación foveolada, fosulada y punteada X 5400.

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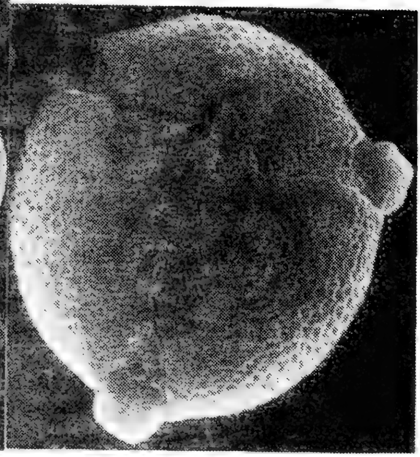

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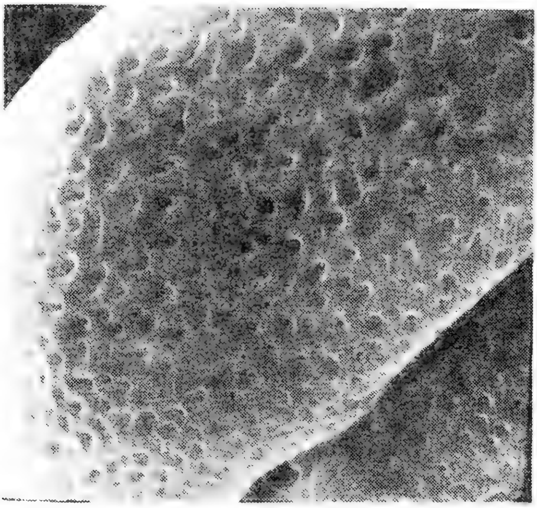

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Lam. IV Erythroxylum rotundifolium. Observaciones al MEB. 20) vista ecuatorial superficial X 2200. 21) vista polar superficial X 3000. 22) acercamiento óptico mostrando la ornamentación foveolada, fosulada y punteada X 6000.

# MORFOLOGIA DE LOS GRANOS DE POLEN DE TURNERA (TURNERACEAE) DE CHAMELA, JALISCO MEXICO. *No. 2.

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## INTRODUCCION

La familia Turneraceae en América Tropical cuenta con 6 géneros y ± 110 especies (Lawrence 1951), *Turnera* es el género más grande con cerca de 60 especies. En México se encuentra representada la familia con 3 géneros y alrededor de 6 especies. En Chamela solo se ha encontrado *Turnera diffusa*.

## ANTECEDENTES

Erdtman (1966), estudia 4 géneros y 4 especies de Turneraceae y describe los granos de polen como tricolporados o tricolporoidados, con ornamentación reticulada, así también hace el comentario que los granos de polen de esta familia son similares a los de algunos miembros de las familias Passifloraceae y Flacourtiaceae.

## MATERIAL Y METODOS

El material floral para este estudio fué proporcionado por el Dr. S.H. Bullock, investigador de la Estación de Biología de Chamela, Jal. El material para las observaciones al ML se proceso con la técnica de Acetólisis de Erdtman (1943) levemente modíficada y en las observaciones al MEB se utilizarón granos de polen sin acetolizar recubiertos con Au empleándose un microscopio JEOL modelo JSM 35.

## DESCRIPCION E ILUSTRACION DE LOS GRANOS DE POLEN

*Turnera diffusa* Willd. Estación Biológica de Chamela, Jal.
E. Lott 1695 (MEXU)
Figs. 1 - 6

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* Trabajo parcialmente subsidiado por el Consejo Nacional de Ciencia y Tecnología PCECBNA - 030184

** Becarios de COFAA

Polen tricolporado, semitectado, oblato esferoidal de 28.5 (35.4) 41.5 micras por 27(32.5) 35.5 micras, índice P/E = 0.91. Vista polar circular de 25(34)43 micras de diámetro. Exina de 2 a 3.5 micras de grosor, con sexina generalmente más gruesa -- que la nexina, ornamentación al ML y al MEB reticulada. Colpos de 20 a 34 micras de largo por 1 a 1.5 micras de ancho. Colpos transversos de 12.5 a 17 micras de largo por 2.5 a 10 micras - de ancho. Indice del área polar 0.50, grande.

DISCUSION Y CONCLUSIONES

Los granos de polen de Turnera diffusa son muy similares a - las de otras Turneraceae estudiadas por Erdtman 1966.

RESUMEN

En este trabajo se estudian los granos de polen de Turnera diffusa (Turneraceae) que se encuentra en Chamela, Jal. El polen es tricolporado con ornamentación al ML y MEB reticulada.

SUMMARY

In this paper is studied al LM and SEM pollen grains of -- Turnera diffusa (Turneraceae) from Chamela, Jalisco. Pollen - grains are tricolporate, the ornamentation at LM and the SEM is reticulate.

AGRADECIMIENTOS

Se agradece a la Biól. Yolanda Hornelas Orozco del Instituto de Ciencias del Mar y Limnología de la Universidad Nacional -- Autónoma de México, por haber procesado y tomado las fotografías del polen al MEB, y al Dr. S.H. Bullock por enviar el material floral identificado.

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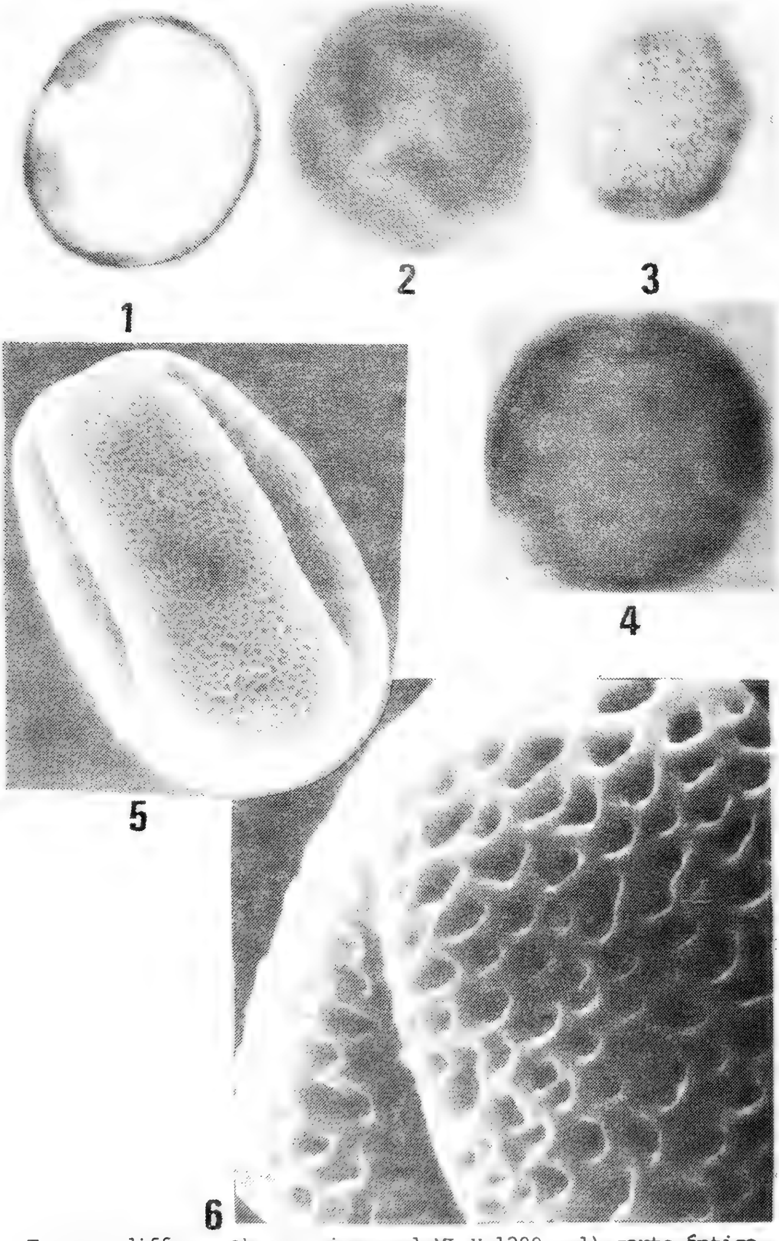
Lawrence, G.H.M. 1951. Taxonomy of Vascular plants. Macmillan Publishing Co., Inc. New York. 823 p.p.




_Turnera diffusa_ Observaciones al ML X 1200. 1) corte óptico - en vista ecuatorial. 2) vista polar mostrando los colpos. 3) -- vista superficial mostrando la ornamentación. 4) corte óptico -- en vista polar. Observaciones al MEB. 5) vista ecuatorial superficial X 1300. 6) Detalle de la ornamentación X 7200

## MORFOLOGIA DE LOS GRANOS DE POLEN DE *JACQUINIA* (THEOPHRASTACEAE) DE CHAMELA, JALISCO MEXICO * No. 3.

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David Leonor Quiroz-García
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### INTRODUCCION

La familia Theophrastaceae en América tropical e islas Hawaianas, cuenta con 4 géneros y aproximadamente 60 especies (Lawrence 1951), *Jacquinia* es el género más grande con alrededor de 25 especies. En México se encuentra representada la familia con 2 géneros y 10 especies. En Chamela se encuentra *Jacquinia pungens*.

### ANTECEDENTES

Erdtman (1966) estudió 2 géneros y 2 especies de Theophrastaceae y describe los granos de polen como tricolporados con ornamentación finamente reticulada y hace el comentario que los granos de polen de esta familia son similares a los de algunos taxa de Myrsinaceae y Primulaceae.

### MATERIAL Y METODOS

El material floral para este estudio fué proporcionado por el Dr. S.H. Bullock, investigador de la Estación de Biología de Chamela, y el tratamiento que se les dió a los granos de polen para observaciones al ML fué el de la acetólisis de Erdtman (1943) y en las observaciones al MEB se utilizaron granos de polen sin acetolizar y fueron recubiertos con Au empleando un microscopio JEOL modelo JSM 35.

### DESCRIPCION E ILUSTRACION DE LOS GRANOS DE POLEN

*Jacquinia pungens* Gray — Estación de Biología de Chamela, Jal.
A. Pérez 681 (MEXU)
Figs. 1 - 6

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* Trabajo parcialmente subsidiado por el Consejo Nacional de Ciencia y Tecnología. PCECBNA-030184.
** Becarios de COFAA.

Polen tricolporado, tectado, esferoidal de 19.5 (20.7) 22 micras por 20(21)22 micras. Indice P/E=1.02. Vista polar circular de 18.6 (20) 24.5 micras de diámetro. Exina de 2 a 2.5 micras de grosor, sexina generalmente más gruesa que la nexina con ornamentación al ML formando un patrón reticulado con lúmenes menores de 1 micra y al MEB la ornamentación se observa punteada. Colpos de 14 a 18 micras de largo por 1 a 1.5 micras de ancho. Colpos transversos de 4 a 8.5 micras de largo por 1 a 2 micras de ancho. Indice del área polar 0.48, media.

DISCUSION Y CONCLUSIONES

Los granos de polen de Jacquinia pungens son muy similares a otras especies y géneros estudiados por autores como Erdtman (1966).

RESUMEN

En este trabajo se estudian los granos de polen de Jacquinia pungens (Theophrastaceae) que se encuentra en Chamela, Jalisco. El polen es tricolporado con ornamentación al ML formando un patrón reticulado y al MEB punteada.

SUMMARY

In this paper is studied at LM and SEM pollen grains of Jacquinia pungens (Theophrastaceae) from Chamela, Jalisco. The pollen grains are tricolporate, the ornamentation at LM, is observed a patron reticulate and with SEM is punctate.

AGRADECIMIENTOS

Se agradece a la Biól. Yolanda Hornelas Orozco del Instituto de Ciencias del Mar y Limnología de la Universidad Nacional Autónoma de México, por haber procesado y tomado las fotografías del polen al MEB y al Dr. S.H. Bullock por enviar el material floral identificado.

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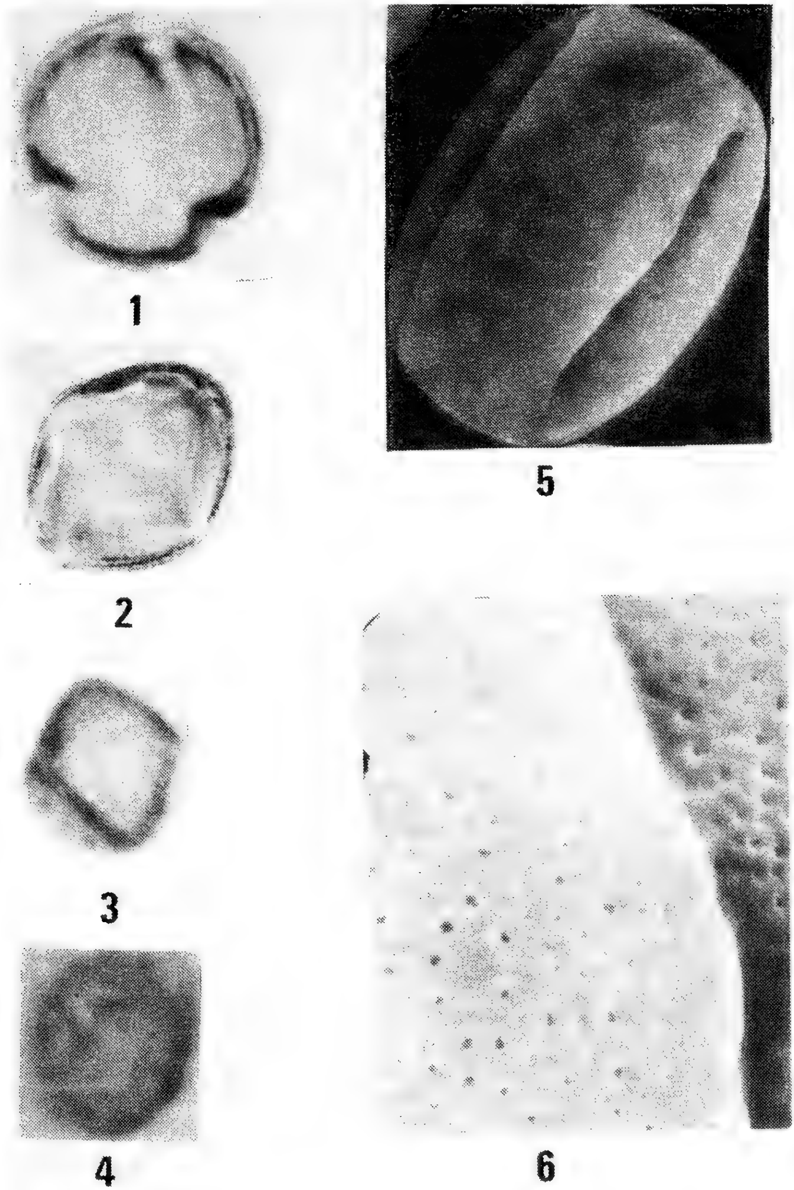
Lawrence G.H.M. 1951. Taxonomy of Vascular plants. Macmillan - Publishing Co., Inc. New York and London. 823 pp.



*Jacquinia pungens* Observaciones al ML X 1200. 1) Vista polar mostrando grosor de la exina. 2) Corte óptico vista ecuatorial. 3) Vista ecuatorial superficial. 4) Vista ecuatorial mostrando los colpos. Observaciones al MEB. 5) Vista ecuatorial X 3200 6) Detalle de la ornamentación X 10000.

## NOTES ON THE GENUS *CLERODENDRUM* (*VERBENACEAE*). XXVI

Harold N. Moldenke

*CLERODENDRUM* Burm.

Additional synonymy: *Clereodendron* Sharma & Mukhopadhyay, Journ. Genet. 58: 373 sphalm. 1963. *Clerojendrum* Blasco, Trav. Sect. Scient. Techn. Inst. Franç. Pond. 14: 83 sphalm. 1975.

Additional & emended bibliography: Blanco, Fl. Filip., ed. 3, 2: 14 & 292--294 (1878) and 6: pl. 173 & [222--225]. 1878; Fern.-Villar & Naves in Blanco, Fl. Filip., ed. 3, 4: Nov. App. 160--161. 1880; Mercado, Lib. Med. 45. 1880; Vidal y Soler, Phan. Cuming. Philip. 5, 21, 53, 55, 62, 64, 67, 74, 87, & 135. 1885; Vidal y Soler, Rev. Pl. Vasc. Filip. 211 & 221. 1886; R. Good, Feat. Evol. Flow. Pl., imp. 1, 352. 1955; J. A. Wolfe, Madroño 20: 95. 1969; R. Good, Feat. Flow. Pl., imp. 2, 352. 1974; Blasco, Trav. Sect. Scient. Techn. Inst. Franc. Pond. 14: 17, [19], 22, 23, 28, 38, 39, [44], 58, 64, 83, 116, 119, 129, 130, 138, 141, 153, 173, & erratum, fig. 7 & 9. 1975; Alcorn, Huastec Mayan Ethnobot. 604--605 & 870. 1984; Mold., Phytologia 61: 77--116. 1986.

Additional excluded species: *Clerodendron bhramaramari* Pammell, Man. Poison. Pl., ed. 2, 65 & 932 nom. nud. 1911 = ? probably not verbenaceous!

*CLERODENDRUM ACULEATUM* (L.) Schlecht.

Additional bibliography: Mold., Phytologia 61: 22, 24, 26, 97, & 105. 1986.

A key to help distinguish this species from other cultivated Hawaiian species will be found under C. *indicum* (L.) Kuntze in the present series of notes (61: 24--25).

*CLERODENDRUM ALATUM* Gürke

Additional bibliography: A. W. Hill, Ind. Kew. Suppl. 7: 51. 1929; Mold., Phytologia 60: 360. 1986.

*CLERODENDRUM BRACHYANTHUM* Schau.

Additional bibliography: Mold., Phytologia 60: 363. 1986.

A key to help distinguish this species from other Indonesian taxa will be found under C. *klemmei* Elm. in the present species of notes.

*CLERODENDRUM BREVIFLORUM* Ridl.

Additional bibliography: Mold., Phytologia 60: 363. 1986.

A key to help distinguish this species from other Indonesian taxa will be found under C. *klemmei* Elm. in the present series of notes.

*CLERODENDRUM BUCHANANI* (Roxb.) Wal.

Additional & emended bibliography: Hassk., Retzia 60 & 62. 1855;

Mold., Phytologia 60: 364. 1986.
A key to help distinguish this species from other Indonesian taxa will be found under C. *klemmei* Elm. in the present series of notes.

*CLERODENDRUM BUCHHOLZII* Gürke
Additional & emended bibliography: Thiselt.-Dyer, Ind. Kew. Suppl. 2: 43 & 172. 1904; Mold., Phytologia 60: 364. 1986.

*CLERODENDRUM BUNGEI* Steud.
Additional & emended bibliography: Rehd., Journ. Arnold Arb. 15: 324--325. 1934; J. F. MaCBR., Field Mus. Publ. Bot. 13 (5): [Fl. Peru] 698. 1959; Mold., Phytologia 60: 364--365. 1986.
It should be noted that Rehder (1934) dates Léveillé's Fl. Kouy-Tchéou as "1915", rather than 1914, perhaps from some evidence not known to me. *Pavetta esquirolii* Lévl., in the synonymy of *Clerodendrum bungei*, is based on *Esquirol 805* from Tchéou-mao-tan, Kweichow, China, collected on July 30, 1905, and *Maire s.n.* from the Vallée de Hong-lou, at 600 m. altitude, Yünnan, collected in June of 1912. The species was referred to C. *bungei* by Rehder and also by workers in the Edinburgh herbarium, according to an undated notation on Maire's cotype in that herbarium. It was also placed here doubtfully by P'ei (1932). Rehder notes that "Besides the characters mentioned by P'ei to distinguish C. *fragrans* and C. *Bungei* the calyx-teeth seem to present good character; they are lanceolate and long-acuminate in the former and triangular-ovate and acute in the latter."

*CLERODENDRUM BURUANUM* Miq.
Additional bibliography: Mold., Phytologia 60: 365. 1986.
A key to help distinguish this species from other Indonesian taxa will be found under C. *klemmei* Elm. in the present series of notes.

*CLERODENDRUM BURUANUM* f. *LINDAWIANUM* (Lauterb.) Bakh.
Additional bibliography: Mold., Phytologia 60: 365. 1986.
A key to help distinguish this form from other Indonesian taxa will be found under C. *klemmei* Elm. in the present series of notes.

*CLERODENDRUM CALAMITOSUM* L.
Additional bibliography: Paxt., Mag. Bot. 11: [169]. 1841; Edwards, Bot. Reg. 30: pl. 19 in textu. 1894; Boorsma, Meded. Lands Plant. 52: [22]. 1902; Mold., Phytologia 60: 365. 1986.
A key to help distinguish this species from other Indonesian taxa will be found under C. *klemmei* Elm. in the present series of notes.

*CLERODENDRUM CALYCINUM* Turcz.
Additional bibliography: H. J. Lam, Verbenac. Malay. Arch. 284 & 363. 1919; Mold., Phytologia 58: 410--411. 1986.
Lam (1919) reduces this species to synonymy under what he calls C. *infortunatum* L.

*CLERODENDRUM CANESCENS* Wall.
Additional bibliography: Mold., Phytologia 60: 366 & 368 (1986)

and 61: 88. 1986.

A key to help distinguish this species from others in Taiwan will be found under C. *intermedium* Cham. in the present series of notes.

*CLERODENDRUM CAPITATUM* (Willd.) Schum. & Thonn.

Additional bibliography: Isaacson, Flow. Pl. Ind. 1: 335. 1979; Mold., Phytologia 60: 366. 1986.

A key to help distinguish this species from other taxa known from Indonesia will be found under C. *klemmei* Elm. in the present series of notes.

*CLERODENDRUM INERME* (L.) Gaertn.

Additional bibliography: Blasco, Trav. Sect. Scient. Techn. Inst. Franc. Pond. 14: 17, [19], 22, 22/23, 38, 39, [44], 58, 116, 119, 138, & 173, fig. 7. 1975; Mold., Phytologia 61: 77--116. 1986.

A key to help distinguish this species from other Indonesian taxa will be found under C. *klemmei* Elm. in the present series of notes.

The *Adlard s.n.* [1/25/38], distributed as C. *commersonii* Lam., actually is C. *klemmei* Elm.

Additional citations: SRI LANKA: *Marcovicz s.n.* [12.III.27] (L).

*CLERODENDRUM INERME* f. *PARVIFOLIUM* Mold.

Additional bibliography: Mold., Phytologia 61: 105. 1986.

The *Clerodendron emarginatum* of Briquet was based by him on an unnumbered Ruíz & Pavon specimen in the Delessert Herbarium at Geneva, thought by Briquet to have come from Mexico and by Merrill to have come from South America, perhaps Peru.

Santapau states that small-leaved plants of C. *inerme*, when grown on his University campus, produced leaves of the normal size and shape of the typical form of the species. However, small-leaved specimens are known from cultivated plants grown in England, France, Germany, and India, so it does not seem that cultivation in "better" soil conditions always "restores" the typical *inerme* form of the leaves. Vernacular names for the small-leaved form in Sri Lanka are "burende" and "gulinda" -- names also applied to the typical form there.

The form is based on *N. Wirawan 683* from a rocky area near the Smithsonian Camp, Patanagala, in Ruhuna National Park, Hambantota District, Sri Lanka, collected on October 28, 1968, and deposited in the Britton Herbarium at the New York Botanical Garden.

Willdenow's original (1809) description of his *Volkameria buxifolia* is merely "fol. obovatis retusis integerrimis nitidis; pedunculis axillaribus sub-1-floris. Patria ? ♄ ". Seemann (1866), uniting it with *Clerodendrum inerme*, comments that "The small-leaved form I have seen from Mangalor (Hohenacker!), China (Amhurts!), Hongkong (Urquhart! Hance! Champion!), Rangoon (M'Cleland!)". Macbride (1960) records it "Without locality, Ruiz & Pavon" from Peru, and this may well be the same Ruíz & Pavon collection on which Briquet, in 1896, based his *Clerodendron emarginatum*, and for which he gives the following detailed description: "Frutex ramosus, ramis inermibus, brevissime adpresse pubescentibus, internodiis sat brevibus. Folia obovata, apice acute marginata, marginibus rotundatis, basi cuneiformiter in petiolem brevem extenuata, utrinque viridia, glabra, integra, tenuia, herbacea; nervatio pinnatim simplex, haud prominula. Cymae axillares vel versus apicem ramorum confertae, saepius 3 florae, pedunculatae, pedicellis elongatis, axibus tenuibus subglabris. Calix obconico-campanulatus, glaber vel subglaber, haud striatus, minute mucroniformiter 5 dentatus. Corolla syphonoidea, tubo tenui, calicis os multoties superante, aequali, fauce tantum aliq. ampliato; limbus subbilabiatus; labri lobi minores obovati; labioli lobi majores patentes obovati. Stamina longissime exserta, basi tubi corollini inserta, filamentis capillaceis glabris, antheris oblongis, versus medium affixis. Stylus capillaceus longissime exsertus, apice minute et acute 2 fidus, glaber. Fructus desunt. Internodia suppetentia 1--1,5 cm. longa. Foliorum petiolus 2--4 mm. longus, limbus superficie 1,5--2 x 1,2--1,5 cm., sinus apicalis ad 2 mm. profundus. Calicis tubus 3--4 mm. longus, dentibus 0,5--08 mm. longis. Corolla calicis os 3--3,5 cm. excedens, tubo 3 cm. longo et medio vix 1 mm. lato; labri lobi superficie circa 3 x 2 mm., labioli lobi superficie circa 5 x 4 mm. Genitalia corollae os circa 1,5--2 cm. excedentia. In America tropica (verisimiliter Mexico) (Ruiz et Pacon in h. Delessert). Species a caeteris americanis foliorum forma facillima distinguenda." E. D. Merrill, in a personal communication to me, gave the opinion that this collection was made in Peru, not Mexico.

Sweet (1826) calls this the "box-leaved clerodendrum" and avers that it was introduced into English gardens in 1818, but does not hazard a guess as to where from.

Recent collectors describe the plant as a low, gregarious, straggling, sprawling, or spreading, even scandent, branched, profusely flowering shrub, 0.5--2 m. tall, the stems to 2 m. long, arching, silvery-white or ochraceous, the branches decussate, stout or (mostly) slender, gray, and tangled, the leaves strong-smelling when bruised, the blades coriaceous or fleshy when fresh, varying from obovate or elliptic-obovate to elliptic or broadly oval, often plainly bicolored, dull or shiny dark-green above, yellowish beneath, the inflorescence 3-flowered, the flower-buds pinkish or white and apically tinged pink-purple, the flowers conspicuous, the calyx pale-green, the corolla-tube 1--1.5 cm. long during full anthesis, the filaments red or red-purple to purple or dark-purple or maroon, sometimes basally white and apically purple, the style also red or reddish-purple to purple or maroon, and the immature fruit green.

Collectors have encountered this plant in alluvial or swamp forests, in the partial shade of forest scrub, along tidal rivers, on riverbed sand-bars, in or at the edge of salt-water, on sandy seashores and in seashore scrub, on coral sand beaches, riverine thickets, in brackish water and saltmarshes, in sedimentary soil on savannas and "in open places with few herbs". on rocky coasts and sand-dunes, often in association with *Acanthus ilicifolius* in the mangrove zone, from sealevel to 1000 m. altitude (the upper figure according to Yeshoda in Madras), in flower from October to January, as well as in March and May to July, and in fruit in July.

The corollas are described by most collectors as "white" (e.g., on *Amaratunga 101, Bernardi 14274, 15345, 15603, 16003,* & *16051, Comanor 896, Croft & Vibas LAE.61303, Davidse & Sumithraarachchi 9144, Fosberg & al. 53019* & *53627, Hu 10250, Jayasuriya 1352, Moldenke & al. 28244, Sohmer & al. 8859, Sumithraarachchi & al. DBS.778a* & *794, Tirvengadum 622,* and *Wirawan 683* & *1114*), but as "rosy-white" on *Guillaumin 8545,* "white, pink-tinged" on *Simpson 7917,* "violet-white" on *Bernardi 15300,* and "yellow" on *Waas 2140.* Fosberg describes the plant as "common near water channels on low dunes back of the beach"; Sumithraarachchi refers to it as "a common maritime shrub", while Bernardi, also in Sri Lanka, refers to it as "frequent", "rather frequent", "occasional", "rather rare", and "rare" in various localities on that island.

Hohenacker asserts that the plant flowers "in the rainy season", while Mukherjee, amazingly, describes it as an "annual herb". St. John, in Bombay, describes it as having "stems 2 m. long, arching, forming thickets 6 m. across". Bernardi, on his *no. 15300* notes "per viam litoralim....ad mare, haud frequens...frutex sarmentosus; ramis robustis, rectis, armatis; cortice leucophaeo; flores conspicui, albo-violacei; folia carnosiuscula, ovata, discoloria, sublucida" and for his *no. 14274* "in arenosis maritimis....rara....frutex foetidus; folia coriaceo-carnosa, elliptica; flores conspicui, candidis, filamentis exsertis".

It should also be mentioned that on *Clapp P-7l-9* and *Sohmer & al. 8869* the leaf-blades are apically decidedly pointed; on *Wirawan 1114* they are almost rotund, but rather large; on *Moldenke & al. 28243* they are various in shape and size on the same shrub, on *28244* they are also various, but decidedly mostly small in size. Santapau affirms that he has transplanted a small-leaved shrub from the seacoast to his garden and found that it there produced the normal large leaves of typical *C. inerme* (L.) Gaertn. It is for this reason that I am regarding the taxon as a mere edaphic form, rather than a true biological variety (or species). Most of the Hong Kong material cited under typical *C. inerme* exhibits quite small leaves and may better be regarded as representing f. *parvifolium* or an intermediate form.

Material of *C. inerme* f. *parvifolium* has mostly been identified and distributed in herbaria as typical *C. inerme* (L.) Gaertn. or its var. *neriifolia* S. Kurz or "Kuntze", *Clerodendrum enerme* Joshi, *C. litoreum* Roxb., *Volkameria inermis* L., *Pavetta* sp., or even *Goodeniaceae.*

Citations: PERU (?): Province undetermined: *Pavon s.n.* [Macbride photos 24625] (Cb, F--772026--photo, K--photo, Kr--photo, Ld--photo, N--photo, S--photo). INDIA: Kerala: *Hohenacker 78* (Mu--809). Maharashtra: *St. John 24063* (Bi). Tamil Nadu: *Yeshoda 215* (N). Union Territory: *Brasc 2091* (W--2827255, W--2827256). SRI LANKA: *Amaratunga 101* (Pd); *Bernardi 15300* (W--2808313), *15345* (W--2807858), *15603* (W--2808765), *16003* (W--2808786), *16051* (W--2808787); *Burmann 10* (Mu--803); *Comanor 896* (Kh, Ld, N, Pd); *Cooray 68053016R* (Pd, W--2612077); *Davidse & Sumithraarachchi 8231* (Ld, W--2808700), *9144* (Ld, W--2833952); *Fosberg, Mueller-Dombois, Wirawan, Cooray, & Bala-*

*krishnan 51218* (N, W--2676595); *Fosberg & Sachet 53019* (Ac, W--2750169); *Jayasuriya 1352* (Ac, W--2806295); *Moldenke, Moldenke, & Jayasuriya 28243* (Ac, Gz, Ld, Pd, W--2764529), *28244* (Ac, E, Gz, Kh, Ld, Pd, Tu, W--2764530); *N. B. Simpson 7917* (N); *Sohmer, Waas, & Eliezer 8859* (Lc, N, W--2803908), *8869* (Lc, N, W--2803918); *Sumithraarachgchi DBS.778a*(N, W--2807752), *DBS.794* (Or--163260, W--2805419); *Tirvengadum 622* (W--2806275); *Waas 249* (Or--163345, W--2803771), *2140* (W--2877601); *Wirawan 683* (Ld--isotype, N--type, Pd--isotype, W--2612073--isotype), *1114* (E, N, Pd, W--2718794). SRILANKAN OFFSHORE ISLANDS: Kayats: *Bernardi 14274* (W--2765449). Mannar: *Fosberg & Balakrishnan 53627* (Ld, N, W--2750172). BANGLADESH: *Thomson & Hooker s.n.* [Plan. Ganget. Inf.] (Mu--810, Pd). CHINA: Kwangtung: *Hance 392* in part (Pd). CHINESE COASTAL ISLANDS: Hainan: *Fung 20275* (B, Bz--19685, Ca--11530, Mi, N, W--1751090); *Wang 33809* (Mi, N). Lantau: *Hu 10250* (W--2731884). VIETNAM: Annam: *Clemens & Clemens 3364* (Ca--339578. Gg--156633, Mi, N, Ut, W--1428033); *Kuntze 3683* (N), *3800* (N). PHILIPPINE ISLANDS: Luzon: *Escritor, Herb. Philip. Bur. Sci. 21080* (Bz--19604, N); *Loher 4425* (Mu--3928, W--446872). PHOENIX ISLANDS: Canton: *Clapp P-71-9* (W--2774601). NEW GUINEA: Papua: *Croft & Vibas LAE.61303* (Mu, W--2741694). NEW CALEDONIAN ISLANDS: New Caledonia: *Baumann-Bodenheim 5072* (N); *Franc 1384* (La, N), *2233* (Ca--390577, N, W--1625459); *Guillaumin 8545* (N); *Vieillard 1049* (C, Pa). CULTIVATED: Germany: *Herb. Hort. Bot. Berol. s.n.* [C] (V). India: *Herb. Cooke s.n.* [College Bot. Gard. Poona] (Pa); *Mukherjee s.n.* [July '75] (Ld). Italy: *Herb. Rottböll s.n.* [Monticello] (Cp, Ld--photo, N--photo, S--photo). Pakistan: *Fosberg 57757* (W--2887565). Russia: *Herb. Ledebour s.n.* (L, L). LOCALITY OF COLLECTION UNDETERMINED: *Collector undetermined 1573/1837* (Pd); *Herb. Roxburgh s.n.* [Herb. Martii] (Br); *Herb. Willdenow s.n.* (E--photo, Ld--photo, N--photo); *Kuriakose s.n.* [Korealam, 18-1-33] (M); *C. Wright s.n.* (T).

*CLERODENDRUM INFORTUNATUM* L., Sp. Pl., ed. 1, imp. 1, 2: 637 [as "*infortunata*"]. 1753; Gaertn., Fruct. Sem. Pl. 1: 271, pl. 57, fig. 1. 1788 [not Auct., 1935, nor Blume ex H. Hallier, 1918, nor Dennst., 1959, nor "L. ex parte Rheede", 1967, nor Lindl., 1918, nor Lour, 1935, nor Miq., 1968, nor Wight, 1918].

Synonymy: *Clerodendron folio lato & acuminato* J. Burm., Thes. Zeyl. 66--69, pl. 29. 1737. *Clerodendrum foliis simplicibus cordatis tomentosis* L., Fl. Zeyl., ed. 1, 104--105. 1747. *Clerodendrum infortunata* L., Sp. Pl., ed. 1, imp. 1, 2: 637. 1753. *Clerodendrum folio lato & acuminato* Burm. apud L., Sp. Pl., ed. 1, imp. 1, 2: 637 in syn. 1753. *Viburnum zeylanicum maximum conjugato oblongo folio, flore albo* Hartogh ex N. L. Burm., Fl. Indica 137 in syn. 1768. *Clerodendrvm infortunatum* Retz., Nom. Bot. 155. 1772. *Clerodendrum foliis cordatis tomentosis* L. apud Murray in L., Syst. Veg., ed. 12, 578. 1784. *Clerodendrum infortunatum* Gaertn., Fruct. Sem. Pl. 1: 271. 1788. *Pinnakola* Herm. ex Gaertn., Fruct. Sem. Pl. 1: 271 in syn. 1788. *Clerodendrum infortunatum* β *fol. lato & acuminato* P. Mill., Gard. Dict., ed. 9, 1: *Clerodendrum* 1. 1797. *Clerodendrum infortunatum* Vent. apud Pers., Sp. Pl. 3: 365. 1819. *Clerodendrum* *infortunatum* P. S. ex Loud., Encycl. Pl. 522. 1829. *Clerodendrum depauperatum* Wall. ex Steud., Nom. Bot. Phan., ed. 2, 1: 382 in syn. 1840. *Clerodendron infortunatum γ depauperatum* Wall., Numer. List [49], no. 1796/7 hyponym. 1829. *Clerodendron infortunatum β vestitum* Wall., Numer. List [49], no. 1796/5 & 6 in syn. 1829. *Clerodendron depauperatum* Wallroth ex Morr., Ann. Soc. Roy. Agr. Bot. Gand, 1: 17 in syn. 1845. *Clerodendron infortunatum* L. apud Buek, Gen. Spec. Syn. Candoll. 3: 106. 1858 [not Auct., 1963, nor Blume ex Fern.-Villar, 1880, nor Bot. Reg., 1895, nor Dennst., 1893, nor. F.-Vill., 1882, nor Lam., 1947, nor Lour., 1793, nor (Roxb.) Linn., 1913,, nor Schau, 1847, nor Walp., 1843, nor R. Wight, 1850]. *Clerodendron infortunatum* Gaertn. ex C. B. Clarke in Hook. f., Fl. Brit. India 4: 594. 1885. *Clerodendron depauperatum* Wall. apud Jacks. in Hook. f. & Jacks., Ind. Kew., imp. 1, 1: 561 in syn. 1893. *Clerodendron vestitum* Wall. apud Jacks. in Hook. f. & Jacks., Ind. Kew., imp. 1, 1: 562 in syn. 1893. *Clerodendron infortunatum* Lindl. ex Briq. in Engl. & Prantl, Nat. Pflanzenfam., ed. 1, 4 (3a): 175. 1895 [not *Clerodendrum infortunatum* Lindl., 1918]. *Clerodendron folio lato et acuminato* Burm. apud H. Hallier, Meded. Rijks Herb. Leid. 37: 64 in syn. 1918. *Clerodendron foliis simplicibus cordatis tomentosis* L. apud H. Hallier, Meded. Rijks Herb. Leid. 37: 64 in syn. 1918. *Clerodendron depauperatum* "Wall. ex Steud." apud H. J. Lam, Verbenac. Malay. Arch. 363 in syn. 1919. *Clerodendrom infortunatum* L. apud Lourteig, Taxon 15: 26 sphalm. 1966. *Clerodendrum infortunatum* "L. ex parte Rumpf" apud Mold., Résumé Suppl. 15: 19 in syn. 1967.

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Illustrations: J. Burm., Thes. Zeyl. pl. 29. 1737; Wight, Icon. Pl. Indiae Orient., imp. 1, 4 (3): pl. 147. 1849; Blatter, Caius, & Mhaskar in Kirtikar & Basu, Indian Med. Pl., ed. 2, imp. 1, pl. 746. 1935; Wight, Icon. Pl. Indiae Orient., imp. 2, 4 [Cramer & Swan, Hist. Nat. Class. 31]: pl. 1471. 1963; Arachi, Pict. Present. Indian Fl. 158 & 159, fig. 160 & 161. 1968; Blatter, Caius, & Mhaskar in Kirtikar & Basu, Indian Med. Pl., ed. 2, imp. 2, pl. 746. 1975.

A mostly single-stemmed, branching shrub, 1--2 m. tall, or small, slender, erect tree to 5 m. tall; branchlets medium-slender, obtusely tetragonal, densely appressed-pubescent with antrorse flavescent hairs; nodes slightly flattened, not annulate; principal internodes 5--9 cm. long; leaves decussate-opposite; petioles slender or rather stout, 1.5--13 cm. long, densely appressed-pubescent, sometimes collapsing at the base in drying; leaf-blades thinly membranous or chartaceous, uniformly dark-green on both surfaces, ovate, 7--24 cm. long, 4.5--15 cm. wide, apically abruptly short-acuminate, marginally entire, basally mostly truncate or subtruncate on the uppermost leaves, sometimes cordate on the lower ones, strigillose above on the lamina but densely pilose on the venation, densely pilose-pubescent with extremely short, flavescent, and appressed hairs over the entire venation beneath but only slightly so on the lamina; inflorescence large, terminal, laxly paniculate, to 22 cm. long and wide, appressed-pubescent with antrorse flavescent hairs throughout, composed of 5--8 pairs of decussate-opposite and divaricate many-flowered cymes; peduncles 1.5--9 cm. long, continuous with the adjacent branchlet and exactly similar in texture and pubescence; sympodia 2--5 cm. long; pedicels slender, 4--22 mm. long, green when fresh, densely pubescent with more or less tangled brownish or reddish hairs; bracts few, foliaceous, ovate, to 6 cm. long and 3.2 cm. wide, similar to the uppermost leaves in all respects but smaller and often more densely pubescent, stipitate, caducous; bractlets few, often foliaceous, caducous; prophylla obsolete or very small, setaceous, inconspicuous; flowers fragrant; calyx green before and during anthesis, 5-fid to below 3/4 of its length, cinereous-pubescent and often with a few scattered discoid glands especially basally, the lobes lanceolate, apically acuminate, the midrib dorsally prominent and more densely pubescent; corolla hypocrateriform, white, the tube narrow-cylindric, 2--3 times as long as the calyx, internally with white strigose hairs, externally ferruginous-villous, the limb 5-parted, the lobes short, equal, oblong or obovate, apically obtuse; stamens inserted in the corolla-tube, 4, the filaments capillary, twice as long as the corolla, alternate with the corolla-lobes; anthers oblong; pollen grains isopolar, circular in polar view, transversely elliptic in equatorial view, the aperture tricolpate, the extoaperture lolongate, its aperture irregularly dentate, the sexine spinulose, baculate, thicker than the nexine; pistil equaling the stamens; stigma bifid; ovary 4-celled, each cell 1-ovulate; fruiting-pedicels scarlet; fruiting-calyx much accrescent, persistent, bright-pink or dark-maroon to red or scarlet, coriaceous, succulent, spreading, venose; fruit drupaceous, subglobose, black or purplish to violet-black when mature, about 8 mm. long and wide, externally glabrous, succulent, shiny, composed of 4 pyrenes, nondehiscent; seeds basifixed, 1 in each pyrene; embryo conforming to the seed in size and shape, erect, white; cotyledons oblong-ovate, thick, fleshy, plano-convex; radicle very small, subglobose, inferior; chromosome number: probably 2n = 52.

This is the designated type species of the genus. According to a letter received by me from my longtime friend and colleague, William T. Stearn, dated August 25, 1970, the "obligate lectotype" of *C. infortunatum* "is a Ceylon specimen collected by Paul Hermann preserved in the Hermann Herbarium (vol. 4 fol. 46) here in the British Museum (Natural History)". Lourteig (1966) identifies this as Hermann's specimen number 17, type of his *Clerodendron folio lato & acuminato* of 1737.

In the Linnean Herbarium, in London, I personally examined, under genus 789 [810], sheet no. 1, which is inscribed "*infortunatum*" in Linnaeus' own handwriting and is definitely this taxon; it was present there in Linnaeus' first enumeration.

This much confused species is apparently native to Sri Lanka (and possibly the Andaman Islands) and there endemic. Thwaites & Hooker (1861) describe it as "not uncommon in damp forests, up to an altitude of 5000 feet" in Sri Lanka and my wife and I confirmed this on our recent visit to that island nation.. It was Britton & Wilson, in 1925, who first designated it as the type species of the genus.

Bojer (1837) states that C. *infortunatum* was cultivated in gardens in Mauritius in his day, flowering there in April and May, from material originally obtained from Sri Lanka. Thwaites & Hooker (1839) cite *C.P. 2894* from Sri Lanka and Schauer (1847) cites from Sri Lanka *Burman s.n.* and *Leschenault s.n.*

The bibliography of "C. *infortunatum*" is quite extensive, but, unfortunately, most of it is partially or completely unreliable because of the nomenclatural confusion which has plagued this taxon almost since its establishment by Linnaeus. The Hermann (1717) and Burman (1737) pre-Linnean references apparently correctly apply to this species, but those of Rheede (1679) and Petiver (1695) probably not, and that of Rumpf (1743) certainly not. For instance, it seems apparent that the so-called "*Clerodendron infortunatum* Gaertn." [or "*Clerodendron infortunatum* L."] of Bose (1920), Burkill (1934, 1965, 1966), Crevost & Pételot (1934), Chevalier (1919), Poiret (1804), and Ridley (1911) is really C. *villosum* Blume; that of Babu (1977), Bor & Raizada (1954), Desfontaines (1804, 1815), Dop (1935), Farnsworth (1971), Gamble (1908), Haines (1922, 1961), Fletcher (1938), Jain & De (1966), Jain & Tarafder (1970), Kurz (1875, 1877), Lam (1919), Löve (1979), Kanjilal & al. (1939, 1982), Kitamura (1955, 1959), Nairne (1894), Maximowicz (1886), Parker (1924), Penna (1936), Petelot (1953), Panigrahi & Saran (1967), Singh & Patnaik (1966), Stewart (1972), Thrower (1971), Troth & Nicolson (1977), Voss (1895), and Yamazaki (1966) is C. *viscosum* Cent.; that of Pardo de Tavera (1892) is C. *minahassae* var. *brevitubulosum* H. J. Lam; that of Briquet (1895) is C. *kaempferi* (Jacq.) Sieb.; while that of the following authors, all based on non-Srilankan material, is either C. *villosum* or C. *viscosum* or a combination of both: Banerjee (1964), Caaudhuri (1969), Chopra & al. (1969), Craib (1911, 1912), Duthie (1911), Dymock (1893), Haines (1910), Hartwell (1971), Kariyone (1967), Kihara (1955), Kitamura (1959), Mukerjee (1965), Nath (1960), Osmaston (1927), Patel (1971), Prain (1903), Puri (1960), Rodger (1922), Stewart (1899), Talbot (1909), and Watt (1889). The plant referred to by Dastur (1923), Sydow (1923), and Wangerin (1923) is most probably C. *villosum*, while that referred to by Synge (1956) is probably C. *speciosissimum* Van Geert and that referred to by Nair (1965) and by Nair & Rehman (1962), with pollen description, is most probably C. *viscosum*. The "C. *infortunatum*" with red corollas, illustrated by Edwards (1895) is probably C. *kaempferi* (Jacq.) Sieb., while that of Paxton (1844), also with red corollas, is probably C. *speciosissimum* Van Geert. Without examination of any voucher herbarium material that may (hopefully) have been kept, it is imposible to state with certainty the true identity of the "C. *infortunatum*" of Manzoor-i-Khuda (1966), but it probably was C. *viscosum* Vent. and this applies also to the illustration given by Letouzey (1974).

The *Clerodendron infortunatum* illustrated by Wight (1849, 1963) and copied by Blatter & al. (1935, 1975), is probably correctly named -- the fig. 1 shows an elongated corolla-tube, although the corolla-tubes on the flowers depicted on the habit sketch are rather foreshortened.

The description of the chromosome number as "probably 52", as given above, is based on several published descriptions (e.g. Nair, 1965, Cave, 1959), but if the material used to obtain this figure actually represented the true *C. infortunatum* L. is extremely dubious -- the material much more likely was the widespread Indian and Nepalese *C. viscosum* Vent., a species which has very widely been misidentified as "*C. infortunatum*" by more recent authors and collec tors. The vast majority of the Indian material examined by me and originally labeled as "*C. infortunatum*" has proved actually to be *C. viscosum* Vent. or *C. villosum* Blume, two very similar species. In *C. infortunatum*, however, the leaf-blades are marginally entire, the uppermost (most usually seen on herbarium specimens) are usually basally truncate or subtruncate, and the corolla-tube is 2--3 times as long as the calyx during full anthesis. In *C. villosum* the leaf-blades are also marginally entire, but usually all decidedly basally cordate and the corolla-tube is only as long as or slightly longer than the calyx during full anthesis. In *C. viscosum* the leaf-blades are marginally denticulate to even coarsely dentate and basally uniformly cordate and the corolla-tube is about 2 cm. long in full anthesis.

The true *Clerodendrum infortunatum* is known to me only from Sri Lanka and possibly the Andaman Islands; *C. villosum* is known to me from 7 states of India, Burma, the Mergui Archipelago, Thailand, Laos, Vietnam, 9 states of Malaya, 5 islands of the Philippines, and 13 of the Sunda Islands; *C. viscosum* is known to me from northwestern Pakistan, Nepal, 18 states of India, Bangladesh, Burma, South Andaman, the Nicobar Islands, Yünnan (China), Hainan Island, Hong Kong, Thailand, Vietnam, 3 of the Philippine Islands, 3 of the Greater Sunda Islands, and Queensland (Australia), also perhaps naturalized in Brazil. All three species are or have been cultivated in various parts of the world. Other species greatly resembling *C. infortunatum* are the Indonesian *C. adenophysum* H. Hallier, *C. buruanum* Miq., and *C. confusum* H. Hallier.

Jack (1843) tells us that *C. villosum* differs "abundantly" [from *C. infortunatum*] "by the softness of the leaves which are larger and more deeply cordate, by the comparative shortness of the tube of the corolla and by the white calyx of the fruit".

According to Ventenat (1803) *Clerodendrum infortunatum* was based by Linnaeus on the *Clerodendrum folio lato et acuminato* of Burman in Thes. Zeyl. pl. 29, p. 66 (1737) and is restricted to Ceylon. Its chief characteristics are entire and merely subcordate leaf-blades and an especially small calyx only 1/3 as large as the corolla-tube, and a small bilabiate corolla-limb, well illustrated in Burman's plate and verified by Ventenat by examination of a specimen in the Jussieu Herbarium in Paris.

The pollen description, given above, is taken from Arachi (1968) whose material apparently was the true C. *infortunatum* if his excellent illustration can be relied on.

Gaertner (1788) credits C. *infortunatum* to "Ind. or., Malaya", but, as stated above, I do not know it either from eastern India nor Malaya; Raeuschel (1797) also lists it from -- and only from -- "Ind. orient." [of course, Sri Lanka was often regarded as part of eastern India in those days]. Angely (1971) credits it to "Orbis vet. reg. calid." Loudon (1830) and Sweet (1826) both claim that it was introduced into cultivation in England from the "E. Indies" -- if so, then the material was probably not C. *infortunatum*. Bailey (1935) lists it as existing in cultivation, with material available to the horticultural trade from the Edinburgh botanical garden; he does, however, not list it as known to him from any American gardens (Hortus, 1935), nor does he list C. *villosum* or C. *viscosum*.

Many scientific and pre-Linnean names have been reduced erroneously to the synonymy of C. *infortunatum* L. because of the mixup in its circumscription and geographic distribution. For instance: *Clerodendron macrocalyx* Lam. and *Volkameria rubra* Lour., sometimes reduced to C. *infortunatum*, actually are C. *villosum* Blume; *Volkameria petasites* Lour. is *Clerodendrum petasites* (Lour.) S. Moore; *Clerodendron calycinum* Turcz., C. *castaneifolium* Klotzsch, C. *vestitum* Wall., C. *cordatum* Don, *Volkameria infortunata* Roxb. [placed here by Jackson, 1895], and *Marurang* Rumpf (1743) are C. *viscosum* Vent., as is also the *Petasites agrestis* Rumpf listed by Linnaeus (1771), Gaertner (1788), Nemnich (1791), Schauer (1847), Fernandez-Villar (1880), Miller (1797), and other authors, as can plainly be seen from the splendid illustration of its toothed leaf-blades given by Rumpf (1743) and by the fact that it was described from the Malabar Coast (India), not from Sri Lanka. The Rheede and Sloane synonyms listed by Burman (1737) and the Ray, Commelyn, and Rheede synonyms listed by Linnaeus (1743) must also by excluded.

Poiret (1804) includes *Tittius littorella* Rumph. as a synonym, but actually it belongs in the synonymy of *Guettarda speciosa* L. in the *Rubiaceae*. Schauer (1847) includes *Volkameria infortunata* Roxb. and *Clerodendron viscosum* Vent., both now regarded as C. *viscosum* Vent., and gives the species' overall distribution as "India orientali, Madras, Courtallum, Penang, Audih, etc." Fernandez-Villar (1880) includes C. *fortunatum* Blanco and C. *blancoi* Naves, but these are now regarded as synonymous with C. *minahassae* var. *brevitubulosum* H. J. Lam. Pételot (1953) includes C. *viscosum* Vent., C. *cordatum* D. Don, C. *macrocalyx* Lam, *Volkameria infortunata* Roxb., and *Volkameria petasites* Lour., all now excluded. The *Peragu* included as a synonym by Linnaeus (1753, 1763), Burman (1768), Miller (1797), and Poiret (1804) is actually C. *villosum* Blume, while the *Arbor zeylanica fortunata quibusdam* Petiv., *Planta fortunata, pinna zeylonensibus* Herm., and *Frutex flore perlato, fructu rotundo* Kleinhof seem to belong in the synonymy of C. *serratum* (L.) Moon. Steudel (1821) actually reduces C. *infortunatum* L. to synonymy under C. *viscosum*; Roxburgh's *Volkameria infortunata* certainly is C. *viscosum*.

Several of the infraspecific taxa proposed by various authors must also be excluded -- for instance, *Clerodendron infortunatum albiflorum* Teijsm. is *Clerodendrum speciosissimum* f. *album* Mold., *Clerodendron infortunatum* var. *albiflorum* Hassk. is *Clerodendrum villosum* Blume, *Clerodendron infortunatum* β *vestitum* Wall. is *Clerodendrum viscosum* Vent., and *Clerodendron infortunatum* var. *splendens* Voss is *Clerodendrum speciosissimum* Van Geert. The presumed natural hybrid, "*Clerodendron infortunatum* x *villosum*" of Backer (1916) seems actually to be *Clerodendrum confusum* H. Hallier.

Recently Meeuse (1942) has regarded the Indian plants, as distinguished from the Sri Lankan ones, as *C. petasites* (Lour.) Meeuse, but Merrill (Journn..Arnold Arb. 19: 65. 1938) has plainly shown that Loureiro's *Volkameria petasites* actually is a very different plant, *Clerodendrum petasites* (Lour.) S. Moore, which see.

Various economic, medicinal, and pharmaceutical uses have been reported in literature for *C. infortunatum* [e.g., by Dymock & al., 1893, Watt, 1889, Kosteletzky, 1834, Jain & Tarafder, 1970], some of which were listed by my wife and myself in our 1983 work on Sri Lankan plants, but it seems rather definite that most, if not all, of these references are based on misidentifications and apply, rather, to *C. villosum* and/or *C. viscosum*. They will be more fully treated by me under those taxa in the present series of notes, which see. It is, however, known definitely that flowering branches of *C. infortunatum* are often used in temple offerings and decorations in Sri Lanka, and Trimen (1895) asserts that the leaves are used there as an anthelmintic. Interestingly, Balfour (1862) avers that the species is "the reverse of useful in medicine" -- apparently merely an attempted translation of the scientific specific epithet.

Paul and his associates (1961, 1962) give detailed chemical analyses of the clerodin found in what they refer to as *Clerodendrum infortunatum* L.

Most of the illustrations listed by Stapf (1930) as depicting this species seem to be illustrative of non-Sri Lankan material and are therefore not cited here by me, but, rather, under *C. villosum* Blume or *C. viscosum* Vent., which see.

*Clerodendrum infortunatum* is said to be attacked by the fungi, *Colletotrichum infortunati*, *Meliola callicarpicola*, and *Aulacophora* sp. [cfr. Singh & Patnaik, 1966], but, again, I suspect that the host in these cases was either *C. villosum* or *C. viscosum*. Ramakrishnan (1952) describes the fungus, *Physalospora clerodendri* from *C. infortunatum*, based on one of his own collections in South Kanara (Kerala, India), but, again, I suspect that the host was not *C. infortunatum*, but more probably either *C. villosum* or *C. viscosum*.

Fifty or more common and vernacular names have been reported for *C. infortunatum*, but most of these probably apply, not to this species, but to *C. villosum* and/or *C. viscosum* instead. The only ones which seem definitely to apply to *C. infortunatum* are "gas-pinna", "infortuné". "l'infortuné", "long-flowered clerodendrum", "ongelukkige boom", "ongelukkige lotboom", "piene", "pinna", "pinna kole". "pinnakola", "unfortunate clerodendrum", "unglückliche Losbaum", "unglücksbaum", and "vata madakki".

Recent collectors in Sri Lanka describe the true *Clerodendrum in-*

*fortunatum* as a low, erect or somewhat spreading, pyramidal, profusely flowering shrub, 1--5 m. tall. or even a tree or treelet, 2--5 m. tall, often simple-stemmed, sometimes "dense", the leaves membranous and "yam-like". the "bracts" conspicuous, red or red-violet, the panicle's rachis dark-red, the flowers tetramerous, fragrantly scented, the calyx red or "the calyx and pedicels at first green, later scarlet", the corolla salverform, its tube strigose, the stamens exserted, white, the filaments and style exserted and white,the fruiting-calyx accrescent, persistent, bright-red or carmine to scarlet or dark-maroon, and the fruit drupaceous, subglobose, black, glabrous, and shiny.

They have encountered the plant in scrub jungles and their edges, in hedgerows and fencerows, in both montane and remnant forests, on grassy roadside cuts and banks, along roadsides and streamsides, in both primary and secondary forests, at the edges of marshes, along railroad tracks and jeep tracks, on slopes, in shrub and grass thickets and "regeneration scrub", in waste ground, and in semi-sun on roadsides through cardamon plantations, often in brown-red clayey soil, at altitudes of 2--1350 meters, in anthesis from August to June, and in fruit in February, March, and August to October. Theobold & Grupe found it "common in dense shade and along disturbed edges of roads"; Maxwell and his associates report it "very common along roads", and Kostermans also refers to it as "common". Davidse & Sumithraarachchi call it a "common small tree"; Fosberg found it "common on the edges of degraded forests above tea plantations" and "occasional in disturbed ground along recently opened logging roads in tall rainforests". Comanor reports it "abundant in ectone", while Amaratunga describes it as "a very common weed in waste ground in the low country". Cramer calls it "common along shady roadsides", while Bernardi found it "rather common" in one locality and "apparently rare" in another. My wife and I observed it quite often in roadside shrubbery, on road shoulders, and scattered at the edges of jungles, but certainly never observed it forming a true tree.

The corollas are described as "white" on almost all collections where a flower color is given at all, except that Waas refers to the "flowers" as "red" and Balakrishnan calls them "purple" -- I suspect that it may be the calyxes or fruiting-calyxes to which these collectors are referring. Amaratunga erroneously refers to the fruit as a "berry" and Bernardi describes the inflorescences as corymbs. Pollen has been collected from *Comanor 1008*.

Many unjustified homonyms have been published (in synonymy) by various authors: their disposition, in my view, is as follows: *Clerodendron infortunatum* Auct. (1963), "Auct. non Linn" (1968), Blume (1918), Lour. (1793) in part, (Roxb.) Linn. (1913), and Schau. (1847) are all *Clerodendrum viscosum* Vent., while F.-Vill. (1882) is *C. minahassae* Teijsm. & Binn., Bot. Reg. (1895) is *C. speciosissimum* Van Geert, Lam (1947) is *C. petasites* (Lour.) S. Moore, Lour. (1793) in part is *C. kaempferi* (Jacq.) Sieb., Dennst. (1893), Walp. (1843), and R. Wight (1850) are *C. villosum* Blume, and Blume ex Fern.-Villar (1880) is *C. buchanani* (Roxb.) Walp.

*Clerodendrum infortunatum* Auct. (1935), "Auct. mult. non Linn."

Lour. (1935) in part, Miq. (1968), Willd. (1976), and Blume ex H. Hallier (1918) are all C. *viscosum* Vent., while Lindl. (1918) is C. *speciosissimum* Van Geert, "L. ex parte Rheede" (1967), Wight (1918), and Dennst. (1959) are C. *villosum* Blume, and Lour (1935) in part is C. *kaempferi* (Jacq.) Sieb.

It should be noted here that C. *infortunatum* γ *depauperatum* Wall. is based on *Wallich 1796/7* from Pagoda Hill, Mulmain, Burma, collected in 1827, to which Wallich had appended a note: "vix non distincta spec." Wallich's C. *infortunatum* β *vestitum*, based on *Wallich 1796/5* & *6*, from Nepal, the latter later cultivated in Calcutta, appears plainly to be C. *viscosum* Vent. If the Burmese collection was from wild material, it probably is not C. *infortunatum*, and may also prove to be C. *viscosum*. Examinations of the type specimens in the East India Company Herbarium at Kew is necessary to resolve this issue. It is also worth noting here that Wallich's *1795/H* was from the Roxburgh herbarium, *1795/J* was from the Madras herbarium, *1795/K* was from the Russel herbarium, *1795/L* was from Hamilton's herbarium, *1795/M* was from Wight's herbarium, and *1795/N* was collected in Penang in 1822, while *1795/O* was collected in Oude in 1825. It is most probable that most or all of these collections represent C. *viscosum*, and not the true C. *infortunatum* L.

Parkinson (1922, 1972) speaks of "two types" of C. *infortunatum* growing on South Andaman island -- presumably C. *infortunatum* and C. *viscosum*. Sharma & Mukhopadhyay (1963) speak of six types of C. *infortunatum*, all of which have the 2n chromosome number of 52 but "differing in their minor characters". Surely they must have had some C. *villosum* and C. *viscosum* material among these "6 types". They assert that "In the present investigation 2n = 52 chromosomes have been seen in C. *infortunatum* and all its varieties" [as well as in C. *minahassae*, C. *philippinum*, C. *wallichii*, C. *indicum*, and C. *kaempferi*], in contradistinction to 46 in "one variety of" C. *thomsonae*, C. *inerme*, and C. *splendens*, 48 in "another variety" of C. *thomsonae*, and 184 in C. *ugandense*.

Because of the involved nomenclatural and taxonomic history of this species and the resulting past confusion in its interpretation, it may be worthwhile to reproduce here a few of the relevant treatments:

(1) Hermann (1747, 1748): "232. *Clerodendrum foliis simplicibus cordatis tomentosis*. / *Clerodendron folio lato & acuminato*. Burm. zeyl. 66. t. 29. / *Frutex baccifer malabaricus, floribus pentapetalis binis, una bacca nigra in calyce stelliformiter expanso*. Raj. hist. 1571. Comm. mal. 31. / *Peragu*. Rheed. mal. 2, p. 41. t. 25./ *Pinnakola, sive infelix & infortunata*. Herm. zeyl. 25.54. / Descr. Arbor ramis subtomentosis. Folia opposita, cordata, acuta, venosa, scabriuscula, magna, integerrima, petiolis longitudine foliorum insidentia. Panicula florum ramos terminata ex pedunculis brachiatis & per dichotomiam subdivisis. Calyx campanulatus, monophyllus, amplus, quinquefidus profunde: laciniis oblongis, acuminatis, aequalibus. Corollae tubus filiformis, longus, angustus. Limbus brevis, laciniis quinque, obverse ovatis, aequalibus, duabus inter se remotioribus. Filamenta quatuor, capillaria, flore duplo longiora, ad

hiantem laciniam corollae. Antherae oblongae. Pistillum staminum figura & longitudine, stigmate bifida."

(2) Gaertner (1788): "*Clerodendrum infortunatum*. Tab. 57. fig. 1. / *Petasites agrestis* Rumph. amb. 4. p. 108. t. 19. / *Clerodendron folio lato & acuminato*. Burm. zeyl. 66. t. 29. / *Clerodendrum foliis cordatis tomentosis*. Linn. syst. veg. 578. / *Pinnakola*. *zeylonens* E collect. sem. hort. lugdb. / Per. Bacca succulenta, calycis laciniis triangularibus trinerviis contecta, subglobosa, depressiuscula, sulco cruciato in vertice inscripta, unilocularis, tetrapyrena. Cuticula tenuis, glaberrima, splendens, non dehiscens. Pulpa mollis, per aetatem evanescens. Ossicula subossea, hinc convexa rugosa, inde angulata glabra, unilocularia. / Rec. nullum; semina basi affixa. / Sem. in singulo ossiculo unicum, eidemque conforme, rufescens. / Int. duplex, utrumque membranaceum, tenue. / Alb. nullum. / Emb. semini conformis, erectus, albus. Coty. ovato oblongae, carnosae, crassae, plano convexae. Rad. minima, subglobosa, infera."

(3) Roth (1821, 1975): "*Clerodendron infortunatum*. / *C. foliis cordatis tomentosis*. Linn. Flor. Zeylan. n. 232. Spec. Plant. ed. Willd. Tom. III. P. 1, p. 386. / Observ. Specimen meum a Veneratiss. Heyne acceptum omnimode respondet descriptioni Linneanae in Flora Zeyl. l. c. At *Petasites agrestis* Rumph. Amboin. Vol. IV. pag. 180. Tab. 49. quam Linneus in Flor. Zeyl. non adduxit, in posterioribus Specierum Plantarum editionibus huic plantae pro synonymo adscripta videtur, quamvis minus respondeat. Folia enim repando-dentata delineata et descripta sunt, quae constanter integerrima observantur et Panicula ramosior est, quam figura representat. Willdenow in posterum errorem emendavit, cum in Enumeratione Plant. Horti Berol. pag. 658. hoc synonymum ad *Clerodendron viscosum* Vent. retulerit."

(4) Morren (1845): Le *Clerodendron infortunatum* (Linn. fl. Zeyl. 232. -- Bot. reg. 1811. tab 19), se distingue à ses grandes feuilles presque arrondies, profondément cordiformes, dentées, poilues au-dessus, tomenteuses au-dessous, à sa panicule colorée simple, pubescente, à ses fleurs presque sessiles au sommet des rameaux, à son calice grand, quinquefide, aux divisions de sa corolle planes, obovales, obtuses, un peu plus courtes que les étamines. Le bouquet de ses fleurs d'un rouge légèrement briqueté fait le plus bel effet. Il faut remarquer que les *Clerodendron vestitum* et *depauperatum* de Wallroth, ne sont autres que se même *Clerodendron infortunatum*; mais le Clerodendre infortunê de Willdenow est une espèce particuliere admise par les botanistes sous le *Clerodendron viscosum*. De même, le *Clerodendron infortunatum*, de Dennstedt est la *Cleradendron villosum* de Blume. La confusion peut donc facilement s'établir dans les catalogues relativement cette espèce."

(5) Trimen (1895): "*C. infortunatum*,* L. Sp. Pl. 637 (1753). Gas-pinna, S. / Herm. Mus. 25, 45. Burm. Thes. 66.Fl. Zeyl. n. 232. Moon Cat. 46. Thw. Enum. 243. C.P.2894. / Fl. B. Ind. iv. 594. Burm. Thes. t. 29. Wight, Ic. t. 1471. / A shrub or small slender tree, 4--10 ft., branchlets very bluntly quadrangular, yellowish dirty-pubescent; l. large, 4--6 in., ovate, cordate or round-

ed at base, acuminate, acute or subacute, entire, thinly hairy on both sides, especially on the veins beneath, somewhat 3-nerved from the base, venation prominent beneath, petioles 1½--3 in., cylindrical, pubescent; fl. large, on rather long pubescent ped., cymes stalked, in large, lax, pyramidal, pubescent panicles, bracts leafy, deciduous; cal. ½ in., silky-pubescent, very much enlarged in fruit, segm. deep, lanceolate, very acute; cor.-tube about 1 in., slender, lobes large, ½ in., oblong, obtuse; drupe 1/3 in., nearly globose, succulent, purplish-black, shining, seated in centre of the very much enlarged, spreading, succulent, bright pink cal. 1½ in. diam., pyrene usually solitary, brittle. / Moist region up to 5000 ft.: common. Fl. April--August; white. / Also in India and Malaya. / Leaves have a smoky odour when bruised; they are used as an anthelmintic. / *This name is due to Hermann (l.c.), who so translates the Sinhalese 'Pinnakola;' he has also (l. c.) a 'planta fortunata' (='Pinna', S.), which is probably the same species. I do not know the origin of these terms."

(6) Hallier (1918): "*Clerodendrum* (§. *Paniculata*) *infortunatum* (haud Bl. nec Hassk. nec Lindl. nec Wight) L., Sp. Pl., ed. 1, II (1753) p. 637 excl. synn. Rheed. et Raj.; Gaertn.! l.c. p. 271 t. 57 fig. 1 excl. syn. Rumph.; Schauer l.c. (1847) p, 667 quoad pl. zeyl., excl. synn. Lindl., Roxb., Vent., Rumph.; Miq. l.c. (1856) p. 876 quoad pl. zeyl. (excl. synn. Wight., Roxb.,Vent., Rumph., Rheed.); Clarke l.c. p. 594 ex p. (excl. synn. Wight., Vent., Don., Klotzsch., Roxb., Rumph., Rheed. etc.); Trimen l. c. p. 361 excl. syn. Wight. et pl. ind. et mal.; Gamble l. c. p. 835 ex p.. -- *Clerodendron folio lato et acuminato* Burm., Thes. Zeyl. (1837) p. 66 t. 29 excl. synn. Rheed. et Sloan.. -- *Cl. foliis simplicibus cordatis tomentosis* L., Fl. Zeyl. (1748) p. 104 no. 232 excl. synn. Raj., Comm., Rheed.. -- Ramuli teretes vel praecipue infra nodos obtuse complanato-tetragoni, breviter dense appresse ochraceo-tomentelli. Foliorum lamina cordata, integerrima vel obsolete et irregulariter repando-dentata, subtus prominter palmato- et pinnato- et clathrato-nervosa, in nervis densius, in venis parcius pubescens, sub lente ubique pilis glandulosis punctulata glandulisque majoribus fuscis pezizaeformibus praecipue prope basin et nervum medianum punctata, basi haud bullata, supra praeter nervos (pubescentes) subglabra. Calyx usque infra 3/4 longitudinis 5-fidus, extus cinereo-pubescens et praeter basin glandulis discoideis praeditus, lobis lanceolatis acuminatis, nervo mediano extus prominente densius pubescente, in fructu valde auctus, coriaceus, nervosus, drupam subinvolucrans. Corollae (incompleta tantum suppetit) tubus dupla calycis longitudine (cf. etiam Burm. l. c. t. 29), extus ferrugineo-villosus. / Zeylon (König? in der Fruchtsamml. des Hb. L. B. unter d. Namen Pinne-ette 1), vermuthlich Gärtner's Originalexemplare) (Herb. zeyl. hort. Amst. no. 98 im Hb. L.-B., bl.. -- 'Piene') (von unbekanntem alten Sammler no. 148, steril. -- 'Pinne gala'). / Verbr.: Anscheinend endemisch. / 1) singal. ette = Same."

(7) Santapau (1961): "*Clerodendrum viscosum* Vent. / The identity and nomenclature of this plant is somewhat confusing. Three plants are often mixed together: *Clerodendrum infortunatum* Linn.; *C. vis-*

*cosum* Vent. and *Volkameria petasites* Lour. / The real C. *infortunatum* Linn. is described by Meeuse in Blumea 5: 77, 1942. as 'pubescence of corolla ferrugineous, calyx lobes with prominent midrib, leaves on lower surface with minute glands and with a number of larger glands near the base and near the midrib; Ceylon (endemic)'. Meeuse gives the name of the common Indian plant as C. *petasites* Moore, based on *Volkameria petasites* Lour. On the other hand Merrill wrote on the identity of the latter plant in Trans. Amer. Phil. Soc. n. s. 24: 338, 1935: 'Loureiro took his specific name from *Petasites agrestis* Rumph...which he cites as illustrating his species, but which, however, represents a species very different from *Clerodendron petasites* Moore. Schauer, perhaps interpreting the species from the Rumphian illustration, erroneously reduced *V. petasites* Lour. to C. *infortunatum* Gaertn. Loureiro's type is preserved in the herbarium of the British Museum, which on examination Moore found to be identical with *Clerodendrum subpandurifolium* O. Ktz., a species based on specimens collected by Kuntze at Tourane, Annam: Kuntze's actual type is preserved in the herbarium of the New York Botanical Garden; the species is also represented by *Squires 329* from the classical locality Hue, and *Robinson 1290* from Nha Tang. *Petasites agrestis* Rumph. which I......referred to *Clerodendron speciosissimum* van Geert is placed by Lam (Bull. Jard. Bot. Buitenzorg III 3: 91. 1921) as a synonym of *Clerodendrum buchanani* (Roxb.) Walp., this apparently being the correct disposition of it.' / The oldest valid name for the present species is *Clerodendrum viscosum* Vent., which has been adopted by Moldenke in several of his publications on the *Verbenaceae*, and by the present author in the Flora of Khandala, with the following nomenclature: / *Clerodendrum viscosum* Vent., Jard. Malm. t. 25, 1803; Moldenke, Geogr. Dist. 54 et in Litt. priv. ad auctorem; Santapau 190. C. *infortunatum* auct. mult. non Linn. FBI 4: 595; Cooke 2: 432. C. *petasites* Moore in Journ. Bot. 63: 285. 1925 (non *Volkameria petasites* Lour., 1790)."

(8) Arachi (1968): "*Clerodendron infortunatum* Linn.: A large villous shurb [sic]. Leaves: Simple, opposite cordate, suborbicular, entire. Flowers: White, in axillary and terminal cymes, bracts leafy. Sepals: Companulate [sic], 5 lobed. truncate, partite. Petals: 5. oblique lobes spreading. Stamens; 4, inserted at throat, filaments long, anthers linear. Pistil: 4 celled. one ovule in each cell. style long, stigma bifid. Fruit: A fleshy globose drupe, black."

In addition to the many nomenclatural errors in the bibliography of *Clerodendrum infortunatum* L., there are also some others to add to the confusion. For instance, Linnaeus' 1747 work is sometimes cited to "page 232", but "232" is the species number, not the page number. Also, Rheede (1679) is sometimes erroneously cited as published in "1703"; Lamarck's work (1796) is cited by Stapf (1930) as "1797", but the entire Tome 3 was actually published on November 21, 1796. The Willdenow (1800) work is sometimes erroneously cited as "3 (2)" instead of 3 (1); the Moon (1824) reference is sometimes incorrectly cited as published in "1821" and the Baillon

(1891) work is often cited by the titlepage date of "1892". Of the ten illustrations listed by Stapf (1930) as representing C. *infortunatum* not a single one seems definitely to depict this species, while that given by Bose (1920) seems definitely to represent C. *villosum* Blume.

Material of C. *infortunatum* has been misidentified and distributed in some herbaria as C. *villosum* Blume. On the other hand, a very large number of other taxa have been misidentified as C. *infortunatum* in many herbaria -- for instance, *Bartlett 6460, 7207,* & *7729, Boeea 6671* & *8831, Hallier B.2506, Krukoff 4001, Native Collector 2013* & *5286, Toroes 184, 1647 bis, 2394, 2528, 2668,* & *5160,* and *Yates 1032* & *2600* are C. *adenopysum* H. Hallier; *Mjoberg 173* is C. *buchanani* (Roxb.) Walp.; *Hern. Hort. Bot. Bogor. XI.B.XIX.121* and *Pijl 715* are C. *buruanum* Miq.; *Native Collector 526* is C. *buruanum* f. *lindawianum* (Lauterb.) Bakh.; *Merrill 1299* & *7237* are C. *curranii* Elm.; *Qureshi s.n.* [Nov. 1968] is C. *indicum* (L.) Kuntze; *Kurz s.n.* [South Andaman] is C. *lankawiense* var. *andamanense* Mold.; *Rock 2895* is C. *philippinum* Schau.; *Rock 2862* is C. *philippinum* f. *multiplex* (Sweet) Mold.; *Hahn 541* is C. *speciosissimum* Van Geert; *Clarke 11432, Hügel s.n., Janaki 313, Thomson s.n.* [Maisor & Carnatic], and *Wight 2316* are C. *villosum* Blume; *Cleghorn s.n.* [Jan. '53], *Griffith 6053, Harsukh s.n.* [8.4.98], *Herb. Hort. Bot. Calcutt. s.n., Herb. Hort. Monac. s.n.* [1849.23.I], *Herb. Nat. Bot. Gard. 20232, Herb. Schreber s.n., Herb. Zuccarini d.n., Hooker & Thomson s.n.* [0--4000 ped.], *Hosseus 470a, Jenkins s.n.* [Assam], *Kerr 2062a, King's Collector s.n.* [13.4.1895], *Löffler s.n.* [1957], *Mukherjee 90, Native Collector 527* & *DI.88, Nicolson 3054, Prain's Collector 20, Ratt 3242, Rice 30, Rock 710, Roxburgh s.n.* at Kew, *Schomburgk 106, Singh 94* & *130, Thomson s.n.* [Plan. Ganget. Sup.], and *Troth 686* & *830* are C. *viscosum* Vent.; *Helfer 6053* and *Maxwell 75-273* are C. *viscosum* var. *helferi* Mold.; *Hohenacker 162* & *1442* are C. *viscosum* var. *nilagiricum* H. Hallier; *Hassib s.n.* [24/12/1929] is *Callicarpa longifolia* Lam.; and *Toroes 1647* is in part a composite.

Citations: SRI LANKA: *Alston 1329* (Pd); *Amaratunga 294* (Pd), *375* (Pd), *901* (Pd), *1782* (Pd), *2281* (Pd); *Balakrishnan NBK.271* (Pd, W--2720401); *Bernardi 14138* (W--2766368), *15406* (W--2807750), *15725* (W--2808797); *Bremer & Bremer 801* (Pd, S, W--2877176), *894* (Pd, S, W--2976966); *Burman 66* (Mu--812); *Collector undetermined 1833*(N), *s.n.* [Ceylon 1831] (K, Ld--photo, N--photo), *s.n.* [gas-pinna] (Pd); *Comanor 511* (N, Pd), *523* (Ac, N, Or--163276, W--2612070), *1008* (Ld, N, Pd, W--2766225), *1101* (Ac, N, Pd); *Cramer 2480* (Ld), *3889* (W--2766608); *Davidse & Sumithraarachchi 8767* (Ld, W--2808701), *8783* (Ld, W--2807758); *Fosberg 56584* (Ld, N), *57887* (Lc); *Fraser s.n.* [Ceyl. 62] (W--74536); *Gardner 62* (Du--166601); *Herb. Linnaeus 810/1* (Ls, N--photo); *Herb. Wight s.n.*[Ceylon] (K); *König s.n.* (Le), *Jayasuriya 265* (Pd, W--2721115); *Kostermans 24057* (Pd, W--2718982); *Maxwell, Hepper, & Fernando 971* (E--2145504, N, Pd, W--2760479); *Moldenke, Moldenke, & Jayasuriya 28117* (Ac, Gz, Kh, Ld, Pd, Tu, W--2764566), *28208* (Ac, E, Gz, Kh, Ld, Pd, Tu, W--2764473), *28254* (Ac, Ld, Pd, W--2764514); *Moldenke, Moldenke, Jayasuriya, & Dassanayake*

*28336* (Ac, E, Gz, Kh, Ld, Pd, Tu, W--2764548); *Nooteboom & Huber 3102* (W--2890911); *Palmer & Worthington 1634*(Pd); *R. W. Read 2262* (Ld); *Reitz 30008* (W--2762765); *F. M. de Silva 24* (W--1529151); *J. M. de Silva 96* (N), *s.n.* [July 16, 1925] (Pd); *Sumithraarachchi DBS.89* (W--2803405); *Sumithraarachchi & Jayasuriya DBS.169* (W--2803411); *Theobald & Grupe 2380* (Pd, W--2603024); *Thwaites C.P.2894* (Br, L, N--photo, Pd, Pd, Pd); *Waas 12* (W--2806277), *37* (N, W--2803775), *430* (W--2803419); *A. W. Walker 1325* (K, L, N); *Worthington 348* (K), *1859* (K), *1860* (K). ANDAMAN ISLANDS: South: *King's Collector s.n.* [5 April 1893] (W--2497084). CULTIVATED: Netherlands: *Collector undetermined 148* (Le); *Herb. Lugd.-Bat. 908.266-45* (Le), *908.266-51* (Le); *Herb. Zeyl. Hort. Amst. 98* (Ld--photo, Le, N, N--photo). LOCALITY OF COLLECTION UNDETERMINED: *Herb. Swartz s.n.* (S). MOUNTED ILLUSTRATIONS: Arachi, Pict. Present. Indian Pl. 159, fig. 161. 1968 (Ld); Wight, Icon. Pl. Indiae Orient., imp. 1, 4 (3): pl. 1471. 1849 (Ld).

*CLERODENDRUM INGRATUM* Lauterb. & K. Schum. in K. Schum. & Lauterb., Fl. Deutsch. Schutzgeb, Südsee 526 [as "*Clerodendron*"]. 1900; Mold., Alph. List Inv. Names 18 & 21. 1942.

Synonymy: *Clerodendron ingratum* Laut. & K. Schum. in K. Schum. & Lauterb., Fl. Deutsch. Schultgeb. Südsee 526. 1900. *Clerodendron ingratum* K. Schum. & Lauterb. apud Thiselt.-Dyer, Ind. Kew. Suppl. 2: 43, 1904. *Clerodendrum ingratum* K. Schum. & Lauterb. apud Mold., Alph. List Inv. Names 18 & 21. 1942.

Bibliography: K. Schum. & Lauterb., Fl. Deutsch. Schutzgeb. Südsee 526. 1900; K. Schum., Justs Bot. Jahresber. 28 (1): 495. 1902; Thiselt.-Dyer, Ind. Kew. Suppl. 2: 43. 1904; K. Schum. & Lauterb., Nachtr. Fl. Deutsch. Schutzgeb. Südsee 373. 1905; H. J. Lam, Verbenac. Malay. Arch. 308 & 363. 1919; Bakh. in Lam & Bakh., Bull. Jard. Bot. Buitenz., ser. 3, 3: 75, 84, 109, & ix. 1921; H. J. Lam, in Lauterb., Engl. Bot. Jahrb. 59: 97. 1924; Mold., Alph. List Inv. Names 18 & 21. 1942; Mold., Known Geogr. Distrib. Verbenac., ed. 1, 67 & 90 (1942) and ed. 2, 149 & 182. 1949; Mold., Résumé 193, 196, 200, 265, 271, & 450. 1959; Mold., Fifth Summ. 1: 322, 335, 448, & 459 (1971) and 2: 867. 1971; Hartley, Dunstone, Fitzg., Johns, & Lamberton, Lloydia 36: 293. 1973; Farnsworth, Pharmacog. Titles 9 (1): vi. 1974; Mold., Phytol. Mem. 2: 313, 325, & 538. 1980; Mold., Phytologia 58: 351. 1985.

A shrub, 0.5--2 m. tall, or small tree, to 7.5 m. tall; crown narrow; bole to 3 m. long, to 10 cm. diam. at breast height; bark gray-brown, prominently fissured; wood white, moderately soft; branches slender, terete, leafy, the younger parts flattened and subtomentose, about 3 mm. thick, the tomentum thin and rusty, the leafy portion about 15 cm. long, the bark gray; leaves decussate-opposite; petioles 5--10 mm. long, subtomentose; leaf-blades thin-chartaceous, medium-green, glossy, oblong or elliptic, 2.5--8 cm. long, 2--3 cm. wide, apically acute or subobtuse, dark olive-green when dry, minutely pilose on both surfaces, more densely so beneath; secondaries 5 or 6 per side, conspicuous, stronger and elevated beneath.

[to be continued]

# CONTRIBUTION TO THE STUDY OF ARGENTINE **PARMELIACEAE**. THE GENUS **PUNCTELIA** KROG AND **FLAVOPUNCTELIA** (KROG) HALE

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## Abstract

In this paper 11 species of **Punctelia** Krog and 2 of **Flavopunctelia** (Krog) Hale are described and illustrated, all from N Argentina. It includes keys for the identification of the taxa, differentiating characters and data on distribution.

## Introduction

The genus **Punctelia** is widely distributed in temperate regions of Asia and tropical regions of Africa, Australia and America, comprising 20 species.

In Argentine occurs 11 species distributed in the N, also little collections from La Pampa province, and **P. borreri** (Sm.) Krog was known for one locality in Islas Malvinas, (Grassi, 1950).

## Key to genera

1- Thallus with narrow lobes, 0,5-4(5) mm.
  2- Margins of lobes ciliate.
    3- Cilia marginal bulbate, coronate apothecia.
      4- Without cortical pigments.
        **Bulbothrix** Hale
      4- With cortical pigments (usnic acid abundant).
        **Relicina** (Hale & Kurok.) Hale
    3- Cilia marginal simple, sometimes inconspicuous, ecoronate apothecia.
      **Parmelina** Hale
  2- Margins of lobes without cilias.
    5- Upper surface smooth, without pseudocyphellae.
      6- Rhizines simple.
        7- Upper surface mineral gray, thallus corticolous.
          **Pseudoparmelia** Hale
        7- Upper surface yellowish or greenish yellow, thallus saxicolous with usnic acid.
          **Xanthoparmelia** (Vain.) Hale

6- Rhizines richly branched, numerous, upper surface mineral gray, with atranorin, lower surface black.
**Hypotrachyna** (Vain.) Hale

5- Upper surface with pseudocyphellae.
8- Pseudocyphellae effigurate, inconspicuous, sometimes absent, conidia bifusiform.
9- Upper surface mineral gray, lobes often apically truncate, with atranorin, lower surface uniformly rhizinate, rhizine dichotomously branched and proyected beyond the margins.
**Parmelia s. str.**

9- Upper surface yellowish, lobes apically rounded, with usnic acid, lower surface with rhizines simple not proyected beyond the margins.
**Flavopunctelia** (Krog) Hale

8- Pseudocyphellae orbicular, punctiform or conspicuous; conidia unciform, filiform or cylindric with the ends swollen.
**Punctelia** Krog

1- Thallus with broad lobes, 5-20 mm.
**Parmotrema** Mass.

## **Flavopunctelia** (Krog) Hale

Hale M., 1984. Mycotaxon 20(2): 681-682.
**Punctelia** subgen. **Flavopunctelia** Krog, 1982. Nordic Journal of Botany 2: 290-291.

Thallus foliose, loosely attached, lobes broad, rotund, 12 mm wide. Upper surface yellowish to turtle green, with usnic and lecanoric acid; pseudocyphellate, pseudocyphellae effigurate.

Lower surface black or dark brown, sparsely rhizinate, with naked and pale zone along the margins.

Apothecia disc imperforate, spores globose. Conidio cylindric with two ends swollen.

**Flavopunctelia flaventior** (Stirton) Hale
Plate 1, A.

Hale M., 1984. Mycotaxon 20(2): 682.

**Parmelia flaventior** Stirton, Scot. Nat. 4: 254. 1877-78. Hale M., 1959. The Bryologist 62: 126 "Canadá, USA, Colombia, Brasil, Perú, Bolivia". Culberson W. L., 1962. Nov. Hedwigia 4: 573 "USA". Krog & Swinscow, 1977. Norw. J. Bot. 24: 170 "E de Africa". Hale M., 1980. Journ. Hattori Bot. Lab. 47: 76-78 "USA, Mexico". Krog H., 1982. Nord. J. Bot. 2(3): 291.

Thallus corticolous, laxe adnatus, 6,5-12 cm in diameter, yellowish-green or yellow-gray.

Upper side striate or wrinkle at the center, lobes rotund, 3-12 mm wide, canaliculatus, margins erect and sorediate, soralia linear, marginal, white, 0,5 mm wide, often laminal are mostly punctiform, conspicuous.

Lower side black, shiny, sparsely rhizinate and cooper coloured zone along the margins.

Apothecia disc imperforate, epitecio brown-reddish, amphithecium sorediate, margin complete. Spores globose or oblong, uncoloured, 10-14,20 um x 6-7 um. Conidio cylindric with two ends swollen.

Chemistry: medulla K-, C+, P-, with usnic acid in the cortex, K+ yellow and lecanoric acid in the medulla.

Exsicc. selecta: **Argentina**: Jujuy, Ferraro 471 (CTES, MVM, COLO, LG), 480 (CTES, US), 500 (CTES, COLO, MVM), 503 (CTES, COLO, O); Córdoba, Cabido 2, 4 (CTES).

**Flavopunctelia soredica** (Nyl.) Hale

Hale M., 1984. Mycotaxon 20(2): 682.

**Parmelia soredica** Nyl., Flora 68: 605. 1885. Hale M., 1980. Journ. Hattori Bot. Lab. 47: 83.

**Punctelia soredica** (Nyl.) Krog (1982)

Thallus small, 2,5-4 cm in diameter, corticolous, coriaceous, green-yellowish.

Upper surface rugulose at the center, lobes short and rotund, 5-15 mm wide with erects and sorediate margins, soralia white, 0,5-1 mm wide, cap shaped involute on the margin; pseudocyphellae inconspicuous or absent. Lower side brown, black maculate, sparsely rhizinate.

Chemistry: with usnic acid in the cortex, medulla white, C+ red.

Exsicc. selecta: **Argentina**: Mendoza, on **Bougainvillea spinosa**, Redón 101 (CTES, MERL).

## Observations

**Flavopunctelia praesignis** (Nyl.) Hale was known only from Perú in South America (Hale, 1980), but now was found in Chile: Provincia de Coquimbo, Parque Nacional de Fray Jorge, Altos de Talinay, 30º 30' S, Ferraro & Redón 2092 (CTES, VALPL), 2100, 2101 (CTES, VALPL, US).

The Chile locality represents the most austral record of this species.

**F. praesignis** is recognized by the yellowish-green thallus, esorediate, sparsely pseudocyphellatae, pseudocyphellae effigurate, medulla C-, KC- and conidio cylindric with two swollen ends.

## Punctelia Krog

Krog H., 1982. Nord. J. Bot. 2: 287-292. Serusiaux E., 1983. Nord. J. Bot. 3: 517-520.

Thallus foliose, adnatus, lobes 0,5-1,5 cm wide, short usually canaliculate.

Upper surface gray-greenish, green-yellowish upto brown, margins sometimes with a thin brown shiny rim; pseudocyphellate, pseudocyphellae elipticas or orbiculare, with or without margins.

Lower side white, brown upto black, rhizinate, rhizines, concolorous or black.

Apothecia laminal, not always present, disc black, epithecio light, brown-reddish; spores 8, simple. Conidia unciform, filiform or cylindric with one or two ends swollen.

Medulla white.

## Key to Punctelia in Argentina

1- Medulla C+ deep red or rose, with lecanoric or gyroforic acid respectively.
  2- Medulle C+ deep red with lecanoric acid. Lower side light or black.
    3- Lower side light.
      4- Upper side lacking isidio or soredio.
        5- Pseudocyphellae conspicuous, orbiculars, marginate, conidio 5-6 um, unciform.
          **Punctelia lorentzii**
        5- Pseudocyphellae small, inconspicuous, punctiforms, conidio 10-16 um, filiforms.
          **Punctelia hypoleucites**
      4- Upper side isidiate, sorediate or with phyllidia.
        6- Pseudocyphellae small, punctiform or elliptic.
          7- Upper side isidiate, conidia filiform.
            **Punctelia rudecta**
          7- Upper side sorediate, conidia cylindric with one end swollen.
            **Punctelia subrudecta**
        6- Pseudocyphellae wide, marginate, upper side with phy-llidia, conidio unciform.
          **Punctelia punctilla**
    3- Lower side black, upper side sorediate, soralia orbicular, laminal.
      **Punctelia borreri**
  2- Medulla C+ rose, gyroforic acid, lower side dark.
    8- Upper side lacking isidia or soredia.
      9- Spores globose, 13-14 um x 7-10 um.
        **Punctelia subpraesignis**
      9- Spores ovoid or oblong, wide 21-23 um x 14-21 um.
        **Punctelia riograndensis**
    8- Upper side with numerous phyllidia.
      **Punctelia constantimontium**
1- Medulla C-, with fatty acids. Conidio filiform.
  10- Lower side light, lobes canaliculate, conidio 10 um long..
    **Punctelia canaliculata**
  10- Lower side dark, lobes plane, large, conidio 14-16 um long..
    **Punctelia microsticta**

**Punctelia lorentzii** (Krempl.) Krog
Plate 1, B

Krog H., 1982. Nord. J. Bot. 2(3): 291.
**Parmelia lorentzii** Krempelhuber, Flora 61: 477. 1878. Räsänen V., 1941. Ann. Soc. Cient. Arg. 3(131): 98 "Argentina: Mendoza". Grassi M., 1950. Lilloa 24: 369 "Argentina: Tucumán". Krog & Swinscow, 1977. Norw. J. Bot. 24: 171.

Thallus corticolous or saxicolous, mineral-gray to brown, coriaceous, fragile, 5-10 cm in diameter.

Upper side striated, lobes rotund, 2-7 mm wide, with the margin crenated, brown, shiny and pycnidiate. Pseudocyphellae white, conspicuous, margined.

Lower side light, whitish-albescens and more tan in a zone along the margins. Rhizines concolorous, numerous, simple.

Apothecia abundant, disc imperforate, epitecio brownish, brown-reddish to brown-black, 5-22 mm in diameter, exciple with pseudocyphellae; spores globose or oblonges, 10-13 um x 7-9 um. Conidio 5-6 um long., unciform.

Chemistry: P-, K-, C+ red, KC-.

Exsicc.selecta: **Argentina**: San Luis, on **Prosopis**, Passera s/n (CTES, MERL); Mendoza, Ruiz Leal s/n (CTES, MERL), Redón 51, 100, 47 (CTES, MERL); La Rioja, on **Mimoziganthus corinatus**, Ruiz Leal s/n (CTES, MERL).

**Punctelia hypoleucites** (Nyl.) Krog
Plate 1, C

Krog H., 1982. Nord. J. Bot. 2(3): 291.
**Parmelia hypoleucites** Nyl., Flora 41: 379. 1858. Hale M., 1965 Svensk Botanisk Tidskrift 59(1): 44-45 "USA, Mexico". Krog & Swinscow, 1977. Norw. J. Bot. 24: 171 "E de Africa". Osorio H., 1980. The Bryol. 83(2): 219 "Argentina: Buenos Aires". Idem, 1981. The Bryol. 84(1): 80 "Brasil: Rio Grande Do Sul". Idem, 1981. Com. Bot. Mus. Montevideo 63(4): 5 "Argentina: Misiones".

Thallus corticolous, loosely adnate, 5-15 cm in diameter, brown-yellowish, shiny in the young parts.

Upper side striate or scrobiculate, without isidia or soredia.

Pseudocyphellae white, punctiform, marginals, the mayority along the striat. Lobes erects, 1,5-3 mm wide, sublinears, with the rim brown in the margin.

Lower side brown or whitish, rhizines numerous, concolorous. Apothecia numerous, 5-8 mm in diameter, epitecio brown-black, disc imperforate, exciple pseudocyphellate. Spores subglobose or widely ellipsoid, 10-15 um x 9-14 um. Pycnidia black, numerous in the margin of the lobes, conidio filiform.

Chemistry: P-, K-, C+, KC-; atranorin and lecanoric acid.

Exsicc. selecta: **Argentina**: Corrientes, on bark of **Prosopis**, Ferraro 1108 (CTES, US); La Pampa, Ferraro 1966 (CTES, US, O, COLO, BG, LG, VALPL, C); Jujuy, Ferraro 572 (CTES, US). **Paraguay**: Cordillera, Schinini 21588 (CTES).

**Punctelia rudecta** (Ach.) Krog
Plate 1, D

Krog H., 1982. Nord. J. Bot. 2(3): 291.

**Parmelia rudecta** Ach., Syn. Meth. Lich.: 197. 1814. Müller Arg., 1888. Rev. Mycol. 10(38): 56 "Paraguay". Grassi M., 1950. Lilloa 24: 371 "Argentina: Tucumán". Culberson W. L., 1962. Nova Hedwigia 4: 567-568 "China, Mexico, Argentina: Salta". Hale M., 1965. Svensk. Botanisk. Tidskrift 39(1): 45-46 "USA". Osorio H., 1981. Com. Bot. Mus. Montevideo 63(4): 6 "Argentina: Misiones".

Thallus mineral-gray to brown, corticolous, adnate, 12 cm in diameter, lobes rotund, 2-4 mm wide, with the brown rim in the margin. Upper side densely isidiate, striate, stria numerous extendid towards the margins. Isidia thick laminals, simple or coralloids, usually developed on plane squamules (Phyllidia?). Pseudocyphellae punctiform, white, emarginate.

Lower side light, whitish to brown, densely rhizinate, rhizines concolorous, sometimes proyected around the lobe margins.

Apothecia 5-11 mm in diameter, disc brown-reddish, exciple pseudocyphellate, generally split when adult. Spores oblong or widely elipsoid, 10-16 um x 8-10 um, episporium 1 um. Conidio 10 um long., filiform.

Chemistry: C+ red, with atranorin and lecanoric acid.

Exsicc. selecta: **Argentina**: Corrientes, Ferraro 2040 (CTES, US, COLO, BG), 2673 (CTES, US, BG, O, C, TSB, COLO), Schinini 14697, 19636 (CTES), Krapovickas 32959 (CTES, COLO, VALPL); Misio nes, Quarín 3533 (CTES), Ferraro 2273 (CTES, BG, COLO); Chaco, Ferraro 1805 (CTES, US, BG, VALPL, KASSEL), 1812 (CTES, LG, US, COLO, VALPL, BG); Salta, Schinini 14542 (CTES); Santiago del Estero, Krapovickas 37483 (CTES); Santa Fé, Ferraro 2648 (CTES); Tucumán, Meyer s/n (CTES, LIL); Jujuy, on **Podocarpus** forest, Ferraro 454, 558 (CTES, COLO), 646 (CTES, US). **Brasil**: Rio Grande Do Sul, M. Fleig 1627 (CTES, ICM).

**Punctelia subrudecta** (Nyl.) Krog
Plate 1, E

Krog H., 1982. Nord. J. Bot. 2(3): 291.
**Parmelia subrudecta** Nyl., Flora 69: 320. 1886. Hale M., 1965. Svensk. Botanisk Tidskrift, 59(1): 42-43 "Europa, USA, S de Africa, Australia". Krog & Swinscow, 1977. Norw. J. Bot. 24: 175-176 "Africa".

Thallus corticolous, saxicolous or muscicolous, 7 cm in diameter, lobes rotund, 2-3 mm wide, imbricate, margins entire or crenate. Upper side ash-grey, yellow-grayish or brown, wrinkled, sorediate, soralia marginal or laminal.

Lower side light-brown, with simple concolorous rhizines. Conidio cylindric with one end swollen. Apothecia not seen in the Argentina material.

Chemistry: C+ red, with lecanoric acid.

Exsicc. selecta: **Argentina**: Corrientes, on forest, Ferraro 3110 (CTES, O, COLO, H, LG); Córdoba, on **Polilepis**, Cabido 8 (CTES); Salta, on bark of **Acacia aroma**, Chalukian 1966 (CTES).

**Punctelia punctilla** (Hale) Krog
Plate 1, F

Krog H., 1982. Nord. J. Bot. 2(3): 291.
**Parmelia punctilla** Hale in Krog & Swinscow, Norw. J. Bot. 24: 172-173. 1977.

Thallus always saxicolous, 5-10 cm in diameter, adnate. Upper side brown-yellowish, coriaceous, shiny, with darker rim in the margin. Pseudocyphellae wide, marginate, orbiculars to elliptica, 0,1-0,3 mm wide. Isidia and phyllidia present, numerous at the center. Lobes linears, 2-3 mm wide, crenate margins, sometimes imbricate.

Lower side light and rhizinate, rhizines simple, concolorous. Apothecia disc imperforate, 2-6 mm in diameter, dark brown, exciple pseudocyphellate. Spores (8)9-12 um x (4)8-10 um, simple, episporium thick. Conidio unciform.

Chemistry: C+ red, with lecanoric acid.

Exsicc. selecta: **Argentina**: Mendoza, on rock, 1500-1800 msm, Ruiz Leal s/n (CTES, MERL).

**Punctelia subpraesignis** (Nyl.) Krog
Plate 2, G

Krog H., 1982. Nord. J. Bot. 2(3): 291.

**Parmelia subpraesignis** Nyl., Lich. Env. París: 36. 1896. Grassi M., 1950. Lilloa 24: 195 "Argentina, lignicola". Culberson W., 1962. Nov. Hedwigia 4: 568-569 "USA, Mexico, Argentina".

Thallus corticolous or lignicolous, adnate, 14 cm in diameter, lobes 4 mm wide, rotund, imbricate, erects in the central parts.

Upper side light-brown to yellowish-gray, wrinkled, lacking isidia or soredia. Pseudocyphellae orbiculare, white, 0,5 mm wide.

Lower side dark, shiny, rhizinate and brown and naked in a narrow zone at the margins. Rhizines black, branched, with the ends whitish.

Apothecia numerous, 7-11 mm in diameter, epithecium light-brown or pale yellow-brown, exciple pseudocyphellate; spores globoses, 13-14 um x 7-10 um. Conidio 4-5 um long., unciform.

Chemistry: C+ rose or red or C-, with atranorin and gyroforic acid.

Exsicc. selecta: **Argentina**: Santiago del Estero, on bark of **Prosopis**, Renolfi 362/2 (CTES, LG). **Brasil**: Rio Grande Do Sul, Krapovickas 37619 (CTES, LG).

**Punctelia borreri** (Sm.) Krog
Plate 2, H

Krog H., 1982. Nord. J. Bot. 2: 291.

**Lichen borreri** Sm., Engl. Bot. 25: Tab. 1780. 1807.

**Parmelia borreri** (Sm.) Turn., Trans. Linn. Soc. 9: 148. 1808. Grassi M., 1950. Lilloa 24: 177 "Argentina: Jujuy, Córdoba, Islas Malvinas"; idem, pag. 181 "Argentina: Tucumán".

**Thallus corticolous, fragile, loosely adnate, mineral-gray to** yellowish to brown, 5-7 cm in diameter.

Upper side sorediate, soralia orbicular, laminal, pseudocyphellae small, punctiform. Lobes rotund with shiny, brown rim in the margins.

Lower side densely rhizinate, lighter to white and naked zone towards the margins.

Apothecia disc imperforate, epithecium brown-reddish, 5-10 mm in diameter, exciple sorediate and striate.

Chemistry: medulla K-, C+ red, P-, with atranorin and lecanoric acid.

Exsicc. selecta: **Argentina**: Jujuy, Krapovickas 36684 (CTES, O).

**Punctelia riograndensis** (Lynge) Krog
Plate 2, I

Krog H., 1982. Nord. J. Bot. 2(3): 291. Serusiaux E., 1983. Nord. J. Bot. 3(4): 520 "Africa".

**Parmelia riograndensis** Lynge, Ark. Bot. 13(13): 26. 1914. Krog H. & Swinscow, 1977. Norw. J. Bot. 24: 175.

**Parmelia microsticta** var. **riograndensis** (Lynge) Lynge. Osorio H., 1973. Rev. Fac. Ciencias (Lisboa) 17(2): 449 "Brasil". Idem, 1981. Com. Bot. Mus. Montevideo 63(4): 5 "Argentina: Misiones".

Thallus corticolous, 6-12 cm in diameter, mineral-gray to gray-greenish, membranaceous; lobes wide and rotund, 2-5 mm wide, imbricate, rare erects.

Upper side wrinkled or scrobiculate, pseudocyphellate, pseudocyphellae abundant, orbicular, white, emarginate; without isidia and soredia.

Lower side brown, rhizinate, rhizine short, simple; naked and light brown in a narrow zone along the margins.

Apothecia numerous, 6-12 cm in diameter, disc imperforate, urceolate, pedicelate, when young, epithecium brown, exciple rugose, pseudocyphellate, spores ovales, 21-23 um x 14-21 um, episporium tick. Pycnidia black, numerous, marginals or laminals. Conidio 5-7 um long, unciform.

Chemistry: medulla C+ rose, with gyroforic acid.

Exsicc. selecta: **Argentina**: Corrientes, in forest, Ferraro 2912 (CTES, US, O, C, COLO, TSB, H), Schinini 16290 (CTES, US); Jujuy, on Podocarpus forest, Ferraro 526 (CTES, COLO), Krapovickas 36683

(CTES); Salta, Krapovickas 36674 (CTES); Santa Fé, Ferraro 2634 (CTES, G, COLO, TSB).

**Punctelia constantimontium** Sérusiaux
Plate 2, J

Sérusiaux E., 1983. Nord. J. Bot. 3(4): 517-520 "Africa, Brasil, Uruguay, Argentina: Buenos Aires, Entre Rios". Osorio & Fleig, 1984. Int. J. Myc. Lich. 1(3): 278 "Brasil".

**Parmelia subpraesignis** sensu W. Culberson non Nyl., Nov. Hedwigia 4: 563-577. 1962.

**Parmelia squamuligera** R. Sant. nom. nud. pp. in Osorio 1968, 1970a, 1970b, 1972 and Osorio & Fleig, 1982 "Argentina: Buenos Aires, Uruguay".

Thallus corticolous, loosely adnate, 5-10 cm in diameter, whitish-gray to brown-yellowish.

Upper side reticulate or scrobiculate, lobulate, lobes 2-6 mm wide, rotund; pseudocyphellate, pseudocyphellae white, small, emarginate.

Lower side dark and more or less shiny on the margins, rhizines numerous.

Apothecia urceolate, 4 mm in diameter, exciple pseudocyphellate; spores 13-16 um x 8-11 um. Conidio unciform.

Chemistry: C+ rose, with gyroforic acid.

Exsicc. selecta: **Argentina**: Corrientes, Schinini 19760 (CTES, O, LG), Ferraro 1474 (CTES, US), 2832 (CTES, O, LG, TSB); Jujuy, on rock, Ferraro 617 (CTES, MVM, LG).

**Punctelia canaliculata** (Lynge) Krog
Plate 2, K

Krog H., 1982. Nord. J. Bot. 2(3): 291.

**Parmelia canaliculata** Lynge, Ark. Bot. 13(13): 28. 1914. Grassi M., 1950. Lilloa 24: 177 "Argentina: Córdoba, Jujuy, Salta". Osorio H., 1978. Rev. Fac. Hum. y Cienc. 1(4): 53 "Uruguay".

Thallus corticolous, loosely adnate, grayish or yellowish, 5-14 cm in diameter.

Upper side striate or scrobiculate, soredia and isidia lacking, pseudocyphellate, pseudocyphellae wide, conspicuous, orbiculars, emarginate, lobes canaliculate, 1-1,5 cm long. and 3-5 mm wide, li nears with the round margins.

Lower side white-yellow or whitish-brown, rhizinate, rhizines concolorous.

Apothecia disc imperforate, 3-15 mm in diameter, exciple pseudocyphellate. Conidio 10 um long., filiform.

Chemistry: C-

Exsicc. selecta: **Argentina**: Corrientes, Schinini 16316 (CTES, COLO, BG), 19704 (CTES, VALPL, LG, US, COLO, C), **Ferraro 1499** (CTES, US, LG, COLO, BG, VALPL), 1508 (CTES, COLO, KASSEL), 1521 (CTES, VALPL, US, BG), Krapovickas s/n (CTES, MVM), on **Sebastiania** sp. 29166 (CTES, US, BG), Herbst s/n (CTES); Misiones, Krapovickas 34144 (CTES, COLO); Jujuy, Ferraro 513 (CTES, AAR).

**Punctelia microsticta** (Müll. Arg.) Krog
Plate 2, L

Krog H., 1982. Nord. J. Bot. 2(3): 291.

**Parmelia microsticta** Müll. Arg., Flora 62: 164. 1879. Arechavaleta, 1888. Rev. Mycol. 10(37): 1 "Uruguay: Montevideo". Grassi M., 1950. Lilloa 24: 187 "Argentina: Buenos Aires, Jujuy, Salta, Córdoba". Idem, 1950. Lilloa 24: 370 "Argentina: Tucumán". Osorio H., 1970. The bryol. 73(13): 393 "Argentina: Chaco, Misiones". Idem, 1976. The Bryol. 79(3): 358 "Argentina: Buenos Aires". Idem, 1978. The Bryol. 81(3): 453 "Brasil". Idem, 1981. Com. Bot. Mus. Montevideo 63(4): 5 "Argentina: Misiones". Idem, 1982. Com. Bot. Mus. Montevideo 64(4): 4 "Argentina: Misiones".

Thallus 8-16 cm in diameter, corticolous, coriaceous, grayish to brown-yellowish, lobes 3-4 mm wide, rare imbricate, margins entire to crenate or sinuate.

Upper side rugose, pseudocyphellate, pseudocyphellae 0,2-0,5 mm wide, numerous, orbiculars, emarginate, lacking soredia and isidia.

Lower side brown and rhizinate at the center, rare white maculate, naked in a zone along the margins.

Apothecia brown-reddish, disc imperforate, more or less 17 mm in diameter, pedicelate, exciple pseudocyphellate, entire margins; spores globose, 16-23 um x 13-17 um, episporium tick. Picnidio black, marginal. Conidio 14-17 um long., filiform.

Chemistry: medulla white, C-, with fatty acid.

Exsicc. selecta: **Argentina**: Corrientes, Ferraro 309 (CTES, MVM), 1298 (CTES, US, COLO), 102a (CTES, AAR, COLO, MVM), 2827 (CTES, C), 2748 (CTES, KASSEL), 2891 (CTES, O), on bark of **Scutia** 938 (CTES),

(CTES), on bark of **Bignoniaceae** 231 (CTES), Schinini 8515 (CTES, AAR, COLO, G), 7838 (CTES, MVM), 19729a (CTES, COLO), on **Schinus longifolia** 14719 (CTES), on **Sebastiania brasiliensis** 14679 (CTES), Krapovickas 28062 (CTES, VALPL, US, MVM, COLO, LG, MSK, G, TSB), on **Castela tweedii** 16202(CTES, COLO); Chaco, Ferraro 3062 (CTES, LG, COLO, H, US); Jujuy, Ferraro 475 (CTES); Santa Fé, Ferraro 2659 (CTES, G), Quarín s/n (CTES, MVM); La Pampa, Krapovickas s/n (CTES, MVM); Mendoza, Ruiz Leal s/n, on rock (CTES, MERL); Salta, Schinini 14546, 19691 (CTES); Santiago del Estero, Krapovickas 37485 (CTES). **Uruguay**: San José, Krapovickas 16347 (CTES). **Bolivia**: Tarija, Krapovickas 33917 (CTES).

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I also thank Dr. T. Nash III for confirming the identification of some taxa.

Plate 1: A, **Flavopunctelia flaventior** (Ferraro 503). B, **Punctelia lorentzii** (Redón 47). C, **Punctelia hypoleucites** (Ferraro 1966). D, **Punctelia rudecta** (Ferraro 1812). E, **Punctelia subrudecta** (Ferraro 3110). F, **Punctelia punctilla** (Ruiz Leal s/n).

Plate 2: G, **Punctelia subpraesignis** (Renolfi 362/2). H, **Punctelia borreri** (Krapovickas 36684). I, **Punctelia riograndensis** (Schinini 16290). J, **Punctelia constantimontium** (Schinini 19760). K, **Punctelia canaliculata** (Ferraro 1499). L, **Punctelia microsticta** (Schinini 19729a).

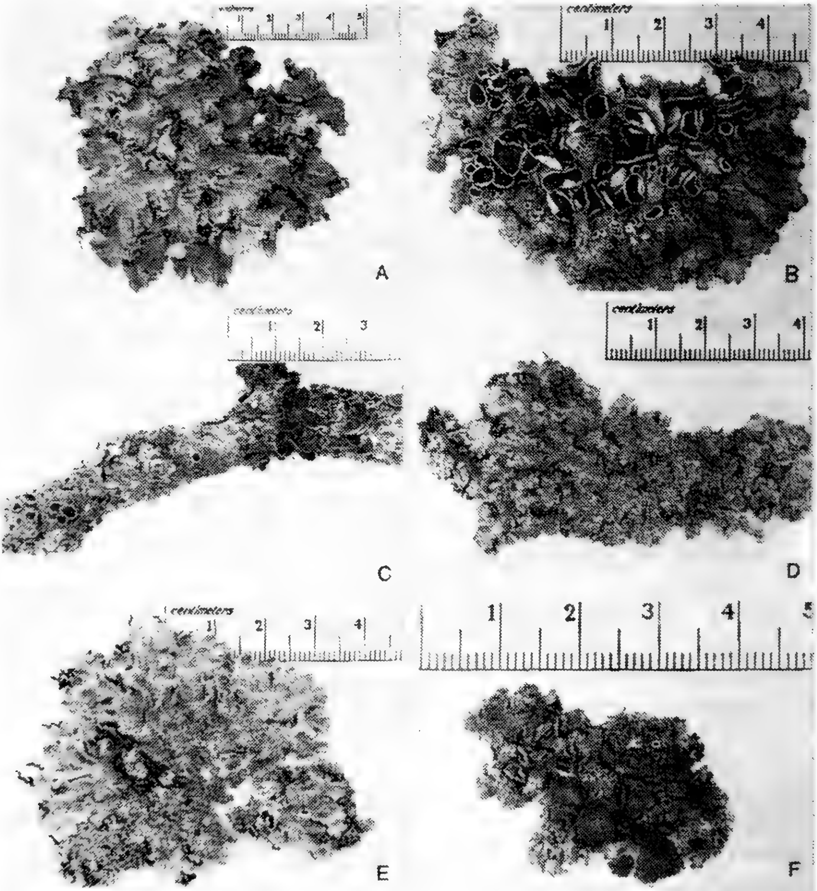


Plate 1

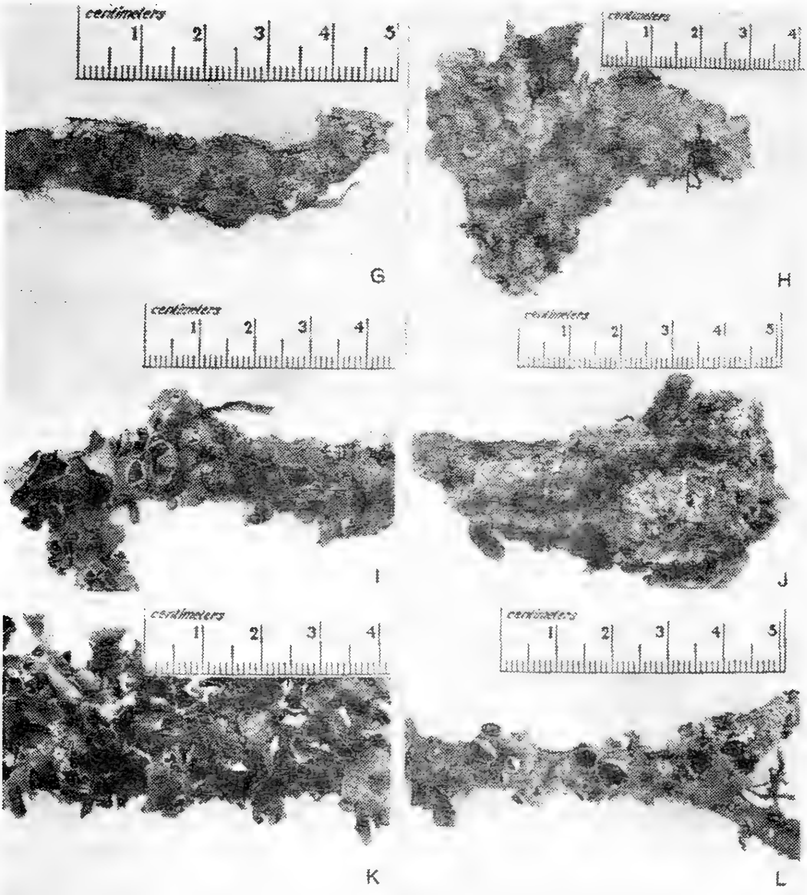


Plate 2

# DATURA LANOSA, A NEW SPECIES OF DATURA FROM MEXICO

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ABSTRACT.--*Datura lanosa* Barclay *ex* Bye, related to *D. inoxia* and *D. wrightii*, is described from northwest Mexico.

Based upon ethnobotanical and floristic studies in the Sierra Madre Occidental of Chihuahua, Mexico, and biosystematic studies of North American species of *Datura*, a new species is proposed:

**Datura lanosa** Barclay *ex* Bye, **sp. nov.** -- *Datura wrightii* Regel affinis, a qua differt foliis supra puberulis, subtus lanato-pubescentibus, marginibus irregulariter sinuato-dentatis, petiolis et ramis juniores et pedunculis floralibus et fructibus et calycibus extus lanatis. Typus: MEXICO. **Sinaloa.** Culiacán and vicinity; volcanic cerro and valley, thorn forest, marginal river sand, 150-500 ft. alt., Aug., 1944, *H. S. Gentry 7052* (Holotype, GH!; isotypes, F!, NY!, UC!, US).

Caulescent dichotomously branched perennial herb up to 1.5 m or more in height, widely spreading, the young branches lanate, the entire plant appearing canescent. Leaves simple, alternate, ovate, margin entire or irregularly sinuate-dentate, the apex acute, the base equal to subequal, petioles up to 10 cm long; leaf blades up to 21.5 cm long and 18 cm wide, one-half to two-thirds as broad as long; upper surface puberulent, lower surface lanate, the same pubescence continuing along the petiole. Flowers pedicellate, erect, borne in the axils of the branches; pedicels lanate, erect during anthesis, later becoming somewhat elongate and recurved; calyx tube cylindrical, 8-15 cm long, 5-toothed at the apex, the exterior lanulose, the interior glabrous; calyx teeth acuminate, 1.5-3.0 cm long, 0.7-1.2 cm broad at the base; corolla white, funnelform, plicate, terminating in a 5-dentate border, 14.5-20.0 cm long, the corolla teeth (acumina) acute to acuminate, 0.6-2.0 cm long and 0.3-0.5 cm wide at the base, each with 3 conspicuous proximal nerves; margin of the corolla between the teeth rounded or with interacuminal lobules giving the corolla the appearance of being 10-angled; exterior of the corolla glabrous to slightly puberulent along the veins, interior glabrous down to the point of staminal adnation, becoming sparsely pubescent below; stamens 5, free, epipetalous, extending 12-17 cm from the base of the corolla and adnate to the tube for about half their length, anthers 1.2-1.6 cm long with filamentous trichomes along the lines of dehiscence; style 11.7-17.7 cm long; stigma bilobed. Fruits subglobose, irregularly dehiscent; capsules up to 4 cm long, recurved on pedicels 2.0-3.5 cm long; pericarp covered with short, sharp spines approximately 5 mm long; surface of both the fruit and the spines villous to lanate; calyx persistent, circumscissile above the base, forming an appressed cup-like structure which subtends the capsule. Seeds reniform, carunculate, 4.0-5.2 mm long, 3.0-4.0 mm wide, with three ridges which form a cord-like band on the convex edge of the seed, the lateral faces smooth.

Originally, this taxon was recognized as a subspecies of *D. inoxia* Miller by Arthur Barclay (1959) but was not published effectively.

*Datura lanosa* is closely related to *D. inoxia* and *D. wrightii*, based upon similarities of morphological characters and karyotypes. The branches, leaves, flowers, fruits and seeds are more similar to these species than to other members of the section Dutra Bernh. The principal difference is the type of pubescence (see key below). The karyotypes of *D. lanosa*, *D. inoxia* and *D. wrightii* are similar in that three chromosome pairs have satellites; they differ from *D. discolor*, another member of section Dutra, and *D. stramonium* (of the section Datura) in having only four chromosome pairs with satellites (Palomino *et al.*, in press). One of the three pairs of *D. lanosa* have satellites at both ends of the chromosome while all three pairs of *D. inoxia* and *D. wrightii* have satellites on only one end.

*Datura lanosa* grows in open, disturbed sites near arroyos and drainage depressions of the thorn forest and tropical deciduous forest of northwest Mexico. It is found from sea level on the coastal plain to 1,000 m snm in the barrancas on the western slope of the Sierra Madre Occidental.

Throughout its range it is called 'toloache', a vernacular name applied to many species of *Datura* and derived from the Nahuatl terms 'toloa' and 'toloatzin'. A poultice prepared by mixing the crushed leaves with animal fat is used to treat various pains, skin inflammations and sores. The people also attribute poisonous properties to all parts of the plant if it is smelled, handled or ingested. In large doses, it may cause permanent insanity or death. The Tarahumara Indians of Chihuahua call the plant 'rikúri' and consider it one of the allies of the devil; hence it is dangerous to harm the plant. The Pima Indians of Sonora call it 'hákundum' ("it does something to our head").

SPECIMENS EXAMINED: MEXICO. **Chihuahua**. Batopilas, Aug.-Nov. 1885, *E. Palmer Z-1* (F, US); La Bufa, *R. Bye 2977, 9612* (COLO), *Bye & Weber 8349* (COLO), *Bye et al. 12850, 12853* (COLO), *Bye & Linares 14246-8, 14250-2* (MEXU); Moris, June 1968, *C. W. Pennington 6, 7* (TEX); Southern Chihuahua, *R. M. Zingg A 73* (F). **Nayarit**. Acaponeta, 30 July 1897, *J. N. Rose s.n.* (US); El Recodo, *Bye & Arellano 13316* (MEXU); Jesús María, El Nayar, *Colunga & Zizumbo 13* (CAS, MEXU, UC). **Sinaloa**. Bella Vista, Mazatlán, *J. Gonzalez Ortega 6373* (DS, GH); Bomoa, *Bye & Arellano 13355* (MEXU); Celaya, Escuinapa, *Bye & Arellano 13363*; Culiacán, *Gentry 7052* (F, GH, NY, UC), *Rose et al. 14918* (NY, US); ca. 66 km N of Culiacán, *Bye & Arellano 13334* (MEXU); El

Fuerte, *Gentry 4920* (ARIZ, MO), *Rose et al. 13452* (US); Guamuchil, *Hansen & Nee 1400* (MEXU, US); Gusave, *Bye & Arellano 13351* (MEXU); La Constancia, El Fuerte, *Gonzalez O. 5483* (MEXU, US); Las Cabras, Escuinapa, *Bye & Arellano 13366* (MEXU); Las Palmas, *Gonzalez O. 4544* (US); Marismas, Escuinapa, *Gonzalez O. s.n.* (MEXU); Mazatlán, *Gonzalez O. 5654* (US); San Blas, *Rose et al. 13355* (US, NY), *M. E. Jones 23115 p.p.* (POM); Villa Union, *Rose et al. 13927* (NY, US), *Bye & Arellano 13323-4* (MEXU). **Sonora**. Alamos, *Rose et al. 13010* (NY, US), *C. E. Smith CS 4703* (US), *Bye & Arellano 13346-7* (MEXU); Onavas, *A. M. Rea 44* (SD); San Bernardo, *Gentry 1346* (ARIZ, F, GH, MEXU, MO, UC, US).

## Key to *Datura lanosa* and related species

A. Lower leaf surface softly pilose, particularly along the veins, the same indument extending to the petiole; venation of the leaves tending to be strongly pinnate with the veinlets inconspicuous; exterior of corolla usually glabrous. *D. inoxia*

AA. Lower leaf surface not as above; venation of leaves pinnate but veinlets more pronounced, giving a more reticulate pattern to the lower leaf surface; exterior of corolla puberulent, especially along the veins. . . . . . . . . . . . . . . . . . . . . . (B)

B. Lower leaf surface and petioles canescent, densely covered with short trichomes. *D. wrightii*

BB. Lower leaf surface, petioles and young branches lanate. *D. lanosa*

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Palomino, G., R. Viveros & R. Bye [in press]. Cytology of five Mexican species of *Datura* L. (Solanaceae). Southwest. Nat.

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BOOK REVIEWS

Alma L. Moldenke

"POPULATION BIOLOGY AND EVOLUTION OF CLONAL ORGANISMS" edited by Jeremy B. C. Jackson, Leo W. Buss & Robert E. Cook, xi & 530 pp., 90 b/w fig., 20 photo., & 46 tab. Yale University Press, 92A New Haven, Connecticut 06520. 1985 - $60.00 clothbound; 1986 - $30.00 paperbound.

Herein the 13 "papers in this volume are a first collective attempt to identify and probe those ecological, morphological, developmental, and evolutionary properties of clonal organisms that distinguish them from aclonal forms". The papers have been revised after their presentation at Yale in 1982. In horticultural and agricultural cloning new plants are established from parts that are already rooted or that might never normally have formed roots, allowing the fixation of desirable properties. Clonal growth, development, organization, microevolution, evolutionary demography in land plants and marine invertebrates, as well as the evolution of mutualism, are some of the topics covered in these well developed papers. Many kinds of biologists should find this presentation valuable and many libraries will find it needful.

"MAMMAL EVOLUTION - An Illustrated Guide" text by R. J. G. Savage & Illustrations by M. R. Long, iii & 259 pp. & hundreds of color & b/w plates, paintings, skeletal drawings & reconstructions, & tab. Facts on File Publications, Inc., New York, N. Y. 10016. 1986. $35.00.

This book was published in Britain for the British Museum (Natural History) by a vertebrate paleontologist and an artist specializing in nature. It is neither an illustrated text nor an annotated picture book, but an effective half-'n-half. Unless one has haunted museums for years, or worked in their paleontology departments, or taken a few advanced courses in vertebrate paleontology, or been a field oryctologist [=a studier of things dug up], that person on reading this book will surely be amazed at the plethora of mammalian fossil materials there are and the very logical and precise way known parts can be carefully elaborated into whole organisms. "Since the close of the Mesozoic times (65 million years ago) as the dinosaurs declined toward extinction, the mammals were left with the insects, the birds, the lizards, the frogs and toads, and the flowering plants, to usher in the Caenozoic era. Throughout the Mesozoic, mammals had occupied small insectivorous or rodent-like niches; now came their big opportunity - the meek did indeed inherit the earth." This book, needed in libraries, can be enjoyed by a biologically oriented individual or by one interested in what was around in really earlier times, and as a very helpful text or reference source for paleontology and evolution courses.

"EVOLUTION - Selected Papers" by Sewall Wright, edited and introduced by William B. Provine, xiii & 649 pp., 177 b/w fig. & 32 tab. University of Chicago Press, Chicago, Illinois 60637. 1986. $70.00 clothbound & $25.00 paperbound.

All of Sewall Wright's pre-1950 papers and some published later on evolution and physiological and mathematic population genetics are cogently introduced by the highly competent editor. Since they come from several journals and the "Encyclopaedia Brittanica", it certainly is advantageous to have them all in this volume for the many advanced students and scholars worldwide who will want or need this material in personal or university library copies. A few of the titles of papers (often presented to symposia) are: The Roles of Mutation, Inbreeding, Crossbreeding and Selection in Evolution, The Distribution of Gene Frequencies in Populations of Polyploids, Statistical Genetics and Evolution, and The Genetical Structure of Populations.

"BARE BONES - Everybody's Inside Out" by David Hawcock, 13½ x 20 inches, plastic wrapped booklet & cut-out. Facts on File Publications, New York, N. Y. 10016. 1986. $12.95.

This package provides a novel and effective way of constructing a human female skeleton, all 206 bones, a meter tall and having it flexible at normal points. It can range in use from an unusual "fun thing" at a Halloween party to an individual or cooperative learning item in a high school biology class or club or for future nurses. Parts can be put together, then identified in games or labelled. The entire package includes "A set of four sheets of heavy paper from which to contruct the skeleton, A 4-page fold-up booklet entitled 'All About Bones' and A fully-labelled, fact-filled wall poster of a real human skeleton."

"GROWING AND USING HERBS AND SPICES" by Milo Miloradovich, 236 pp. & 4 b/w pl. Dover Publications, New York, N. Y. 10014. 1986. $4.95 paperbound.

This new edition "is a slightly abridged republication of the work first published in 1952 by Doubleday & Company, Inc. under the title 'The Home Garden Book of Herbs & Spices'" omitting the out-of-date list of suppliers. The descriptive materials, historical backgrounds and legendry make for delightfully informative reading along with the detailed gardening instructions. There are also some descriptions of the preparation of spices from the large plantations in the tropics.

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# A FLORISTIC PROFILE OF THE McDONOUGH COUNTY, ILLINOIS, SPONTANEOUS VASCULAR FLORA

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## ABSTRACT

A floristic profile of the current spontaneous vascular flora of a west-central Illinois county, McDonough, is presented. Dr. R. M. Myers initiated floristic studies of the McDonough County vascular flora in 1945. Presently there are 1096 species in the County's spontaneous vascular flora which represents about 40% of the Illinois spontaneous vascular flora. Twenty-four percent of these species are alien, 82% of which came from the old world. Nearly 60% of the alien species have been cultivated, probably about 82% naturalized and about 4.7 species introduced yearly since 1948. The 1096 species are in five divisions (2.6% pteridophytes, 0.3% gymnosperms, 97.1% angiosperms), 114 families and 477 genera; they are about 14% woody, 24% annuals, 4% biennials, 72% perennials, 6% obligate aquatics, 28% weeds, 18% poisonous to humans, 6% poisonous to livestock and 16% drug plants. There are seven Illinois threatened and endangered species of which probably only three are extant. In the County there are four areas listed by the Illinois Natural Areas Inventory and no Illinois Nature Preserves.

## INTRODUCTION

McDonough County is located in west-central Illinois, has an elevation ranging from 500 to 775 feet above sea level (averaging 690 feet), is drained principally through the Lamoine River system, is covered mostly with glacial drift from 10 to 140 feet thick with much of the northern part covered with loess up to 50 feet thick, has three main types of soil (dark upland prairie, swamp and bottomland, lighter upland timber), has an average rainfall of 34.76 inches and has an area of 576 square miles (Myers and Wright 1948) of which about 94% is under cultivation (Shadwick 1968 p. 118).

Floristic studies of the McDonough County vascular flora were initiated by Dr. R. M. Myers upon his arrival in the Department of Biological Sciences at Western Illinois University in 1945 and were continued vigorously by him until his retirement as professor and herbarium curator in 1977. He stated (Myers 1972 p. 58) that "There are no reports for collections in the County before 1945" although in an undated (but probably written near the mid 1960's) grant proposal for research on the County flora he stated in the introduction "Previous to 1945 the flora of McDonough had not been studied and only four species of plants had been collected according to the literature." He writes in this same proposal when he came there was no herbarium or facilities for collecting or storing specimens; he then proceeded to obtain some collecting materials, a herbarium case and started a project to collect all the vascular plants (with duplicate specimens being deposited in the Illinois State Museum at Springfield) in the County noting that a herbarium (which he states (Myers 1972 p. 59) was founded in 1946) besides being essential for teaching classes in Plant Taxonomy, Ecology, related fields and research, "also provides a record of the flora which is subject to change due to the destruction of woodlands, draining of swamps, construction of buildings and intensive farming."

In 1946 Dr. Myers, on a typed catalog he prepared of the vascular plants of Illinois as listed in Jones' (1945) Flora of Illinois, annotated the McDonough County species. He listed 187 species (I counted 190) by June 30, 1946. Since there were also some dated after that in 1946, I counted a total of 217 species on his list. Ten of these he noted as cultivated thus resulting in 177 and 207 species respectively as being spontaneous. It appears that nearly all of these observations and collections were made in 1946 within a several mile radius of Macomb including many in the W.I.U. campus vicinity and some at Spring Lake Park. Myers produced mimeographed catalogs (checklists) in 1948 (reproduced as Myers (1983)), 1959, and 1964 in which he listed 522, 745 and 837 species respectively. In 1972 (Myers 1972) he annotated 944 species noting that 919 of these were native and naturalized alien taxa and excluded another 22 (I counted 25) as not naturalized aliens. In this publication he provided a discussion of the County flora (pp. 55-59) and the W.I.U. Herbarium (p. 59). Other annotations of the species included if specimens collected in McDonough County were in the W.I.U. herbarium or not, rare, alien, economic plant, ornamental, poisonous, weed, aquatic and, if not numbered, not naturalized. In 1975 (Myers 1975) he published 15 new County records stating that "The addition of these species increases the known vascular plants growing wild in McDonough County to 947, but 27 are excluded as they are alien ornamentals or economic plants considered to be casual escapes from cultivation, anthropogenetic relicts or railroad migrants." Henry and Scott in 1982 (Henry and Scott 1982) listed 1061 species (as well as an additional 34 subspecific and hybrid taxa) as growing spontaneously in the County. In 1986 the Illinois Natural History Survey (Illinois Natural History Survey 1986) indicated there are between 901 and 1100 species in the County. This paper is based upon 1096 vascular plant species (plus an additional 48 infraspecific taxa and seven hybrids) that have been recorded as occurring spontaneously (growing without having been intentionally planted by man and thus includes all native and non-planted aliens whether naturalized or not) in the McDonough County flora and which serve as the basis for this floristic profile.

Most of McDonough County is in the transitional zone between the Grand Prairie and Forest-Prairie Transition floristic provinces of Illinois, the former province occurring at the northeastern edge and the latter province occurring at the southern edge of the County (Anderson and Ugent 1980). The Natural Division of Illinois which includes McDonough County is the Western Forest-Prairie Division (specifically the Galesburg section) according to Schwegman (1973). A map of Illinois published in 1982 (Illinois Department of Conservation 1982) titled The Forests of Illinois, depicts the forest cover of McDonough County from the time of settlement (1810) until recently as well as the general forest types, acerage and coverage. Myers and Wright (1948) published a paper on the vegetation of McDonough County showing that generally the original vegetation was prairie in the north-east one-half and forest in the southwest one-half of the County. The natural vegetation has also been generally summarized by Shadwick (1968 p. 9-11). In general, the forest coverage of the County has been reduced from about 45% to around 8% and the prairie from 55% to practically none today.

Some other publications concerning the McDonough County flora that are not otherwise cited in this paper are: Mavis and Mavis (1972 on wildflowers; text supplemented by Kodachrome transparencies, a set of which was given to the Illinois State Museum (Springfield) and to the W.I.U. library), Myers (1950 on *Marsilea*), Henry and Scott (1984 on seeps), Henry and Scott (1985 on Ferster Woods), Henry (1965 on lawnplants), Laughberaugh (1856 on original land survey), Henry, Ives, O'Flaherty and Stidd (1978 and partially revised 1986 for keys to common plants), Thurow and Henry (1968 on chestnut trees), Myers (1982 reprint of 1975 mimeograph on a tall grass prairie west of Macomb), Coon, Guilinger and Martin (1984 reprint of a 1964 report of a wet prairie remnant), Morris (1961 on trees), and Schwegman (1982 on *Leptochloa uninervia*). Relevant W.I.U. master degree theses are Murphy (1951 on a phytosociological study of an oak-hickory woods), Seely (1949 on poisonous plants), Neal (1969 floristics of Lake Vermont), Reese (1979 on the railroad flora) and currently in process a floristic study of Macomb's Spring Lake Park area by C. Wirmum. In the W.I.U. herbarium library are some student class reports and term papers that contain useful information on some areas. Some publications that deal with County records and distributional information that include McDonough County are Mohlenbrock and Ladd (1978), Jones and Fuller (1955), Winterringer and Evers (1960), Henry, Scott and Shildneck (1978), Henry and Scott (1983), Scott and Henry (1982), Scott and Henry (1979), Ladd and Mohlenbrock (1983), Mohlenbrock (1985) and Henry and Scott (1986).

This floristic profile is based upon an updated copy of "Checklist of the Vascular Plants of McDonough County, Illinois" (Henry and Scott 1982) which is summarized in Table 1. Taxa nomenclature at and below the family level, as well as taxa numbers in Illinois used in this paper follow Mohlenbrock (1975) rather than Mohlenbrock (1986) which was published after the bulk of the data in this paper was prepared.

## TAXONOMIC ANALYSIS

There are 1096 species in the McDonough County, Illinois, spontaneous vascular plant flora. This represents 40.2% of the present-day species in the spontaneous Illinois vascular plant flora (based on Mohlenbrock 1975). Of these species 269 (24.5%) are alien and 827 (75.5%) native species. In addition to the 1096 species there are 48 infraspecific taxa and 7 hybrids which represent 18.1% and 8.4% respectively of those in the present day Illinois flora based on Mohlenbrock (1975).

The 1096 species occur in all 5 vascular plant divisions that occur in Illinois. One (0.1%) is a *Lycopodiophyta*, 3 (0.3%) are *Equisetophyta*, 24 (2.2%) are *Polypodiophyta*, 4 (0.3%) are *Pinophyta* and 1064 (97.1%) are *Magnoliophyta*. Thus the species are about 2.6% pteridophytes, 0.3% gymnosperms and 97.1% angiosperms. Within the angiosperms 286 (26.9%) are *Liliopsida* (monocots) and 778 (73.1%) are *Magnoliopsida* (dicots). The monocots represent 26.1% and the dicots 71% of the 1096 species in this flora.

The 1096 species occur in 114 families. This represents 73.5% of the families in the spontaneous Illinois vascular plant flora based on Mohlenbrock (1975). One (0.9%) belongs to the *Lycopodiophyta*, one (0.9%) is an *Equisetophyta*, four (3.5%) are *Polypodiophyta*, three (2.6%) are *Pinophyta* and 105 (92.1%) are *Magnoliophyta*. Thus the families are about 5.3% pteridophytes, 2.6% gymnosperms, and 92.1% angiosperms. Within the angiosperms 18 (17.1%) are *Liliopsida* and 87 (82.9%) are *Magnoliopsida*. The monocots represent 15.8% and the dicots 76.3% of the 114 families in this flora. The five largest families are the *Compositae* (with 144 species), *Poaceae* (126 species), *Cyperaceae* (85 species), *Leguminosae* (48 species), and *Rosaceae* (47 species).

The 1096 species occur in 477 genera. This represents 57.5% of the genera in the spontaneous Illinois vascular plant flora based on Mohlenbrock (1975). One (0.2%) belongs to the *Lycopodiophyta*, one (0.2%) is a *Equisetophyta*, 14 (2.9%) are *Polypodiophyta*, three (0.7%) are *Pinophyta* and 458 (96%) are *Magnoliophyta*. Thus the genera are about 3.3% pteridophytes, 0.7% gymnosperms and 96% angiosperms. Within the angiosperms 105 (22.9%) are *Liliopsida* and 353 (77.1%) are *Magnoliopsida*. The monocots represent 22% and the dicots 74% of the 477 genera in this flora. The five largest

TABLE 1. SUMMARY OF McDONOUGH COUNTY, ILLINOIS, FLORISTIC DATA

A. Taxa Data

| | | | | | | Magnoliophyta | | |
|---|---|---|---|---|---|---|---|---|
| | Total | Lycopo-diophyta | Equise-tophyta | Polypo-diophyta | Pin-ophyta | Total | Lili-opsida | Magnoli-opsida |
| Families | 114 | 1 | 1 | 4 | 3 | 105 | 18 | 87 |
| Genera | 477 | 1 | 1 | 14 | 3 | 458 | 105 | 353 |
| Species | 1096 | 1 | 3 | 24 | 4 | 1064 | 286 | 778 |
| Infra-specific taxa | 48 | 0 | 0 | 1 | 0 | 47 | 12 | 35 |
| Hybrids | 7 | 0 | 0 | 1 | 0 | 6 | 2 | 4 |
| Aliens | 269 | 0 | 0 | 1 | 3 | 265 | 56 | 209 |

B. Other Data

| | Total | Lycopo-diophyta | Equise-tophyta | Polypo-diophyta | Pin-ophyta | Magnoli-ophyta |
|---|---|---|---|---|---|---|
| Woody | 148 | 0 | 0 | 0 | 4 | 144 |
| Tree | 82 | 0 | 0 | 0 | 4 | 78 |
| Shrub | 53 | 0 | 0 | 0 | 0 | 53 |
| Vine | 13 | 0 | 0 | 0 | 0 | 13 |
| Duration | | | | | | |
| Annual | 261 | 0 | 0 | 0 | 0 | 261 |
| Biennial | 40 | 0 | 0 | 0 | 0 | 40 |
| Perennial | 795 | 1 | 3 | 24 | 4 | 763 |
| Poisonous | | | | | | |
| Human | 197 | 0 | 0 | 0 | 1 | 196 |
| Livestock | 60 | 0 | 3 | 1 | 0 | 56 |
| Drug | 178 | 0 | 1 | 2 | 2 | 173 |
| Aquatic | 61 | 0 | 0 | 1 | 0 | 60 |
| Native | 827 | 1 | 3 | 23 | 1 | 799 |
| Threatened | 2 | 0 | 0 | 0 | 0 | 2 |
| Endangered | 5 | 0 | 0 | 1 | 0 | 4 |
| Weed | 310 | 0 | 3 | 1 | 3 | 303 |
| Aliens | 269 | 0 | 0 | 1 | 3 | 265 |
| Aquatic | 4 | 0 | 0 | 1 | 0 | 3 |
| Origin | | | | | | |
| Old World | 221 | 0 | 0 | 1 | 0 | 220 |
| Tropics | 17 | 0 | 0 | 0 | 0 | 17 |
| United States | 31 | 0 | 0 | 0 | 3 | 28 |
| east/north | 3 | 0 | 0 | 0 | 2 | 1 |
| south | 2 | 0 | 0 | 0 | 1 | 1 |
| west | 26 | 0 | 0 | 0 | 0 | 26 |
| Duration | | | | | | |
| annual | 128 | 0 | 0 | 0 | 0 | 128 |
| biennial | 23 | 0 | 0 | 0 | 0 | 23 |
| perennial | 118 | 0 | 0 | 1 | 3 | 114 |
| Cultivated | 159 | 0 | 0 | 1 | 3 | 155 |
| Woody | 32 | 0 | 0 | 0 | 3 | 29 |
| Weed | 123 | 0 | 0 | 0 | 2 | 121 |

genera are *Carex* (with 61 species), *Polygonum* and *Aster* (18 species each), *Panicum* (13 species), *Solidago* (12 species) and *Viola* (11 species).

Of the 48 infraspecific taxa, one (2.1%) is *Polypodiophyta* and 47 (97.9%) are *Magnoliophyta* of which 12 (25.5%) are *Liliopsida* and 35 (74.5%) are *Magnoliopsida*. Of the 7 hybrids one (14.3%) is a *Polypodiophyta* and six (85.7%) are *Magnoliophyta* of which two (33.3%) are *Liliopsida* and four (66.7%) are *Magnoliopsida*.

## WOODY VS. HERBACEOUS SPECIES

Of the 1096 species 148 (13.5%) are woody and 948 (86.5%) are herbaceous. Of the 148 woody species 82 (55.4%) are trees, 53 (35.8%) are shrubs and 13 (8.8%) are vines. All of the pteridophytes are herbaceous, all of the gymnosperms woody (4 species, all trees, which represent 2.7% of the 148 woody species) and in the angiosperms 144 are woody which represents 97.3% of the 148 woody species and 13.5% of the 1064 angiosperm species. Of the 144 woody angiosperm species 78 (54.2%) are trees, 53 (36.8%) are shrubs and 13 (9.0%) are vines. There are 920 herbaceous angiosperms which are 86.5% of the angiosperm species.

Of the 148 woody species 32 (21.6%) are alien and 116 (78.4%) are native whereas of the 948 herbaceous species 237 (25%) are alien and 711 (75%) are native. Three of the 4 (75%) gymnosperm species (which are all woody) are alien and one (3.6%) of the pteridophyte species (which are all herbaceous), *Marsilea* of the *Polypodiophyta*, is an alien. In the angiosperms 29 (20.1%) of the woody species are aliens and 115 (79.9%) are native and of the herbaceous species 236 (25.7%) are aliens and 684 (74.3%) are native.

The largest woody genera are *Quercus* (10 species); *Crataegus*, *Rubus*, *Salix* (8 species each); *Lonicera* (7 species) and *Acer*, *Carya*, *Prunus*, *Rosa* (5 species each). The largest herbaceous genera are the largest genera listed near the end of the taxonomic analysis section of this paper.

## DURATION

Of the 1096 species 261 (23.8%) are annuals, 40 (3.7%) are biennials and 795 (72.5%) are perennials. There are no annual or biennial pteridophytes or gymnosperms. Of the perennial species one (0.1%) is a *Lycopodiophyta*, three (0.4%) are *Equisetophyta*, 24 (3.0%) are *Polypodiophyta*, four (0.5%) are *Pinophyta* and 763 (96.0%) are *Magnoliophyta*. Of the 1064 angiosperm species 261 (24.5%) are annuals, 40 (3.8%) are biennials, and 763 (71.7%) are perennials.

Of the 261 annual species 128 (49%) are aliens, of the 40 biennial species 23 (57.5%) are aliens and of the 795 perennial species 118 (14.8%) are alien. There are no alien *Lycopodiophyta* or *Equisetophyta*, in the *Polypodiophyta* the only alien is one out of 24 (4.2%) perennial species and in the *Pinophyta* three out of four (75%) perennial species. In the angiosperms 128 of the 261 (49%) annual species are aliens, 23 of the 40 (57.5%) biennial species and 114 of the 763 (14.9%) perennial species.

## HABITAT

Of the 1096 species 61 (5.6%) are obligate aquatics and 1035 (94.4%) are terrestrial. There are no aquatic *Lycopodiophyta, Equisetophyta* or *Pinophyta*; one (1.6%) is a *Polypodiophyta (Marsilea)* and 60 (98.4%) are *Magnoliophyta*. Of the angiosperm species 60 (5.6%) are aquatic. Of the 61 aquatic species 4 (6.5%) are aliens and of the 1035 terrestrial species 265 (25.6%) are aliens. In the *Polypodiophyta* there is one aquatic species and it is an alien. In the angiosperms three (5%) of the 60 aquatic species are alien and 262 (26.1%) of the 1004 terrestrial species are aliens.

## NATIVE SPECIES

Of the 1096 species of spontaneous vascular plants in McDonough County, 827 (75.5%) are native species. These include one (0.1%) *Lycopodiophyta*, three (0.4%) *Equisetophyta*, 23 (2.8%) *Polypodiophyta*, one (0.1%) *Pinophyta* and 799 (96.6%) *Magnoliophyta*. Of the 799 native species of the *Magnoliophyta* 230 (28.8%) are *Liliopsida* and 569 (71.2%) are *Magnoliopsida*. The 827 native species in McDonough County represent 42.1% of the native species in Illinois.

As a primary result of habitat destruction, principally due to man's activities (i.e. agricultural practices, transportation corridors, housing and urban development), the numbers of native species and plants have been reduced and without preservation and/or mitigation efforts this trend will continue. An indicator of this trend is that native species become rare, threatened, endangered and finally extinct. The Illinois Natural History Survey (1986) indicates 0-5 endangered or threatened species for McDonough County. Bowles, et al. (1981) lists 5 such species one being threatened and 4 endangered:

*Panax quinquefolius*: threatened; although indicated to not be presently known to be extant there are at least three extant locations.

*Beckmannia syzigachne*: endangered; although indicated to be extant based on collections in 1974, this author has been unable to locate it at this location the past two years. Myers (1975) states that at this location (a railroad prairie) it is "probably a railroad migrant."

*Cypripedium reginae*: endangered; indicated to not being presently extant seems to be accurate since the last collection is recorded from 1881 per Sheviak (1974).

*Habenaria leucophaea*: endangered; indicated to not being presently extant seems to be accurate since the last collection is recorded from 1950 per Sheviak (1974).

*Thelypteris phegopteris*: endangered; indicated to not being presently extant seems accurate since no recent collections are known.

Recent collections in the County have resulted in the location of the following three species not in Bowles, et al. (1981) for McDonough County.

*Tradescantia bracteata*: endangered; two small colonies are extant but their location on private land intended for agriculture makes their future precarious. Bowles et al. (1981) states that no populations are presently known in Illinois.

*Hydrastis canadensis*: threatened; many plants are present in a preserve (Ferster Woods) owned by Western Illinois University.

(*Pinus resinosa*: endangered; a number of plants are present resulting from reproduction of plants planted in Argyle State Park about 1949. Although these are spontaneous plants they should be excluded from this list since they are not part of the original native vegetation.)

The seven threatened and endangered species represent 0.64% of the 1096 species recorded for McDonough County. Of these seven two (28.6% or 0.18% of all species) are threatened species and five (71.4% or 0.46% of all species) are endangered. All of the threatened species are *Magnoliophyta* whereas four (80%) of the endangered species are *Magnoliophyta* and one (20%) is a *Polypodiophyta*. Of the 827 native species in the County, these seven are 0.85%, the two threatened species being 0.24% and the five endangered ones being 0.6% of the native species. Of the 799 angiosperm native species, two (0.25%) are threatened and four (0.5%) are endangered. Of the Illinois threatened and endangered species, seven (1.93%) are reported from McDonough County. However of these seven species, only three species *Panax quinquefolius* (threatened), *Hydrastis canadensis* (threatened) and *Tradescantia bracteata* (endangered) are known to be extant; these three species represent 42.9% of the seven reported threatened and endangered species in McDonough County, 0.83% of the endangered and threatened species in the Illinois flora, and 0.4% of the native McDonough County species.

Although there are no Illinois Nature Preserves in McDonough County, there are four areas that are on the Illinois Natural Areas Inventory which are Area #144--Good Hope Marsh, Area #145--Lake

Argyle Barren, Area #171--Daniels Marsh and Area #172 (Argyle Lake) Sphagnum Seep (Illinois Department of Conservation 1978). Henry (1985) has listed and very briefly given some of the species (including some uncommon ones) in 23 representative areas exemplifying some of the best examples of remnants of the original vegetation of the County including the four areas on the Natural Areas Inventory.

Principally per Mohlenbrock and Ladd's (1978) distribution maps of the Illinois vascular plant species the following McDonough County species are generally disjunctive from the indicated Illinois geographical range: *Acer rubrum* (S 1/3, NE), *Beckmannia syzigachne* (NE), *Carex caroliniana* (S 1/3), *C. flaccosperma* (S 1/3), *C. gracillima* (N 1/3), *C. laevivaginata* (S 1/3, NE 1/3), *Commelina virginica* (S 1/4), *Galium boreale* (N 1/3), *Gerardia pedicularis* var. *ambigens* (NE 1/4), *Jussiaea decurrens* (S 1/3), *Lechea pulchella* (N and E 1/3), *Liquidambar styraciflua* (S 1/3), *Lonicera dioica* (N 1/3), *Lycopodium flabelliforme* (N,E,S edge), *Polypodium vulgare* var. *virginianum* (N 1/3, S 1/3), *Ranunculus micranthus* (S 1/2) and *Specularia biflora* (S 1/4).

Myers and Henry (1976) listed native taxa they considered extinct, nearly extinct, rare or endangered in McDonough and Hancock counties based upon later floristic data compared to floristic data derived from Kibbe (1952). Sixteen percent (130 species) of the native species were considered extinct or nearly extinct and another 68 species rare or endangered. It was emphasized by Myers and Henry (1976 p. 35) that further collections might change the status of some of the plants which the following data is intended to do. The following list of species are those from Myers and Henry's (1976) list that at some time have been recorded for McDonough County. These species are listed in the same order as in Myers and Henry (1976) and are annotated with Mohlenbrock's (1975) synonym (if there is one) and in parenthesis the last date of collection (and comments if needed) which for a number of these species indicate a change in the status of their occurrence to uncommon.

*Athyrium angustum* = *A. felix-femina* var. *rubellum* (1983), *Dryopteris marginalis* (1984), *Pteridium latiusculum* = *P. aquilinum* var. *latiusculum* (1984; population decreasing), *Dianthera americana* = *Justicia americana* (1985), *Callitriche heterophylla* (not present in 1969 location in 1984 due to stream channelization), *Campanula aparinoides* (1983), *Silene nivea* (no new collections since 1968), *Stellaria longifolia* (1969), *Aster anomalus* (1984), *Aster sericeus* (1981), *Cirsium hillii* = *C. pumilum* (1986), *Dyssodia papposa* (1984) *Helenium nudiflorum* = *H. flexuosum* (exact collection date unknown but presumed to be between 1960 and 1978), *Verbesina helianthoides* (1983), *Convolvulus spithamaeus* = *Calystegia spithamaea* (1986), *Cuscuta glomerata* (1979; rare), *Arabis virginica* = *Sibara virginica* (1982), *Acalypha gracilens* (1979), *Euphorbia obtusata* (1984), *Gentiana flavida* = *G. alba* (1982), *Carya laciniosa* (1969), *Agastache scrophulariaefolia* (1979; rare), *Teucrium occidentale* = *T. canadense* var. *occidentale* (1983), *Desmanthus illinoensis* (1979), *Lobelia cardinalis* (exact collection date unknown but presumed to be between 1954 and 1978), *Ludwigia palustris* = *L. palustris* var. *americana* (1983), *Caulophyllum thalictroides* (1983), *Phlox glaberrima* = *P. glaberrima* ssp. *interior* (1979), *Polygonum hydropiperoides* (1983), *Polygonum tenue* (no new collections since 1948), *Lysimachia quadriflora* (1979; rare), *Anemone cylindrica* (1984), *Hydrastis canadensis* (1983), *Ranunculus fascicularis* (1984), *Agrimonia rostellata* (exact collection date unknown but presumed to be between 1954 and 1978), *Crataegus calpodendron* (1983), *Crataegus punctata* (1967), *Gillenia stipulata* (1986), *Salix rigida* (1983), *Aureolaria pedicularia* = *Gerardia pedicularia* var. *ambigens* (exact collection date unknown but presumed to be between 1954 and 1978), *Chelone glabra* (1983), *Gerardia purpurea* (no new collections since 1950), *Gratiola neglecta* (1983), *Pedicularis lanceolata* (1983), *Verbena canadensis* (1983), *Vitis aestivalis* (1979; rare), *Tradescantia virginica* = *T. virginiana* (1983), *Carex albolutescens* (1979), *Carex artitecta* (no new collections since 1969), *Carex crinita* (1984), *Carex cruscorvi* (1984), *Carex granularis* (1969), *Carex hirtifolia* (1983), *Carex jamesii* (1983), *Carex lacustris* (1983), *Carex muskingumensis* (1984), *Carex oligocarpa* (1979; rare), *Carex scoparia* (1984), *Carex trichocarpa* (1984), *Carex vesicaria* (no new collections since 1950), *Cyperus rivularis* (1983), *Eleocharis compressa* = *E. elliptica* var. *compressa* (1979), *Scleria triglomerata* (1984), *Agrostis perennans* (1984), *Brachyelytrum erectum* (1983), *Diarrhena americana* = *D. americana* var. *obovata* (no new collections since 1974), *Koeleria cristata* = *K. macrantha* (1979; rare), *Melica nitens* (1979), *Muhlenbergia racemosa* (1979), *Muhlenbergia sylvatica* (1979; rare), *Panicum leibergii* (1979; rare), *Panicum praecocius* (exact collection date unknown but presumed to be between 1954 and 1978), *Paspalum ciliatifolium* (1979; rare), *Phragmites communis* = *P. australis* (1984), *Poa palustris* (1979; rare), *Sporobolus vaginiflorus* (1979), *Stipa spartea* (1984), *Tripsacum dactyloides* (1984), *Juncus acuminatus* (1979; rare), *Allium tricoccum* (1983 var. *burdickii*), *Cypripedium reginae* (1881; perhaps extinct), *Habenaria leucophaea* (no new collections since 1950; perhaps extinct), *Spiranthes cernua* (1950; Sheviak (1974) as *S. magnicamporum*; Sheviak annotation label as *S. cernua* X *S. magnicamporum*-"low prairie race 3n"), *Spiranthes gracilis* = *S. lacera* (1983), and *Potamogeton diversifolius* (no new collections since 1951).

Myers (1972 p. 58) listed 19 species considered rare in Illinois that were reported for McDonough County. Four others similarly annotated (R) in his catalog are #56, *Dryopteris phegtopteris* (= *Thelypteris*); #1387, *Galium tinctorium*; #1634, *Echinodorus rostratus* (= *E. berteroi* var. *lanceolatus*); and #1805, *Cyperus flavescens*. Some of these 23 species have been referred to and commented on in other parts of this section of this paper. Collection data up to the present indicate that all of these species are uncommon and as noted before at least *Habenaria leucophaea* and *Dryopteris (= Thelypteris) phegopteris* may be extinct. Myers (1972) catalog did not include any annotated McDonough County species as extinct (= X).

A closing comment on two species that are of interest is that *Lycopodium flabelliforme* first collected in 1976 (Henry and Scott 1978) has not be found since 1984. Perhaps it died due to a severe summer drought followed by severe winter cold in 1983. The thin soil where it was growing would dry out quickly. *Heracleum maximum* is uncommon being known at one location about two miles northeast of Colchester where there is a nice stand of it in the Lamoine River floodplain.

## ALIEN SPECIES

Myers and Henry (1979) discussed the alien flora of an area consisting of both McDonough and Hancock counties; this paper concerns the current status of alien species in McDonough County only.

Of the 1096 spontaneous vascular plant species, 269 (24.5%) are alien and 827 (75.5%) native. These 269 alien species represent 35.5% of the alien species in the Illinois vascular flora. Of these 269 alien species there are none in the *Lycopodiophyta* or *Equisetophyta*, one (0.4%) in the *Polypodiophyta*, three (1.1%) in the *Pinophyta* and 265 (98.5%) in the *Magnoliophyta* of which 209 (78.9%) are *Magnoliopsida* and 56 (21.1%) *Liliopsida*. Fifty-six (20.8%) of the County alien species are *Liliopsida* and 209 (77.7%) are *Magnoliopsida*. Of the 1096 species one (0.1%) in an alien *Polypodiophyta*, three (0.3%) are alien *Pinophyta* and 265 (24.2%) alien *Magnoliophyta* (56 (5.1%) *Liliopsida* and 209 (19.1%) *Magnoliopsida*). One (4.2%) of the *Polypodiophyta*, three (75%) of the *Pinophyta* and 265 (24.9%) of the *Magnoliophyta* species are aliens. Of the dicot species 209 (26.9%) are alien whereas 56 (19.6%) of the monocot species are aliens. The 56 monocot alien species represent 5.3% of the 1064 angiosperm species whereas the 209 dicot alien species represent 19.6%.

At least 90% of the land area of McDonough County is occupied by alien species, principally as crops and pasture, indicating their economic importance. Many aliens are well adapted to and occur County-wide in disturbed soil areas (disturbophytes) where they may or may not be considered weeds depending on their perception and use by varying people. Of the 269 alien species four (1.5%) are obligate aquatic and 265 (98.5%) are terrestrial. Out of the four aquatic alien species one (25%) is a *Polypodiophyta* and three

(75%) are *Magnoliophyta*. In the divisions that have alien species 100% of the *Polypodiophyta* alien species are aquatic, 100% of the *Pinophyta* are terrestrial and three (1.1%) of the *Magnoliophyta* alien species are aquatic and (98.9%) are terrestrial.

Of the 269 alien species 221 (82.2%) had their origin from the old world, 17 (6.3%) from the tropics, and 31 (11.5%) from other parts of the United States (three (9.7%) from east and north U.S., two (6.4%) from southern U.S. and 26 (83.9%) from western U.S.). The one *Polypodiophyta* alien species came from the old world, the three *Pinophyta* from the United States (two (67%) from east/northern U.S., one (33%) from southern U.S.) and of the 265 *Magnoliophyta* alien species 220 (83%) are of old world origin, 17 (6.4%) from the tropics and 28 (10.6%) from other parts of the United States (one (3.6%) from east/northern U.S., one (3.6%) from southern U.S., 26 (92.8%) from western U.S.).

Of the 269 alien species 159 (59.1%) are or once were cultivated. Out of these 159 species one (0.6%) is a *Polypodiophyta*, three (1.9%) are *Pinophyta* and 155 (97.5%) *Magnoliophyta*. In the divisions that have alien species one (100%) of the *Polypodiophyta*, three (100%) of the *Pinophyta* and 155 (58.5%) of the *Magnoliophyta* alien species are or once were cultivated.

Of the 269 alien species 128 (47.6%) are annuals, 23 (8.5%) are biennials and 118 (43.9%) are perennials. All (100%) of the annuals and biennials are *Magnoliophyta* and of the perennials one (0.9%) is a *Polypodiophyta*, three (2.5%) are *Pinophyta* and 114 (96.6%) are *Magnoliophyta*. In the divisions that have alien species one (100%) of the *Polypodiophyta*, three (100%) of the *Pinophyta* and 114 (43%) of the *Magnoliophyta* alien species are perennials. The 128 annuals and 23 biennials constitute respectively 48.3% and 8.7% of the *Magnoliophyta* alien species.

Of the 269 alien species 32 (11.9%) are woody. Out of these 32 species three (9.4%) are *Pinophyta* and 29 (90.6%) are *Magnoliophyta*. In the divisions that have alien species three (100%) of the *Pinophyta* and 29 (10.9%) of the *Magnoliophyta* alien species are woody.

Of the 269 alien species 123 (45.7%) are weeds. Two (1.6%) of these weed species are *Pinophyta* and 121 (98.4%) of them are *Magnoliophyta*. In divisions that have alien species there are no weeds in the *Polypodiophyta*, two (67%) of the three *Pinophyta* alien species are weeds and in the *Magnoliophyta* 121 (45.7%) of the 265 alien species are weeds. For further information see Henry (1983a) for a list of the weeds of the spontaneous McDonough County vascular plant flora in which the alien weed species were annotated. In a later paper Henry (1983b) analyzed this weed flora including the alien species.

Comparing the data from Myers' 1948 checklist of McDonough County vascular plants (which is reproduced as Myers (1983)) with his annotated 1972 list (Myers 1972) and with this analysis it is clear that the alien species component of this flora is increasing. At the time of settlement it is presumed that the flora was 100% native species and 0% aliens. Myers listed 522 species for 1948 but with modifying it due to misidentifications, synon yms, omitting infraspecific taxa and hybrids, specimens not verified as being in the County or out of range, the adjusted number is 502 species. Of these 502 species 90 (17.9%) are aliens and 412 (82.1%) native. By 1972 out of 944 species 192 (20.3%) were alien (Myers (1972 p. 59) stated 17.4% out of 919 species but this figure excluded the 22 (25 I counted as excluded as indicated by being unnumbered) unnaturalized alien species) and 752 (79.7%) were native and in 1986 (this paper) out of 1096 species 269 (24.5%) were aliens and 827 (75.5%) were native. Regarding the percent increase in the proportion of these alien species in this flora, it is still true that the alien flora is changing more rapidly than the native flora (as noted for McDonough and Hancock counties (and Europe) in 1979 (Myers and Henry 1979)) since the percent the alien species have increased from 1948-1986 is 6.6% resulting in an equivalent decrease in the percent of the total species today that are native species of which some are becoming rare, threatened, endangered and extinct as commented on earlier in this paper. Over the 24 years between 1948-1972 the addition of 102 alien species represented a per year introduction of 4.25 per year; between 1972-1986 (77 additional species during 14 years) were 5.5 per year and between 1948-1986 (179 species over 38 years) the yearly introduction of alien species averaged 4.7 per year.

It would be useful to have exact data on the time and rate of the naturalization of alien species but this is made difficult by lack of a uniformly agreed upon definition of what constitutes naturalization and how to ascertain it (particularly initially) with certainty in the field. Therefore such decision of naturalization are necessarily somewhat arbitrary and subject to personal interpretations and observations of field, herbarium and published data. Certainly the naturalization process occurs over varying time periods for varying species as influenced by the environmental conditions surrounding the various plants of the species.

Myers in his 1948 list made no annotations regarding naturalized aliens but in his 1972 annotated list indicated that over 160 (my adjusted count is 159) were naturalized (by giving the species numbers in his catalog) which would be 83.3% of the 192 recorded alien species. These 192 species, as previously stated, represent 20.3% of the 944 County spontaneous species while the 160 naturalized species represent 16.9% of the County spontaneous species. Using Myers naturalization criteria (Myers 1972 p. 9), comments on some of the species by Reese (1979) and my observations/interpretations it is estimated that probably 60 alien species (including eight of the 22 (my count is 25) species that Myers (1972) considered unnaturalized (i.e. were not numbered)) have become naturalized between 1972 and 1986. Adding these 60 to Myers' 160 makes 220 (81.8%) probable naturalized alien species out of the present 269 alien species in the flora. These 269 species, as previously noted, represent 24.5% of the County spontaneous species while the 220 naturalized species represent 20.1% of the County spontaneous species. For comparison with the spontaneous vascular flora of Illinois, Myers (1972) data show that in 1972 all aliens composed 25.3% and naturalized aliens 13.6% of the Illinois species and also that 53.6% of the alien species were naturalized. By 1986 Pruka's (1986 p. 3) 811 naturalized non-native species represent 28.4% of the 2853 total species in Mohlenbrock (1986) and 26.2% of the 3100 species mentioned by the Illinois Natural History Survey (1986). Since the Illinois Natural History Survey (1986) reports that approximately 28% of the state's flora is not native then comparison with Pruka's data would indicate that 93 to 100% of the state's aliens are now naturalized. The indication that about 43% of the Illinois alien species became naturalized in the last 14 years (54% by 1972 and averaging 97% by 1986) seems to be an astonishing recent rate of naturalization considering the first alien species were apparently collected in Illinois by Michaux in 1795 (Henry and Scott 1980). The 220 naturalized alien species in McDonough County would represent 27.1% of the 811 (Pruka 1986 p. 3) naturalized aliens in Illinois. It is tempting to indicate the rate of naturalization in McDonough County by stating that of the 77 species collected during the 14 years from 1972-1986 fifty-two (67.5%) became naturalized, in addition to the eight non-naturalized species that Myers listed in 1972 as unnaturalized, indicating 4.3 species naturalized per year (60 divided by 14); however this could be misleading since some (or all) of the 52 species could have already been naturalized when (before) collected meaning the exact time of naturalization could not be precisely determined. Of course, the naturalization status of any alien species is subject to change with the availability of additional data. Myers (1972 pp. 6-9) discusses the role of aliens in floras.

Some of the most recently rapidly spreading aliens in the County are *Dipsacus laciniatus, Coronilla varia, Elaeagnus umbellata, Lonicera* spp., *Rosa multiflora, Sonchus arvensis* var. *glabrescens, Maclura pomifera, Morus alba, Populus alba, Ulmus pumila, Berberis thunbergii* and *Ligustrum vulgare*. Perhaps soon to be more troublesome are *Euomymus alatus, Lythrum salicaria, Naias minor, Potamogeton crispus, Cirsium arvense* and *Chrysanthemum leucanthemum*. Henry (1983c) judged *Marsilea quadrifolia* to not be a serious weed in the Lamoine River system under present conditions; recent observations have shown that it is decreasing since in 1986 there was none immediately below the Spring Lake dam or in the adjacent part of Spring Creek. Perhaps the noticeably higher water level in the creek caused by a beaver dam about 0.3 mile below the dam is responsible for this change which may or may not be only temporary. The original presence of *Marsilea* in the northern end of the lake has been practically totally reduced (perhaps due to the higher water level caused by the new dam) and now the only major population is at the south end of the lake east of the dam. *Taxodium distichum, Pinus resinosa* and *P. strobus* planted in 1948-1949 have apparently just in the last several years started to reproduce (Henry and Scott 1986).

As yet, no genetically (bio-) engineered vascular plant species have been introduced directly (i.e. purposefully) or indirectly (accidentally) into the County flora. Such plants (species) since not of a native genotype are, of course, aliens and should be treated as such. Like any other aliens they could escape, become spontaneous and finally naturalized thus further threatening the well being and distribution of the native flora and ecosystem.

The potential for alien species to become established and naturalized is not static but can vary with time and environmental conditions. Regardless of a species being judged as having a low, medium or high potential for spreading or naturalization at a given time, at least some of any potential is realized once they do escape. The ultimate potential in most if not all cases is unknown. Therefore the escape and naturalization potential of alien species is unpredictable, variable and irregular. Until we are able to predict with certainty the full consequences (both direct and indirect) of an alien's (including genetically engineered plant species) release into an ecosystem (particularly on the disruption and displacement of the native flora) perhaps native rather than alien species should be recommended for use. If aliens are not used then there can be no problems, mistakes, miscalculations or misgivings concerning their use or take-over of native ecological processes and functions. (Native plants, however, can become problems also as evidenced by the fact that 60% of the McDonough County weed species are native species.) I often fear for the future integrity of the native flora as the increase of alien species continues.

## WEEDS

Of the 1096 species, 310 (28.3%) are weeds. Of these weed species none are *Lycopodiophyta*, three (1.0%) are *Equisetophyta*, one (0.3%) is a *Polypodiophyta*, three (1.0%) *Pinophyta* and 303 (97.7%) *Magnoliophyta*. All 3 species (100%) of the *Equisetophyta* are weeds as is one (4.2%) of the 24 species of *Polypodiophyta*, three (75%) out of 4 species of *Pinophyta* and 303 (28.5%) of the 1064 *Magnoliophyta* species. Of the 310 weed species 123 (39.7%) are alien. None of the *Equisetophyta* or *Polypodiophyta* weed species are aliens. Two (67%) out of the three *Pinophyta* weed species are aliens as are 12 (39.9%) of the 303 angiosperm weed species. Henry (1983a) presented a list of the weeds (annotated for aliens) of the spontaneous McDonough County vascular plant flora and in a later paper (Henry 1983b) analyzed this weed flora; this later paper should be consulted for a more detailed analysis of this weed flora. As more marginal and forested areas become subjected to cultivation (often intensive) all weeds, particularly woody species, would be expected to increase as data in Henry (1983b) indicate.

## POISONOUS SPECIES

1. To Humans--Of the 1096 species 197 (18%) are poisonous to humans. None of these 197 species are *Lycopodiophyta, Equisetophyta* or *Polypodiophyta*; one (0.5%) is a *Pinophyta* and 196 (99.5%) are *Magnoliophyta*. One (25%) of the four *Pinophyta* species are poisonous to humans as are 196 (18.4%) of the 1064 *Magnoliophyta* species. Plant species poisonous to humans were determined from Hardin and Arena (1974) and Lampe and McCann (1985).

2. To Livestock--Of the 1096 species 60 (5.5%) are poisonous to livestock. None of these 60 species are *Lycopodiophyta* or *Pinophyta*; three (5.0%) are *Equisetophyta*, one (1.7%) *Polypodiophyta* and 56 (93.3%) are *Magnoliophyta*. Three (100%) of the *Equisetophyta*, one (4.2%) of the 24 species of *Polypopodiophyta* and 56 (5.3%) of the 1064 *Magnoliophyta* species are poisonous to livestock. Plant species poisonous to livestock were determined from Evers and Link (1972).

## DRUG SPECIES

Of the 1096 species 178 (16.2%) were on Tehon's (1951) list of Illinois drug plants the source of the plant drug species used in this analysis. None of the 178 species are *Lycopodiophyta*, one (0.6%) is an *Equisetophyta*, two (1.1%) are *Polypodiophyta*, two (1.1%) are *Pinophyta* and 173 (97.2%) are *Magnoliophyta*. One (33.3%) of the three *Equisetophyta* species are drug plants as are two (8.3%) of the 24 *Polypodiophyta* species, two (50%) of the four *Pinophyta* and 173 (16.3%) of the 1064 *Magnoliophyta* species.

## SUMMARY

1. Dr. R. M. Myers, for whom the Western Illinois University Herbarium (MWI) is named, initiated floristic studies of McDonough County vascular plants in 1945 and continued through

1977.

2. Presently there are 1096 species of plants in the County's spontaneous vascular flora which represents about 40% of the species in the Illinois spontaneous vascular flora. In addition, there are 48 infraspecific taxa and seven hybrids.

   Twenty-four percent of the species are alien and 76% native. Of the native species two are threatened and five endangered in Illinois and of these seven species only three are known to be extant. There are four areas on the Illinois Natural Areas Inventory and no Illinois Nature Preserves in the County.

3. The 1096 species occur in five divisions most (97.1%) being *Magnoliophyta* of which 73% are dicotyledons. Pteridophytes compose 2.6% and gymnosperms 0.3% of the species. These species occur in 114 families (*Compositae* being the largest) and 477 genera (*Carex* the largest).

4. Woody species compose 13.5% and herbaceous species 86.5% of the species. Fifty-five percent of the woody species are trees, 36% shrubs and 9% vines. Thirty-two percent of the woody species and 25% of the herbaceous ones are alien. The largest woody genus is *Quercus* and the largest herbaceous is *Carex*.

5. Of the 1096 species, 24% are annuals, 4% biennials and 72% perennials. Forty-nine percent of the annuals, 58% of the biennials and 15% of the perennials are aliens.

6. About 6% of the species are obligate aquatics and 94% terrestrial. Nearly 7% of the aquatic species and 26% of the terrestrial ones are alien.

7. The 269 alien species represent 36% of the alien species in Illinois and occupy at least 90% of the County's land area primarily as crops and pasture. Most of the alien species had their origin from the old world (82%), 6% from the tropics and 12% from other parts of the United States (mostly from western U.S.). Fifty-nine percent of the alien species have been cultivated. The alien species are about 2% obligate aquatics, 48% annuals, 8% biennials, 44% perennials, 12% woody and 46% weeds. Since 1948 the introduction of alien species averages 4.7 per year. It is estimated that probably about 82% of the alien species are naturalized. As yet, no alien species of genetically-engineered origin have been introduced.

8. Of the 1096 species 28% are weeds of which about 40% of the weed species are alien.

9. Eighteen percent of the 1096 species are poisonous to humans, about 6% poisonous to livestock and 16% are on the list of drug plants of Illinois.

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# GRASSLAND COMMUNITIES AND SOILS ON A HIGH ELEVATION GRASSLAND OF CENTRAL PERU

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## ABSTRACT

There is little information published on the vegetation and soils of the high elevation (4100-4700 m) grasslands of the Central Andes known as the puna. The objective of this study was to describe major plant community types and their associated soils on a 17,000 ha study area in one zone of the puna (moist puna belt).

Ten community types were recognized on the basis of dominant species and topographic position. Major topographic positions were floodplain, glaciated mountain valleys, mountain slopes, and high elevation (> 4600 m) exposed ridges. The vegetation was dominated by grasses (Calamagrostis, Festuca, Poa, and Stipa species) and forbs. Trees were rare and shrubs uncommon. Soils were generally high in organic matter at the surface and had dark surface horizons (mollic or umbric epipedons). Depending on the moisture regime, most soils were classified either as Histosols, Mollisols, or Alfisols. Argillic horizons were prevalent in the soils. Common soil parent materials were glacial till, andesite, limestone, siltstone, and river alluvium. Vegetation was arranged on a moisture gradient controlled by topographic position.

## INTRODUCTION

The Andes are part of a major mountain network which extends from Alaska to Tiera del Fuego. High elevation grasslands of the Andes are unique ecosystems which constitute important grazing lands for the Andean countries. In Peru and Bolivia these grasslands are known as the puna. The puna extends over several hundred thousand square kilometers from latitudes of 8°S to 27°S and is associated with a series of high plateaus and intermontane basins beginning with the Pampa de Junin in central Peru. The altiplano, a vast tableland above 3600 m in southern Peru and Bolivia is the most familiar of these plateaus. Elevation of the puna varies from about 3900 to 4800 m. Troll (1968) divided the puna into three provinces: the moist puna, the dry puna, and the desert puna. The moist puna begins in northern Peru at a latitude of about 8°S where it blends in with another high elevation grassland typical of the northern Andes, the paramo, and lies adjacent to the eastern cordillera of the Andes as far south as Bolivia. The dry puna begins in southern Peru and extends into the altiplano of Bolivia, while the desert puna occurs in southern Bolivia and Chile adjacent to the Atacoma Desert.

A single wet season of variable duration occurs sometime between October and April, and supplies an average of 150 mm of precipitation to the desert puna and 1200 mm to the moist puna belt annually (Molina and Little, 1981). Annual rainfall decreases to the south and west. There is also a steady increase in concentration of rainfall into November to April towards the south (Johnson, 1976). Mean annual temperatures are less than 10°C and nocturnal frosts are common, especially during the dry season (Troll, 1968). Frost occurs nightly at 4100 m. Diurnal fluctuations can be as much as 20°C in the moist puna and even greater in the desert puna. Seasonal temperature differences become greater to the south. Paramo grasslands are distinguished from the puna by the lack of seasonal differences in precipitation and temperature in the paramo, and also by a higher relative humidity.

Puna vegetation has evolved under harsh environmental conditions, including a lengthy dry season, frequent frosts, low temperatures, pronounced diurnal temperature variation, high solar radiation, and low oxygen (Thomas and Winterholder, 1976). Plants have adapted to these environmental stresses in various ways (Cabrera, 1968). Perennial forbs typically have well-developed root systems many times larger than the above ground portions of plants. Leaves are often reduced, felty and lightly pubescent, or have a thick cuticle layer. Succulents such as Opuntia are also common. Many grasses have rolled leaves. Stems are often reduced or are below ground with only the leaves protruding above the surface.

The moist and dry puna are closely related florestically. Evergreen shrubs such as Lepidophyllum quadrangulare, and Fabina densa are more common in the dry puna (Molina and Little, 1981). In the desert puna shrubs predominate and vegetation cover is lower. Vegetation changes as a result of human impact are the elimination of Polylepis forests in much of the puna and proliferation of Opuntia flocosa.

Little information is available about soils of the puna. Early investigators grouped the high Andean soils into broad associations. Drosdoff et al. (1960) described three major soil groups as: (1) dark brown stoney loams to silt loams, (2) deep well-drained, dark brown to black loams and silt loams, and (3) hydromorphic medium to fine textured soils. Beek and Bramao (1968) included the soils of the central Andes as Paramo soils, and described them as being derived from heavy clays of glacial origin.

Information on vegetation and soils in the Central Andes is fragmentary (Glaser and Celecia, 1981). The objective of this study was to describe vegetation and associated soils in one area of the moist puna belt.

## STUDY AREA

The 17,700 ha study area was located on an agricultural cooperative, Sociadad Agricola de Interes Social (S.A.I.S.) Pachacutec, headquartered at Corpacancha in the Department of Junin, Peru (11°25'S, 76°15'W). Corpacancha is about 42 km ENE of La Oroya, Peru. Rangeland of the cooperative has historically received better management than most of the puna, much of which is severely overgrazed. Elevation ranged from 4,150 m to 4,700 m. Topography included both gently rolling glaciated terrain and rugged mountainous terrain.

Corpacancha is in the moist puna belt as classified by Troll (1968). Climatic data from Corpacancha is limited. Vallejos and Quillatupa (1975) reported that in Corpacancha, the average yearly precipitation from 1965 to 1972 was 865 mm, and varied from 1,033 mm to 672 mm. Snow makes up a small percentage of this precipitation and does not accumulate below the permanent snow line (Troll 1968) which begins at about 5,150 m (Thomas and Winterhalder 1976).

## METHODS

Our objective was to describe major plant community types in a 17,000 ha study area. The concept of dominance-types (e.g., Whittaker 1962, 1975; Beard 1975) provided the basis for distinguishing community-types through a combination of environment (indicated by topographic position) and dominant vegetation physiognomy and composition. Similar concepts have been widely applied in the study of tropical vegetation (Shimwell 1971; Beard 1975). Field methods were based on this concept. Potential community-types were tentatively delineated using aerial photographs and verified by extensive ground reconnaissance. Although this approach lacks complete objectivity, it is suitable for large-scale reconnaissance surveys (Mueller-Dombois and Ellenberg 1974) when a vegetation description and workable classification of a given area are required (Whittaker 1975).

Within each community-type 5 to 10 stands were selected on the basis of uniformity of habitat and lack of disturbance (inaccessibility limited sampling of the high elevation ridges to only one stand). Each stand was sampled with 5 to 10 randomly located 25-m line transects placed perpendicular to the slope. A total of 188 transects were established. Species composition and basal cover were estimated with point samples (Goddall 1952) taken at 0.5 m intervals along each transect. Cover categories were specific plant species, bare ground, litter, moss or rock. If a plant species was not encountered at a point, the nearest plant to this point was recorded. Therefore, species identity was recorded at 50 locations on each transect. Species composition was estimated from these data. Basal cover was estimated from point samples on each transect. Although this method overestimates cover, relative differences within a given study are useful in distinguishing species importance in different community types.

Twenty-eight soil pedons were described from hand-dug pits. Samples were collected from selected pedons. In some cases, sampling below 70 cm was by soil auger due to a high water table. Sites for soil description were selected to be representative of surrounding topographic position and parent material. Soils were classified according to the U.S. system (USDA 1975).

## RESULTS AND DISCUSSION

Ten community types were recognized, and named on the basis of topographic position (Table 1). A brief description of the soils and vegetation of each community type follows.

### Flood Plain

The Rio Corpacancha dissected the study site. Its flood plain was entrenched and varied in width from 100 m to 500 m. Elevation was around 4150 m. On the flood plain the water table was at or near the surface throughout the year. Soils developed on alluvial parent material. Organic horizons up to 36 cm thick were observed. The mineral soil was silty and gleyed reflecting poor drainage. Several buried organic horizons were also noted. These soils were classified as Typic Cryaquents.

Vegetation of the flood plain was dominated by grasses and sedges; forbs were uncommon (Table 2). _Poa gilgiana_, _Festuca dolichophylla_, and _Calamagrostis brevifolia_, were all important components of the flood plain flora. _P. gilgiana_ grew evenly interspersed throughout most of the site. Distribution of _Calamagrostis ligulata_ was quite variable, ranging from 2 to 32% of the species composition.

### Glaciated Valley Community Types

All of the mountain valleys in the study area have been reworked by glaciers (Clapperton 1972). In these glaciated valleys four distinct community types were recognized. Soil moisture differences due to changes in topographic position have created a vegetation mosaic in these glaciated valleys.

#### _Glaciated Bottomland_

Glaciated bottomlands occurred in depressed basins in the valleys. Slope seepage creates saturated soils on these sites; soils remain saturated throughout the rainy season and for several months thereafter. Soils on these sites had thick organic horizons

Table 1. Site characteristics for 9 plant communities on the Corpacancha study area, Peru.

| Character | Flood Plain | Xeric Glaciated Upland | Mesic Glaciated Upland | Bottom-land | Mountain Gravelly Loam | Mountain Andesite | Mountain Siltstone | Mountain Deep Loam | High Elevation Ridgetop |
|---|---|---|---|---|---|---|---|---|---|
| Slope (%) | 0 | 8.8 | 6.3 | 6.7 | 41.0 | 36.7 | 59.0 | 43.0 | 7.4 |
| Litter | 45.7 | 58.5 | 54.8 | 45.0 | 41.4 | 46.6 | 32.0 | 51.0 | 62.0 |
| Bareground | 11.0 | 7.6 | 10.4 | 4.3 | 30.9 | 21.4 | 44.8 | 28.0 | 13.8 |
| Rock | 0.0 | 0.3 | 0.0 | 0.0 | 3.6 | 7.0 | 0.8 | 2.2 | 0.0 |
| Moss | 0.0 | 3.2 | 3.4 | 0.6 | 3.9 | 2.6 | 0.8 | 1.5 | 0.0 |
| Basal cover | 43.7 | 30.4 | 30.4 | 50.0 | 20.2 | 22.4 | 20.8 | 17.4 | 23.5 |
| % Grass 1/ | 95.8 | 91.5 | 98.0 | 98.4 | 71.6 | 68.0 | 70.4 | 81.0 | 47.2 |
| % Forb 1/ | 4.2 | 9.5 | 2.0 | 1.6 | 28.4 | 32.0 | 29.6 | 19.0 | 52.8 |
| Species richness 1/ | 9.3 | 10.9 | 9.1 | 7.9 | 13.1 | 14.9 | 14.6 | 12.0 | 13.9 |

[1]Values were based on percent of the relative species composition.

[2]Values were calculated using the average number of plant species encountered along each transect (Whittaker 1970).

Table 2. Plant composition ( > 1%) of the Flood Plain community on the Corpacancha study area.[1/]

| Species | Relative Species Composition (%) | | Basal Cover (1) | |
|---|---|---|---|---|
| | Avg | Range | Avg | Range |
| *Poa gilgiana* | 19.3 | 12-34 | 7.5 | 4-12 |
| *Festuca dolichophylla* | 16.0 | 2-34 | 11.3 | 2-18 |
| *Calamagrostis brevifolia* | 13.8 | 4-20 | 5.8 | 2-14 |
| *Calamagrostis ligularis* | 12.8 | 2-32 | 9.0 | 2-22 |
| *Cyperaceae* sp | 12.3 | 2-22 | 6.0 | 0-10 |
| *Poa spicigera* | 9.8 | 4-22 | 2.3 | 0-8 |
| *Calamagrostis rigescens* | 4.5 | 0-10 | 1.8 | 0-6 |
| *Plantago tubulosa* | 4.0 | 0-8 | 0.5 | 0-4 |
| *Carex* sp | 3.5 | 0-10 | 1.0 | 0-4 |
| *Poa horridula* | 1.3 | 0-4 | 0.3 | 0-2 |

[1/] Data compiled from 8 transects; 17 species were encountered.

(> 40 cm). Mineral horizons were loams and gravelly clay loams. Parent material was glacial till. Soils were classified as Typic Cryohemists.

Vegetation in this community type was similar to the flood plain vegetation (Table 3). Grasses dominated and forbs were uncommon. On this site however, Calmagrostis brevifolia was clearly dominant, Festuca dolichophylla was also important; and Calamagrostis ligularis was absent. Basal cover was also very high on this site (Table 1). Also, species richness was lower than on the flood plain.

Mesic Glaciated Upland

The mesic glaciated upland community type usually occurred on lower slopes of the glaciated valleys. Soils of this community type had mollic epipedons with a relatively high amount of organic carbon. Argillic horizons were observed in all the pedons examined. Often a thin surface organic horizon (< 5 cm) was also present. Soil textures were loam and clay loam and became more gravelly with depth. Soils were classified as Argic Pachic Cryoborolls.

Vegetation was dominated by grasses (Table 4). Sedges were also common. Forbs were not abundant. Festuca dolichophylla was a characteristic spp., followed by Poa gilgiana. Both of these species were present on the flood plain and glaciated bottomland as was Poa spicigera. Calamagrostis brevifolia was less important on this site than on the flood plains and glaciated bottomlands.

Xeric Glaciated Upland

This extensive community type occurred on the drier valley slopes. Soils on the xeric glaciated uplands were very similar to those on mesic glaciated uplands. A dark surface horizon was prevalent; however, the epipedon was umbric rather than mollic because of low base saturation percentage. The bases have probably been leached out on the xeric sites and resupplied to the mesic sites by slope seepage. Argillic horizons were also present. Textures were similar to those of mesic glaciated uplands. Soils were classified as Mollic Cryoboralfs.

Vegetation in this community type was similar to the mesic upland type (Table 5), and the two community types blended into one another. Festuca dolichophylla was the most common species in this type, but it provided less basal cover than the more mesic sites. Carex ecuadorica, Festuca rigescens, and Calamagrostis vicunarum were more common, and Poa gilgiana and P. spicigera were less common in the xeric uplands. Forbs are more abundant in this community type than in other communities in the glaciated valleys (Table 1).

Table 3. Plant composition ( > 1%) of the Glaciated Bottomland community on the Corpacancha study area.[1/]

| Species | Relative Species Composition (%) | | Basal Cover (%) | |
|---|---|---|---|---|
| | Avg | Range | Avg | Range |
| Calamagrostis brevifolia | 50.0 | 26-62 | 29.3 | 10-44 |
| Festuca dolichophylla | 23.0 | 10-36 | 13.0 | 0-24 |
| Poa gilgiana | 7.0 | 0-22 | 1.4 | 0-8 |
| Carex ecuadorica | 6.7 | 0-18 | 1.3 | 0-4 |
| Cyperaceae sp | 3.3 | 0-20 | 1.6 | 0-10 |
| Carex sp | 3.2 | 0-14 | 0.3 | 0-2 |
| Poa spicigera | 3.0 | 0-12 | 0.4 | 0-10 |
| Plantago tubulosa | 1.0 | 0-8 | 0.6 | 0-8 |

[1/] Data compiled from 14 transects; 22 species were encountered.

Table 4. Plant composition ( > 1%) of the Mesic Glaciated Upland community on the Corpacancha study area.[1/]

| Species | Relative Species Composition (%) | | Basal Cover (%) | |
|---|---|---|---|---|
| | Avg | Range | Avg | Range |
| *Festuca dolichophylla* | 33.8 | 18-62 | 16.3 | 8-34 |
| *Poa gilgiana* | 19.2 | 2-46 | 3.4 | 0-14 |
| *Calamagrostis vicunarum* | 9.6 | 0-20 | 4.3 | 0-12 |
| *Poa spicigera* | 8.1 | 0-36 | 1.4 | 0-6 |
| *Carex ecuadorica* | 5.3 | 0-18 | 0.7 | 0-4 |
| *Calamagrostis brevifolia* | 4.2 | 0-18 | 1.3 | 0-8 |
| *Bromus lanatus* | 3.4 | 0-12 | 0.7 | 0-4 |
| *Carex* sp | 3.2 | 0-24 | 0.4 | 0-4 |
| *Cyperaceae* sp | 2.1 | 0-16 | 0.2 | 0-2 |
| *Luzula peruviana* | 1.9 | 0-14 | 0.5 | 0-4 |
| *Festuca rigescens* | 1.4 | 0-12 | 0.2 | 0-4 |

[1/] Data compiled from 20 transects; 34 species were encountered.

Table 5. Plant composition ( > 1%) of the Xeric Glaciated Upland community on the Corpacancha study area.[1/]

| Species | Relative Species Composition (%) | | Basal Cover (%) | |
|---|---|---|---|---|
| | Avg | Range | Avg | Range |
| *Festuca dolichophylla* | 33.0 | 2-68 | 13.7 | 0-32 |
| *Carex ecuadorica* | 16.1 | 2-36 | 2.2 | 0-8 |
| *Calamagrostis vicunarum* | 13.1 | 2-30 | 4.4 | 0-16 |
| *Festuca rigescens* | 10.4 | 0-16 | 2.8 | 0-10 |
| *Bromus lanatus* | 3.6 | 0-10 | 0.9 | 0-4 |
| *Alchemilla pinnata* | 2.4 | 0-22 | 0.3 | 0-4 |
| *Scirpus rigidus* | 2.3 | 0-16 | 1.0 | 0-6 |
| *Agrostis breviculmis* | 2.0 | 0-14 | 0.7 | 0-6 |
| *Aciachne pulvinata* | 1.9 | 0-14 | 1.3 | 0-10 |
| *Poa gilgiana* | 1.4 | 0-14 | 0.2 | 0-4 |
| *Carex* sp | 1.1 | 0-10 | 0 | 0-4 |
| *Muhlenbergia ligularis* | 1.0 | 0-22 | 0.2 | 0-2 |

[1/]Data compiled from 43 transects; 50 species were encountered.

Bofedales

The discussion of the vegetation in glaciated mountain valleys would not be complete without mention of the "bofedal" community type. "Bofedal" is a local word describing small (5-25 m diameter) carpet like plant communities which abruptly appear in glaciated bottomlands and mesic glaciated upland community types. Soils under these dense evergreen mats of forbs were Histosols on either glacial till or alluvial parent material. The organic horizon (Histic epipedon) was quite thick (> 40 cm) and soils were gleyed reflecting poor drainage. Dominant species were Plantago tubulosa, Hypochoeris taraxacoides and some Carex sp. Other common forbs were Gentiana carneorubra and Gentiana prostrata. Calamagrostis brevifolia also appeared in small clumps.

Mountain Slope Community Types

Vegetation changed notably on slopes greater than 25%. Tall (80 cm) grass replaced mid (< 60 cm) grass of the glaciated valleys, and forbs were much more common. Four community types are described on the mountain slopes.

Mountain Gravelly Loam

This community type was found on both glacial till on steep slopes of glacial moraines and limestone colluvium on steep slopes. Soils (Mollic Cryoboralfs) on the glacial till were very similar to the Xeric Glaciated Upland soils. Soils which developed in limestone colluvium had mollic epipedons and argillic horizons (10 cm thick) that were thinner than those in glacial till soils. Textures were silt loams and silty clay loams on the surface, and became gravelly with depth. These soils were classified as Argic Cryoborolls.

The occurrence of the same plant community on two seemingly different soils is noteworthy. The glacial soil was deeper, more strongly developed, and more leached than the limestone soil. Both soils, however, had gravelly clay loam texture in the lower solum, perhaps contributing to similar soil water relationships.

Vegetation was dominated by Calamagrostis macrophylla and Festuca dolichophylla (Table 6). Stipa brachyphylla was also common. The only species present on this community type which also commonly occurred on the flatter glaciated sites were Festuca dolichophylla, Calamagrostis vicunarum, Bromus lanatus, and Alchemilla pinnata. Forbs made up almost 29% of the species composition. Azorella crenata and Baccharis alpina, a spreading prostrate semi-shrub whose woody stems grew underground with numerous small leaves protruding above the surface, were common. Basal cover was lower and species richness was higher on this site than on the valley sites (Table 1).

Table 6. Plant composition ( > 1%) of the Mountain Gravelly Loam community on the Corpacancha study area.[1/]

| Species | Relative Species Composition (%) | | Basal Cover (%) | |
|---|---|---|---|---|
| | Avg | Range | Avg | Range |
| Calamagrostis macrophylla | 31.1 | 14-54 | 11.5 | 4-18 |
| Festsuca dolichophylla | 17.9 | 2-44 | 4.7 | 0-18 |
| Stipa brachyphylla | 11.4 | 2-22 | 1.4 | 0-6 |
| Azorella crenata | 4.3 | 0-22 | 0.6 | 0-4 |
| Bromus lanatus | 2.9 | 0-6 | 0.6 | 0-2 |
| Alchemilla pinnata | 2.8 | 0-12 | 0.2 | 0-2 |
| Baccharis alpina | 2.3 | 0-8 | 0.6 | 0-4 |
| Poa candomoana | 2.3 | 0-8 | 0.1 | 0-2 |
| Agrostis breviculmis | 1.9 | 0-8 | 0.3 | 0-2 |
| Luzula racemosa | 1.8 | 0-10 | 0.5 | 0-4 |
| Calamagrostis vicunarum | 1.5 | 0-10 | 0.5 | 0-4 |
| Werneria cespitosa | 1.3 | 0-6 | 0.3 | 0-6 |
| Werneria villosa | 1.3 | 0-6 | 0.0 | --- |
| Oreithales integrifolia | 1.1 | 0-4 | 0.0 | --- |

1/ Data compiled from 19 transects; 53 species were encountered.

## Mountain Andesite

Portions of the study area were covered by andesite peaks. Only one soil profile was described on this site and it was classified as a Mollic Cryoboralf. Parent material was andesite colluvium and textures were loams and silt loams on the surface and gravelly loams from 50 cm - 100 cm. The mollic epipedon was very thick (75 cm) but the argillic horizon was only weakly developed, indicating the relative youth of the soils and/or the instability of the slope surface.

These slopes were uniformly dominated by *Calamagrostis recta*. The next most important grass was *Stipa brachyphylla*. Other grasses such as *Festuca dolichophylla*, *F. rigescens*, *Poa gymnantha*, and *Agrostis breviculmis* were common but not abundant on this site (Table 7). Forbs made up 32% of the community composition (Table 1). *Baccharis alpina* and *Azorella crenata* were most abundant, but many others were present. The forb component of this community type was very similar to the mountain gravelly loam type.Basal cover was about 22%.

## Mountain Siltstone

This community type, found exclusively on red siltstone residuum parent material, made up a small portion of the study area. Soils on this site were classified as Mollic Cryoboralfs. The argillic horizon was well developed. Textures were silty clay loam in the A horizon and silty clay in the B and C horizons. Unlike the other Mollic Cryoboralfs on the study area, this soil had an ochric rather than an umbric epipedon.

*Stipa brachyphylla* and *Calamagrostis recta* were co-dominants (Table 8). Basal cover estimates of these two species in this community type were very close to their estimates in the mountain andesite community type. *Festuca distichovaginata* and *C. macrophylla*, each dominants on other sloping sites, were present in this community. Other common grasses were *Bromus lanatus*, *Calamagrostis heterophylla*, *Agrostis tolensis*, and *Poa gymnatha*.

Forbs made up 30% of the species composition (Table 1). *Baccharis alpina* was the most abundant forb. *Plantago lamprophylla*, *Hypochoeris setosa* and *Alchemilla pinnata* also were common. Bare ground estimates were highest in this community (45%) and basal cover was about 17%.

## Mountain Deep Loam

This community type was found on glacial till and siltstone residuum and was the most common of all mountain slope community types. Soils were well drained and had deeper B horizons than other mountain soils. Glacial till soils were classified as Mollic Cryoboralfs with umbric epipedons. Thin organic horizons also were

Table 7. Plant composition ( > 1%) of the Mountain Andesite community on the Corpacancha study area.[1/]

| Species | Relative Species Composition (%) | | Basal Cover (%) | |
|---|---|---|---|---|
| | Avg | Range | Avg | Range |
| Calamagrostis recta | 41.5 | 28-52 | 9.7 | 6-16 |
| Stipa brachyphylla | 7.3 | 0-10 | 1.5 | 0-4 |
| Baccharis alpina | 7.2 | 2-16 | 1.8 | 0-4 |
| Azorella crenata | 5.4 | 0-14 | 1.0 | 0-4 |
| Werneria nubignea | 3.7 | 0-10 | 1.0 | 0-6 |
| Festuca dolichophylla | 2.9 | 0-8 | 0.8 | 0-2 |
| Alchemilla pinnata | 2.7 | 0-18 | 0.0 | --- |
| Poa gymnantha | 2.5 | 0-6 | 0.3 | 0-2 |
| Festuca rigescens | 2.3 | 0-6 | 0.0 | --- |
| Agrostis breviculmis | 2.0 | 0-4 | 0.8 | 0-4 |
| Luzula racemosa | 1.8 | 0-4 | 0.2 | 0-2 |
| Geranium sessiliflorum | 1.7 | 0-6 | 0.2 | 0-2 |
| Pycnophyllum molle | 1.5 | 0-8 | 0.7 | 0-6 |
| Bromus lanatus | 1.5 | 0-4 | 0.3 | 0-2 |
| Werneria villosa | 1.3 | 0-4 | 0.0 | --- |
| Agrostis tolensis | 1.2 | 0-8 | 0.2 | 0-2 |

[1/]Data compiled from 12 transects; 44 species were encountered.

Table 8. Plant composition ( > 1%) of the Mountain Siltstone community on the Corpacancha study area.[1]

| Species | Relative Species Composition (%) | | Basal Cover (%) | |
|---|---|---|---|---|
| | Avg | Range | Avg | Range |
| *Stipa brachyphylla* | 22.7 | 18-30 | 2.2 | 0-4 |
| *Calamagrostis recta* | 20.4 | 8-28 | 6.2 | 0-10 |
| *Festuca districhovaginata* | 6.2 | 2-10 | 2.2 | 0-4 |
| *Plantago lamprophylla* | 5.1 | 0-16 | 0.9 | 0-4 |
| *Bromus lanatus* | 4.7 | 0-10 | 1.1 | 0-4 |
| *Baccharis alpina* | 4.4 | 0-12 | 1.8 | 0-4 |
| *Hypochoeris setosa* | 4.4 | 0-10 | 0.7 | 0-2 |
| *Alchemilla pinnata* | 3.8 | 0-12 | 0.4 | 0-2 |
| *Calamagrostis macrophylla* | 3.8 | 0-10 | 0.7 | 0-4 |
| *Bidens andicola* | 3.8 | 0-6 | 0.4 | 0-2 |
| *Calamagrostis vicunarum* | 2.4 | 0-10 | 0.2 | 0-2 |
| *Carex ecuadorica* | 2.2 | 0-12 | 0.2 | 0-2 |
| *Calamagrostis heterophylla* | 2.0 | 0-6 | 0.0 | --- |
| *Stipa hans-meyeri* | 1.6 | 0-10 | 0.2 | 0-2 |

[1] Data compiled from 9 transects; 46 species were encountered.

common. Textures were loam and sandy loam throughout. The B horizon extended to 80 cm. The brown siltstone soil also was deep (B horizon to 90 cm) and well drained. The mollic epipedon was 75 cm thick and the argillic horizon was 70 cm thick. Textures were silt loam and clay loam.

Festuca distichovaginata was the dominant species (Table 9). Stipa brachyphylla was an important subdominant, and Poa candomoana, Calamagrostis vicunarum, Bromus catharticus, and Calamagrostis heterophylla were common. Forbs comprised 19% of the species composition. Trifolium amabile and Alchemilla pinnata were the most common, and Baccharis alpina was absent.

## High Elevation Ridge

On wind blown exposed knolls greater than 4600 m the vegetation changed from that of the tall grasses on mountain slopes to decumbant grasses and forbs. One community type was observed at these elevations.

Sampling was limited on this site because of its inaccessibility and limited extent. Only one soil pedon was described and vegetation sampling was limited to one site. The soil in this community type differed from the other soils described because it lacked a mollic epipedon and an argillic horizon. Parent material was an unidentified sedimentary rock. Textures were loam and clay loam and the B horizon extended to 70 cm. It was classified as a Typic Cryumbrept and was the only Inceptisol described on the study area.

The vegetation was made up of decumbent grasses, forbs and cushion plants. Grasses, dominated by Festuca rigescens, made up 47% of the composition. Calamagrostis vicunarum, Agrostis breviculmis, F. dolichophylla, Dissanthelium calycinum, Festuca humilor, and Aciachne pulvinata were common (Table 10). Forbs and cushion plants made up 54% of the species composition with Azorella crenata the most abundant. Cotula mexicana, Baccharis alpina, Werneria caespitosa, and Gentianella vaginalis also were common. Many of the plants found were unique to this community type.

## CONCLUSION

Ten plant community types were identified and characterized by floral composition. Soils, parent material, and topographic position of each type were also described. Major topographic positions on the study area were the flood plain (alluvial), glaciated valleys (glacial till), mountain slopes (glacial till, limestone, andesite, siltstone) and the high elevation ridge. The vegetation was dominated by grasses. Dominant vegetation changed from mid grasses to tall grasses as slopes became greater than 25%. In the glaciated valleys community types blended into one another, providing few clear or abrupt ecotones, with the exception of the

Table 9. Plant composition ( > 1%) of the Mountain Deep Loam community on the Corpacancha study area.[1/]

| Species | Relative Species Composition (%) | | Basal Cover (%) | |
|---|---|---|---|---|
| | Avg | Range | Avg | Range |
| *Festuca distichovaginata* | 35.1 | 18-52 | 9.5 | 4-22 |
| *Stipa brachyphylla* | 17.6 | 14-40 | 2.6 | 0-6 |
| *Trifolium amabile* | 5.3 | 0-20 | 0.5 | 0-4 |
| *Alchemilla pinnata* | 4.6 | 0-12 | 0.2 | 0-2 |
| *Poa candomoana* | 4.6 | 0-32 | 0.5 | 0-8 |
| *Calamagrostis vicunarum* | 3.0 | 0-14 | 0.6 | 0-4 |
| *Bromus catharticus* | 2.7 | 0-8 | 0.2 | 0-2 |
| *Calamacrostis heterophylla* | 2.6 | 0-14 | 0.2 | 0-2 |
| *Carex ecuadorica* | 2.4 | 0-8 | 0.3 | 0-4 |
| *Bromus lanatus* | 2.3 | 0-10 | 0.2 | 0-2 |
| *Oenotheris multicaulis* | 1.5 | 0-6 | 0.1 | 0-2 |
| *Bidens andicola* | 1.2 | 0-12 | 0.3 | 0-2 |

[1/] Data compiled from 22 transects; 52 species were encountered.

Table 10. Plant composition ( > 1%) of the High Elevation Ridge community on the Corpacancha study area.[1/]

| Species | Relative Species Composition (%) | | Basal Cover (%) | |
| --- | --- | --- | --- | --- |
| | Avg | Range | Avg | Range |
| *Festuca rigescens* | 23.3 | 14-34 | 4.5 | 0-12 |
| *Azorella crenata* | 12.25 | 2-20 | 1.0 | 0-2 |
| *Calamagrostis vicunarum* | 9.5 | 2-18 | 2.0 | 0-6 |
| *Agrostis brevifolia* | 7.5 | 2-12 | 3.0 | 0-6 |
| *Cotula mexicana* | 7.3 | 0-10 | 1.8 | 0-8 |
| *Baccharis alpina* | 6.3 | 2-14 | 2.8 | 0-4 |
| *Festuca dolichophylla* | 4.3 | 0-10 | 1.8 | 0-6 |
| *Werneria cespitosa* | 3.5 | 0-10 | 0.5 | 0-2 |
| *Dissanthelium calycinum* | 3.0 | 0-10 | 1.0 | 0-4 |
| *Gentianella vaginalis* | 3.0 | 0-2 | 0.0 | --- |
| *Festuca humilor* | 2.8 | 0-14 | 0.5 | 0-2 |
| *Alchemilla pinnata* | 2.3 | 0-6 | 0.5 | 0-2 |
| *Aciachne pulvinata* | 1.8 | 0-6 | 0.0 | --- |
| *Pycnophyllum molle* | 1.8 | 0-6 | 1.3 | 0-4 |
| *Oreithales integrifolia* | 1.3 | 0-4 | 0.0 | --- |

[1/] Data compiled from 8 transects; 30 species were encountered.

bofedal community. Basal cover was greater in the glaciated valley community types, and highest in glaciated bottomlands. The ratio of forbs to grasses also changed with moisture conditions. Forbs assumed more importance on the mountain slopes and high elevation ridgetops. Species richness was also greater in these community types. Mountain slope vegetation was most influenced by parent material. Tall grass dominants on these slopes were _Calamagrostis machrophylla_, _Calamagrostis recta_, and _Festuca distichovaginata_. _Stipa brachyphylla_ was also common on these slopes. _Festuca dolichophylla_, _Calamagrostis brevifolica_, and several _Poa_ species dominated the lesser sloping uplands, while _Calamagrostis macrophylla_, _Calamagrostis recta_, and _Festuca distichovaginata_ dominated the mountain slopes. _Festuca dolichophylla_ occurred on most sites.

Soils also differed with topographic position. Soils on the most hydric sites (flood plain, glaciated bottomland) had thick organic horizons (> 30 cm) and exhibited gleyed mineral horizons. Soils were similar on the mesic and xeric glaciated uplands. Usually they had a thin organic horizon (< 5 cm) and dark mollic or umbric epipedons. Argillic horizons were also prevalent. indicating moderate soil stability and maturity. On the mountain slopes soils varied with parent material, and mollic epipedons and argillic horizons were common. Common soil orders in the study area were Histosols (hydric sites), Alfisols and Mollisols.

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# A TAXONOMIC TREATMENT OF THE GENUS *PANICUM* (POACEAE) IN MISSISSIPPI

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## Abstract

A taxonomic treatment of 40 species and 24 varieties of *Panicum* (Poaceae) occurring naturally or naturalized in Mississippi is presented. Fifteen species and five varieties belong in subgenus *Panicum* and 25 species and 19 varieties belong in subgenus *Dichanthelium*. This treatment includes taxonomic keys, brief mention of habitat and distribution, recent nomenclature in major manuals, major references and some notes.

## Introduction

This taxonomic treatment of the grass genus *Panicum* was prepared for the proposed Guide to the Flora of Mississippi; the format and abbreviated descriptions of taxa conform to the guidelines for contributors to this floristic project.

The taxonomy of these grasses, particularly those in the subgenus *Dichanthelium*, is difficult partly because of extensive gene exchange among taxa and because of widespread cleistogamy in addition to chasmogamy. This unusual breeding system often results in an intricate pattern of morphological variations among taxa and obscures interspecific boundaries (Hitchcock and Chase 1910; Lelong 1965; Freckmann 1967; Spellenberg 1975). It is therefore not surprising that students of this perplexing genus have often disagreed on the delimitation and status of taxa recognized within the group.

Nearly 150 species and varieties of *Panicum* were ascribed to the Southeastern United States by Hitchcock and Chase (1910) in their impressive monograph of the North American taxa of this genus. They recognized 3 subgenera of *Panicum*: the subgenus *Paurochaetium* with 6 species, the subgenus *Eupanicum* with 81 species, and the subgenus *Dichanthelium* with 191 species. The species in their subgenus *Paurochaetium* have since been transferred by most recent authors to the genus *Setaria*. Their diverse subgenus *Eupanicum* includes annual and perennial plants with basal leaves essentially similar to cauline leaves and predominantly fertile spikelets. Subgenus *Dichanthelium* includes perennial grasses often forming a more or less extensive winter rosette of short, broad blades usually different from cauline blades; they often produce numerous dense fascicles of short axillary branches with reduced leaves and panicles late in the growing season after maturation of the large terminal panicles produced in the spring.

Spikelets of the vernal panicles are often chasmogamous and sterile whereas those of the reduced autumnal axillary panicles are primarily autogamous or cleistogamous and often fertile.

Lowe (1921) listed 69 species of Panicum for Mississippi. Four of those species have since been transferred to the genera Echinochloa, Sacciolepis, and Leptoloma; nine additional species have been reduced to synonyms by most recent authors. Therefore 56 species of Panicum are included in Lowe's work: 18 species in subgenus Panicum and 38 in subgenus Dichanthelium. Small (1933) followed essentially the taxonomic treatment of Panicum in Hitchcock and Chase (1910); he recognized 117 species for the Southeastern States, including 31 species in subgenus Panicum and 86 in subgenus Dichanthelium. Small noted the occurrence of 84 species of Panicum in Mississippi, 22 in subgenus Panicum and 62 in subgenus Dichanthelium. Hitchcock (1951) ascribed 80 species and 6 varieties of Panicum to Mississippi; 21 species and 2 varieties in subgenus Panicum, and 59 species and 4 varieties in subgenus Dichanthelium. Most recent authors of floras dealing with Southeastern plants have recognized fewer taxa of Panicum than Hitchcock and Chase, reducing many species to the varietal rank and including others in synonymy. This useful trend was primarily initiated by Radford (Radford et al., 1964) and pursued by Correll and Johnston (1970) and others. In 1984, I proposed 22 new varietal combinations for Panicum of southeastern United States.

In 1974, Gould elevated subgenus Dichanthelium to the generic level primarily on the basis of morphological differences and also because species of Dichanthelia studied exhibit the "non-Kranz" type leaf anatomy and the $C_3$ photosynthetic pathway while most of the species in subgenus Panicum have the Kranz-type leaf anatomy with $C_4$ photosynthesis (Smith, B.N. and W.V. Brown, 1973). However, morphological differences between species of the two subgenera are often not consistently sharp and become even less distinct in the Tropics; also, as noted by many botanists, the two types of leaf anatomy and of photosynthetic pathways occur occasionally within other well defined and presumably fairly "natural" angiosperm genera. Therefore, it seems preferable at present to maintain the genus Panicum essentially as defined by Hitchcock (1950) after transfer of a few of their species to better defined genera such as Setaria, Paspalidium, and Brachiaria. Gould and Clark (1978) published a taxonomic treatment of the genus Dichanthelium occurring in the United States and Canada. A total of 45 taxa including 26 species and 19 varieties were recognized by them for the Southeastern States; 17 species and 13 varieties for Mississippi.

In the present treatment, 40 species and 24 varieties of Panicum are treated, including 15 species and 5 varieties in subgenus Panicum and 25 species and 19 varieties in subgenus Dichanthelium. Reference is made to synonyms used in major recent manuals treating the plants of the Eastern United States: Small (1933) indicated by S; Fernald (1950) indicated by F; Gleason and Cronquist (1963) indicated as G; and Radford, Ahles and Bell (1968) indicated by R. Reference is also made to synonyms recognized in the most recent major treatment of North American Dichanthelium by Gould and Clark (1978). Other comprehensive recent works which were consulted in the preparation of this treatment are those of Correll and Johnston (1970), Gould (1975), Godfrey and Wooten (1979) and Allen (1980). County distribution is based primarily on the examinations of Mississippi specimens in numerous herbaria of Southeastern United States including MISS, MISSA, UNA, AUA, NCU, FSU, GA. The invaluable help of curators in charge of those and other collections consulted is gratefully acknowleged.

The 10 physiographic regions of Mississippi recognized in Lowe (1921) are abbreviated in the text as follows: Tennessee River Hills, TRH; Northeastern Prairie Belt, NPB; Pontotoc Ridge, PR; Flatwoods, FW; North Central Plateau, NCP; Jackson Prairie, JP; Loess Bluff, LBH; Yazoo-Mississippi Delta, YMD; Longleaf Pine Region, LPR; and Coastal Plain Meadows, CPM.

## Key to the species of Panicum of Mississippi

Plant annual or perennial, without an overwintering basal rosette of leaves or a dense overwintering basal cushion of leaves. (Mostly subgenus Panicum) . . . . . . . . . . . . . . . . . . Key 1.

Plant perennial producing an overwintering rosette of leaves with short, wide blades unlike cauline blades or a dense overwintering basal cushion of leaves. (Subgenus Dichanthelium) . . . . Key 2.

### Key 1

1. Plant annual.
  2. Spikelets verrucose or tuberculate.
    3. Spikelets 1.7-2.2 mm long, glabrous . 13. P. verrucosum.
    3. Spikelets 3.3-3.9 mm long, pubescent . . . . . . . . . . . . . . . . . . . . 14. P. brachyanthum.
  2. Spikelets not verrucose nor tuberculate.
    4. Fertile floret transversely rugose.
      5. Spikelets 5-6 mm long . . . . . . . Brachiaria texana.
      5. Spikelets 3.1-3.6 mm long . . . . . Brachiaria ramosa.
    4. Fertile floret smooth and shiny.
      6. Spikelets 5.5-7 mm long, subsecund on few stiffly ascending panicle branches . . . . 15. P. gymnocarpon.
      6. Spikelets less than 5.5 mm long, on numerous flexuous or contracted panicle branches.
        7. Sheaths glabrous . . . . . . 1. P. dichotomiflorum.
        7. Sheaths more or less densely papillose-pubescent.
          8. Spikelets 4.5-5.5 mm long . . . 4. P. miliaceum.
          8. Spikelets 1.7-3.5 mm long.
            9. Spikelets 2.7-3.5 mm long; primary panicle about 1/2 as broad as long or less . . . . . . . . . . . . . . . . 3. P. flexile.
            9. Spikelets 1.7-2.5 mm long; primary panicle usually more than 1/2 as long 2. P. capillare.
1. Plant perennial.

10. Panicle narrow, usually less than 2 cm broad with few subsessile spikelets.
 11. Culm wiry, often purplish; blades 1.5-4 mm wide, involute . . . . . . . . . . . . . . . . 7. _P. tenerum._
 11. Culm coarse; blades 5-20 mm wide, flat . . . . . . . . . . . . . . . . . . . . 8. _P. hemitomon._
10. Panicle more than 2 cm broad with numerous spikelets on long or short pedicels.
 12. Spikelets 5.5-7 mm long; culm decumbent and stoloniferous . . . . . . . . . . . 15. _P. gymnocarpon._
 12. Spikelets less than 5.5 mm long (except sometimes in _P. amarum_); culm rhizomatous or tufted.
  13. Sterile palea greatly inflated and indurate at maturity; culm slender, densely tufted 9. _P. hians._
  13. Sterile palea unexpanded at maturity; culm more or less robust, tufted, clumped or solitary.
   14. Plant with stout, elongate, scaly rhizomes, often in large clumps or extensive colonies; culms and sheaths terete.
    15. Spikelets subsessile and subsecund, up to 3.9 mm long, often gaping, falcate and obliquely set on short appressed pedicels . . . . . . . . . . . . 6. _P. anceps._
    15. Spikelets not as above, up to 6.5 mm long, usually on long pedicels.
     16. Spikelets 2.2-2.8 mm long; first glume often subtruncate, rounded or broadly acute . . . . . . . . . . 12. _P. repens._
     16. Spikelets 2.8-6.5 mm long, often gaping at apex; first glume acuminate, acute or beaked.
      17. Panicle open, diffuse; spikelets usually 3-5 mm long . 10. _P. virgatum._
      17. Panicle contracted with appressed branches; spikelets 4-6.5 mm long . . . . . . . . . . . . . 11. _P. amarum._
   14. Plant with short, hard, knotty bases or caudexes, often densely tufted; culms and sheaths more or less strongly compressed . . . . . . . . . . . . . . . . 5. _P. rigidulum._

Key 2

1. Plant forming dense basal cushion of leaves by extensive branching from basal nodes and lack of elongation of lower internodes; the few cauline blades similar to the basal ones.
 2. Basal blades elongate, linear, fairly rigid, suberect, up to 20 cm long and 5 cm wide, usually more than 20 X as long as wide . . . . . . . . . 16. _P. depauperatum._
 2. Basal blades pale green, narrowly lanceolate, thin, spreading to suberect, up to 15 cm long and 12 mm wide, usually less than 20 X as long as wide.

3. Sheaths with fine, long, spreading or retrorse hairs; spikelets 1.7-2.3 mm long, pustulose-pubescent . . . . . . . . . . . . . . . . . . . . 17. *P. laxiflorum*.
3. Sheaths glabrous or puberulent; spikelets 1.1-2.1 mm long, glabrous, puberulent or pubescent.
4. Spikelets 1.1-1.5 mm long, glabrous or puberulent; blades 1-4 mm wide, often involute with whitish cartilaginous margins . . . . . 30. *P. chamaelonche*.
4. Spikelets 1.1-2.1 mm long, glabrous or pubescent; blades 3-8 mm wide, flat, glabrous or pilose, margins papillose-ciliate to middle of blade or beyond . . . . . . . . . . . . . . . . . 18. *P. strigosum*.
1. Plant forming a distinct overwintering rosette of short, broad blades, usually unlike cauline blades, branching at least somewhat from upper nodes; lower internodes usually elongating.
5. Spikelets 0.8-1.9 mm long.
6. Vernal blades narrow, seldom over 4 mm wide; plant eventually branching profusely and forming dense tufts; autumnal blades often more or less involute and pointed.
7. Spikelets 1.7-2.2 mm long; autumnal blades greatly reduced, stiff, prominently nerved, strongly involute and often arcuate . . . . . 23. *P. aciculare*.
7. Spikelets 1.1-1.5 mm long; autumnal blades slightly reduced, thickish, somewhat involute, with whitish margins . . . . . . . . . . . . 30. *P. chamaelonche*.
6. Vernal blades over 4 mm wide; plant usually not forming dense tufts with age (except occasionally in *P. acuminatum*).
8. Ligules actually or apparently 1-5 mm long.
9. Spikelets 0.8-1.1 mm long; ligules 1.5-3 mm long . . . . . . . . . . . . . . . . 31. *P. wrightianum*.
9. Spikelets 1.1-1.9 mm long; ligules 0.2-5 mm long.
10. Blades small, 1.5-3.5 cm long, 1-4 mm wide, often spreading; ligules 0.2-1.5 mm long . . . . . . . . . . . . . . . . . 29. *P. ensifolium*.
10. Blades up to 10 cm long and 10 mm wide; vars. with narrow leaves have erect or ascending blades; ligules 1-5 mm long . 32. *P. acuminatum*.
8. Ligules less than 1 mm long.
11. Spikelets subspherical to broadly ellipsoid, puberulent; blades 4-25 mm wide, broadly cordate to subcordate at base.
12. Spikelets 1.1-1.4 mm long; cauline blades 4 to 7, 5-10 mm wide . . . 22. *P. erectifolium*.
12. Spikelets 1.3-1.8 mm long; cauline blades seldom more than 4; if more than 4, then 4-25 mm wide.
13. Cauline blades usually less than 4, 4.5-10 cm long and 5-14 mm wide . . . . . . . . . . . . 20. *P. sphaerocarpon*.

13. Cauline blades usually more than 4, 10-23 cm long and 14-25 mm wide . . . . . . . . . . . . . . 21. *P. polyanthes*.

11. Spikelets ellipsoid to obovoid, glabrous or pubescent; blades 3-14 mm wide, tapering, strangled or rounded at base.

14. Culms slender, weak, seldom over 4 dm tall; blades small, up to 3.5 cm long and 4 mm wide, thin, spreading or reflexed . 29. *P. ensifolium*.

14. Culms stiffer, often wiry, usually over 4 dm tall; blades longer and wider, firm or thin, ascending to spreading or reflexed.

15. Spikelets asymmetrically pyriform; cauline blades 4 or more, stiffly spreading . . . . . . . . . . . . . . 26. *P. portoricense*.

15. Spikelets ellipsoid to obovoid; cauline blades 3 to 4 and ascending; if more than 4, then soft and spreading to ascending.

16. Plant small up to 4.5 dm tall; blades mostly basal, few cauline blades short, to 8 mm wide, conspicuously papillose-ciliate; spikelets obovoid to broadly ellipsoid, 1.1-2.1 mm long . 18. *P. strigosum*.

16. Plant larger up to 10 dm tall; blades primarily cauline or crowded at base and with 3 to 4 cauline blades (in *P. tenue*); spikelets mostly ellipsoid or obovoid, 1.3-2.7 mm long.

17. Blades usually soft, 4-14 cm long, 3-14 mm wide; spikelets ellipsoid to obovoid, glabrous or pubescent, 1.5-2.7 mm long . . . . 27. *P. dichotomum*.

17. Blades stiffly ascending, conspicuously white-margined, 2-5 cm long, 1.5-6 mm wide; spikelets ellipsoid, 1.3-1.7 mm long . . . . . . . 28. *P. tenue*.

5. Spikelets 1.9-4.7 mm long.

18. Spikelets 1.9-3.2 mm long.

19. Cauline blades distinctly cordate at base, often over 11 mm wide.

20. Plant densely and softly pubescent throughout with densely bearded nodes and glabrous glandular rings just below nodes . 34. *P. scoparium*.

20. Plant mostly glabrous or sparsely pubescent or puberulent; nodes glabrous or sparsely pubescent.

21. Plant robust often more than 7 dm tall; sheaths, at least the lower or the axillary ones papillose-hirsute, papillose-pilose or papillose; blades usually more than 10 cm long . . . . . . . . . . . 39. *P. clandestinum*.

21. Plant usually less than 7 dm tall; sheaths glabrous, finely pubescent or puberulent;

blades usually less than 10 cm long
. . . . . . . . . . . . . . . . . . .37. P. commutatum.
19. Cauline blades rounded or tapering at base, seldom over 11 mm wide (except in P. scabriusculum).
22. Leaf blades elongate, linear, usually more than 14 X as long as wide, often ascending or erect.
23. Blades thick, often striate above and pleated beneath, tapering from base to apex and usually pubescent underneath.
24. Nodes bearded; plant densely grayish pubescent throughout . . . . . . . . . . . 25. P. consanguineum.
24. Nodes not bearded; plant glabrous or sparsely papillose-pilose.
25. Spikelets 1.7-2.2 mm long; blades 3.5-8 cm long and up to 4 mm wide . . . . 23. P. aciculare.
25. Spikelets 2.4-2.9 mm long; blades 5-15 cm long and up to 7 mm wide . . 24. P. angustifolium.
23. Blades thin, not striate or pleated, usually widest near the middle, essentially glabrous 19. P. nudicaule.
22. Leaf blades wider, often lanceolate, usually 10 X as long as wide or less.
26. Leaves mostly basal, thin, cauline blades seldom more than 3, often ascending, uppermost greatly reduced; uppermost internode greatly elongate.
27. Spikelets 1.1-2.1 mm long, broadly ellipsoid, pubescent; blades long papillose-ciliate
. . . . . . . . . . . . . . . . . . 18c. P. strigosum. var. leucoblepharis.
27. Spikelets 2.4-2.9 mm long, narrowly ovate or ellipsoid, glabrous, acuminate . . 19. P. nudicaule.
26. Leaves mostly cauline, relatively thick, usually more than 8 per culm, spreading to ascending or reflexed, uppermost usually not greatly reduced (except in P. acuminatum var. unciphyllum); uppermost intermode not greatly elongate.
28. Hairs of ciliate ligules 1.5-5 mm long.
29. Spikelets 1.1-1.9 mm long, seldom longer
. . . . . . . . . . . . . . . . 32. P. acuminatum.
29. Spikelets 2-2.4 mm long.
30. Sheaths densely to sparsely pilose with fine spreading to ascending hairs up to 4 mm long; spikelets 2-3 mm long 33. P. ovale.
30. Sheaths glabrous or papillose-hispid with stiff ascending hairs less than 2 mm long; spikelets 2.7-4.2 mm long 35. P. oligosanthes.
28. Hairs of ciliate ligules less than 1.5 mm long or ligules not ciliate.
31. Plant robust, 7-14 dm tall; blades large, elongate, 12-25 cm long; ligule membranous, erose, less than 1 mm long . . . . . . . . . . . . . . 38. P. scabriusculum.
31. Plant usually less than 7 dm tall or if more, with retrorsely bearded nodes; blades usually less than

12 cm long; ligules ciliate or obsolete.

32. Culms sparsely ascending-pilose or strigose; nodes appressed-pilose; blades mostly ascending, stiff, often with conspicuous white scaberulous margins . . . . . . . . . . . . . . . . . . . . . . . 33. P. ovale.

32. Culms glabrous or puberulent, often wiry and purple; blades often spreading to reflexed or ascending, thin, usually without white margins.

33. Spikelets 2.7-3.5 mm long, obovoid; sheaths papillose-hispid or papillose-pilose . . . . . . . . . . . . . . . . . 35. P. oligosanthes.

33. Spikelets 1.5-2.7 mm long, ellipsoid or asymmetrically obovoid; sheaths glabrous or puberulent.

34. Culms and nodes wiry, often purple and densely puberulent, up to 5 dm tall; spikelets asymmetrically pyriform or broadly obovoid, pustulose-puberulent to subglabrous . . . . . . . . . . . . . . . 26. P. portoricense.

34. Culms and nodes robust to weak, usually glabrous, up to 10 dm tall; spikelets mostly ellipsoid or obovoid, glabrous or sparsely pubescent . . . . . . . . . . . . . . . 27. P. dichotomum.

18. Spikelets 3.2-4.7 mm long.

35. Spikelets more than 3.7 mm long.

36. Blades broadly cordate at base, 10-35 mm wide.

37. Sheaths usually glabrous or softly papillose-pilose or puberulent; nodes densely bearded with long, retrorse hairs . . . . 40. P. boscii.

37. Sheaths densely papillose-hispid or papillose-pilose; nodes bearded with short, tangled hairs . . . . . . . . . . . . . . 36. P. ravenelii.

36. Blades rounded, tapering at base or subcordate, 5-15 mm wide . . . . . . . . . 35. P. oligosanthes.

35. Spikelets less than 3.7 mm long.

38. Ligules ciliate 1-3 mm long; blades usually less than 10 mm wide . . . . . 35. P. oligosanthes.

38. Ligules ciliate, erose or obsolete, less than 1 mm long; blades usually 10-35 mm wide.

39. Sheaths at least the lowermost and the axillary ones papillose-hispid or papillose-pilose . . . . . . . . . . . . . . . 39. P. clandestinum.

39. Sheaths glabrous, sparsely pilose or puberulent . . . . . . . . . . . . . . . 37. P. commutatum.

1. P. dichotomiflorum Michx., Fall Panicum. May-Oct. Mostly moist, open, disturbed areas; marshy shores, roadside ditches, low waste areas and fields; common throughout. Incl. P. dichomiflorum var. geniculatum (Wood) Fernald--F,G.

2. P. capillare L. Witchgrass. June-Oct. Open, disturbed,

often moist areas such as sand bars, fields and waste places; chiefly YMD, also NPB, FW (Oktibbeha Co.) and LPR (George Co.).

3. P. flexile (Gattinger) Scribner. Sept.-Oct. Moist, open, calcareous areas, limestone outcrops, prairies, uncommon; NPB (Lowndes Co.), FW (Oktibbeha Co), NCP (Scott Co.), JP (Jasper Co.).

4. P. miliaceum L. Broomcorn Millet. July. Waste place; this cultivated eurasian grass rarely escapes from cultivation, Pearl River Co.

5. P. rigidulum Bosc ex Nees.

1. Blades usually 5-12 mm wide, flat, mostly glabrous; ligules membranous, 0.3-1 mm long.
  2. Spikelets 1.6-2.5 mm long, over 0.6 mm wide, green or purplish-tinged . . . . . . . . . . . 5a. var. rigidulum.
  2. Spikelets 2.4-3 mm long, less than 0.6 mm wide, stipitate, usually purple . . . . . . . 5b. var. elongatum.
1. Blades usually 2-7 mm wide, often involute, pilose above at least near base; ligules membranous, usually fimbriate-ciliate, 0.5-3 mm.
  3. Spikelets 2-2.7 mm long, green or purplish-stained, often obliquely set on pedicels . . . 5c. var. pubescens.
  3. Spikelets 2.6-3.7 mm long, usually purple and slender, erect on pedicels . . . . . . . . . . . 5d. var. combsii.

5a. P. rigidulum var. rigidulum. July-Oct. Marshes, low woods, wet meadows, borders of streams, lakes and ponds, ditches and other wet or moist places; common throughout. P. agrostoides Spreng.--S; P. agrostoides Spreng. var. agrostoides--F,G,R; P. condensum Nash--S; P. agrostoides var. condensum (Nash) Fern.--F,R; P. agrostoides var. ramosius (Mohr) Fern.--F.

5b. P. rigidulum var. elongatum (Scribner) Lelong. July-Oct. Same habitats as 5a; this predominantly northern var. doubtfully occurs in the State; reported for Lawrence and Stone Cos. P. stipitatum Nash--S,F,R; P. agrostoides Spreng. var. elongatum Scribn.--G.

5c. P. rigidulum var. pubescens (Vasey) Lelong. July-Oct. Pine savannahs, bogs, ditches and other moist, open, sandy areas; LPR and CPM. P. longifolium Torr.--S; P. longifolium Torr. var. longifolium--F,G,R; P. longifolium var. pubescens (Vasey) Fern.--F.

5d. P. rigidulum var. combsii (Scribner & Ball) Lelong. Sept.-Oct. Marshes, shores of lakes and ponds; rare, Harrison Co. P. combsii Scribn. & Ball--S; P. longifolium Torr. var. combsii Fern.--F,G,R.

6. P. anceps Michaux. June-Oct. Primarily moist sandy areas such as low woods, pine savannahs, fields and ditches,

occasionally on drier sites. Most specimens conform to var. anceps which has falcate spikelets 2.7-3.9 mm long and is common throughout the state. Var. rhizomatum (Hitchc. & Chase) Fern. has spikelets 2.3-2.8 mm long and longer, more slender rhizomes. It occurs chiefly in low pinelands, savannahs and bogs near the coast; LPR, CPM. P. rhizomatum Hitchc. & Chase--S.

7. P. tenerum Beyrich in Trinius. June-Oct. Wet or moist, open, sandy soil, cypress-gum ponds, bogs near the coast, LPR, CPM, George, Harrison and Jackson Cos.

8. P. hemitomon Schultes. Maidencane. May-July. Marshy shores of lakes and ponds, stream banks, ditches, often in shallow water; LPR, CPM, Forrest and Jackson Cos.

9. P. hians Elliott. May-Oct. Wet to moist soil along ponds and streams, marshes, ditches, seldom on drier sites; throughout.

10. P. virgatum L. Switchgrass. June-Oct. Mostly moist, open areas such as fresh-water or brackish marshes, shores of ponds and streams, and savannahs; also drier sites such as open woodlands, prairies and dunes; throughout. Incl. P. virgatum var. cubense Griseb.--S,F. This common grass is quite variable. Smaller plants with spikelets about 3 mm long are recognized by some as var. cubense; robust specimens with congested panicles and spikelets up to 5.5 mm long intergrade somewhat with the coastal P. amarum var. amarulum.

11. P. amarum Ell. July-Oct. Coastal sandy beaches, dunes and swales; CPM, Harrison and Jackson Cos. Most of our plants belong to var. amarulum (Hitchc. & Chase) Palmer (P. amarulum--S,F,G,R) with large, flexuous and densely flowered panicles and spikelets 4-5.8 mm long. The predominantly northern var. amarum has smaller panicles, usually less than 4 cm wide and spikelets 5-6.5 mm long. Palmer, P.G. 1975. A biosystematic study of the Panicum amarum-amarulum complex (Gramineae). Brittonia 27(2):142-150.

12. P. repens L. Torpedo grass. May-Dec. Coastal sandy beaches; sandy shores of lakes, ponds and streams, often extending onto water, roadsides, ditches, waste places; CPM, LPR, Forrest, Hancock, Jackson and Lamar Cos. Incl. P. gouini Fourn.--S, an uncommon dwarf form with small, densely flowered panicles of purplish spikelets which should possibly be recognized as a variety of this widespread grass.

13. P. verrucosum Muhl. July-Oct. Usually in moist or wet, sandy, open areas such as shores, swamp borders, low disturbed pinelands and ditches; CPM, LPR, NCP, Oktibbeha Co.

14. P. brachyanthum Steudel. Oct. Only one specimen

collected Oct. 5, 1962 by Dr. S. McDaniel in a roadside ditch 1 mi. n.w. of Ellisville, Jones Co. (LPR) was seen.

15. P. gymnocarpon Ell. Aug.-Oct. Muddy swamps, often in dense shade, marshy shores of streams and lakes, occasionally in shallow water; YMD, TRH (Tishomingo Co.), NPB, LPR.

Species Nos. 16-40 are placed by Hitchcock and Chase (1910, 1950) in the subgenus Dichanthelium raised to generic level by Gould (1974). They are perennial and form an overwintering basal cushion or rosette of leaves, often quite dissimilar to cauline leaves. Most of them produce large terminal panicles in the spring and numerous smaller panicles on much reduced axillary branches the rest of the year. The bushy, fascicled appearance of these grasses in the summer and fall is often quite different from the unbranched vernal form with relatively large blades and panicles.

16. P. depauperatum Muhl. Dry, open woodlands, grasslands, roasides; TRH, NPB, NCB, LPR. Dichanthelium depauperatum (Muhl.) Gould.

17. P. laxiflorum Lam. Mesic or low woods, usually shady, open woods, woodland borders; throughout. Incl. P. xalapense HBK--S; Dichanthelium laxiflorum (Lam.) Gould.

18a. P. strigosum Muhl. var. strigosum. Spikelets 1.1-1.7 mm long, glabrous; blades variously pubescent. Sandy pinelands, savannahs, bogs; CPM, LPR, NCP. Dichanthelium leucoblepharis (Trinius) Gould & Clark var. pubescens (Vasey) Gould & Clark; D. strigosum var. strigosum Freckmann. Freckmann, R.W. 1981. The correct name for D. leucoblepharis and its varieties. Brittonia 33:457-458.

18b. P. strigosum Muhl. var. glabrescens (Grisebach) Lelong. Spikelets 1.1-1.9 mm long, glabrous; blades essentially glabrous. Sandy pinelands, savannahs, bogs; CPM, LPR, Jackson Co. P. polycaulon Nash--S; P. strigosum Muhl.--R, in part; Dichanthelium leucoblepharis var. glabrescens (Griseb.) Gould & Clark; P. strigosum var. glabrescens Freckmann.

18c. P. strigosum Muhl. var. leucoblepharis (Trinius) Lelong. Spikelets 1.6-2.1 mm long, pubescent; blades usually glabrous. Sandy moist pinelands, savannahs, bogs; CPM, LPR, Harrison and Jackson Cos. P. ciliatum Ell.--S,F,R; Dichanthelium leucoblepharis var. leucoblepharis Gould & Clark; D. strigosum var. leucoblepharis Freckmann.

19. P. nudicaule Vasey. Wet savannahs, bogs, Sphagnum mats, margins of cypress swamps; uncommon, CPM, LPR, George, Greene, Hancock, Harrison and Jackson Cos.

20. P. sphaerocarpon Ell. Sandy, usually open and dry

areas, woodland borders, roadsides; common throughout, possibly somewhat less common in YMD. Incl. *P. sphaerocarpon* var. *inflatum* (Scribn. & Smith) Hitchc.--F; *Dichanthelium sphaerocarpon* (Ell.) Gould var. *sphaerocarpon* Gould & Clark.

21. *P. polyanthes* Schultes. Low woods, woodland openings, stream banks, ditches, usually in shade; throughout, most common northward. *Dichanthelium sphaerocarpon* (Ell.) Gould var. *isophyllum* (Scribner) Gould & Clark.

22. *P. erectifolium* Nash. Moist to wet, sandy pinelands, bogs, marshes, pond margins; CPM, LPR, Jackson Co. *Dichanthelium erectifolium* (Nash) Gould & Clark.

23. *P. aciculare* Desvaux ex Poiret. Dry, sandy, open pine-oak woods, cut-over woodlands, roadsides; throughout except TRH, YMD, and LBH, most common in s. part of State. Incl. *P. neuranthum* Griseb.--S,R; *P. ovinum* Scribner & Smith--S; *P. arenicoloides* Ashe--S; *P. chrysopsidifolium* Nash--S; *Dichanthelium aciculare* (Desv. ex Poir.) Gould & Clark, in part. This taxon grades into *P. angustifolium*; it also approaches *P. portoricense* which has usually smaller spikelets, puberulent sheaths and wider puberulent blades. Allred, K.W. and F.W. Gould. 1978. Geographic variation in the *Dichanthelium aciculare* complex (Poaceae). Brittonia 30:497-504.

24. *P. angustifolium* Ell. Dry, sandy, open pine-oak woods, clearings, roadsides, occasionally on moist sites; essentially same range as *P. aciculare*. Incl. *P. fusiforme* Hitchc.--S,F,G,R; *Dichanthelium aciculare* (Desv. ex Poir.) Gould & Clark, in part. Occasional troublesome specimens are intermediate between this taxon and *P. aciculare*.

25. *P. consanguineum* Kunth. Low pinelands, savannahs, bogs, cut-over sandy pine woods; primarily CPM, LPR, occasionally northward NCP (Kemper Co.), Union Co. *Dichanthelium consanguineum* (Kunth) Gould & Clark. Occasional specimens resemble closely unusually pubescent plants of the preceding species.

26a. *P. portoricense* Desvaux ex Hamilton var. *portoricense*. Spikelets 1.5-1.8 mm long, puberulent to glabrous; blades up to 5 cm long and 4.5 mm wide. Sand dunes along coast, sandy pine-oak woods, low pinelands; CPM, Jackson and Harrison cos. *Dichanthelium sabulorum* (Lam.) Gould & Clark var. *thinium* (Hitchc. & Chase) Gould & Clark, in part.

26b. *P. portoricense* Desv. ex Hamilt. var. *nashianum* (Scribner) Lelong. Spikelets 1.9-2.6 mm long, rarely longer, usually densely papillose-pubescent or puberulent; blades up to 7 cm long and 8 mm wide. Same habitats and range as var. *portoricense*, often on moist sites. Incl. *P. lancearium* Trin.--S,F,G,R; *P. patulum* (Scribn. & Merr.) Hitchc.--S; *P. lancearium* var. *patulum* Fern.--F; *P. patentifolium* Nash--S; *P.*

webberianum Nash--S,R; Dichanthelium sabulorum (Lam.) Gould & Clark var. patulum Gould & Clark, in part. This variable taxon resembles closely the preceding var. It also grades into P. commutatum through forms recognized by some as P. patentifolium. Occasional specimens conforming to P. webberianum suggest the widespread P. sphaerocarpon.

27. P. dichotomum L.

1. Blades of leaves at midculm seldom over 7 mm wide, often narrowed or constricted at base. Nodes usually glabrous or slightly pubescent.
  2. Culms erect, terete.
    3. Blades usually spreading; spikelets ellipsoid, 1.8-2.3 mm long . . . . . . . . . . 27a. var. dichotomum.
    3. Blades often erect or ascending; spikelets obovoid, 1.5-1.9 mm long, often purplish at base . . . . . . . . . . . . . . . . . . . . 27b. var. roanokense.
  2. Culms weak, reclining or sprawling, occasionally flattened . . . . . . . . . . . . . . . . 27c. var. lucidum.
1. Blades of leaves at midculm usually 7-14 mm wide, usually not constricted at base or subcordate. Nodes usually densely bearded with retrorse hairs.
  4. Spikelets 1.5-1.8 mm long, usually glabrous . . . . . . . . . . . . . . . . . . . . . 27d. var. ramulosum.
  4. Spikelets 1.8-2.5 mm long, rarely longer, pubescent . . . . . . . . . . . . . . . . . . . . . 27e. var. nitidum.

27a. P. dichotomum L. var. dichotomum. Dry to mesic woods, occasionally in moist woodlands; throughout. Incl. P. barbulatum Michx.--S; P. dichotomum var. barbulatum Wood--F; Dichanthelium dichotomum (L.) Gould var. dichotomum, in part.

27b. P. dichotomum L. var. roanokense (Ashe) Lelong. Moist to wet pinelands; rare near coast, CPM, LPR, Jackson and Perry Cos. P. roanokense Ashe--S,F,G; P. caerulescens Hack.--S,F; P. dichotomum L.--R, in small part; Dichanthelium dichotomum (L.) Gould var. dichotomum, in small part. This var. exhibits features of P. sphaerocarpon, P. erectifolium and possibly also P. portoricense.

27c. P. dichotomum L. var. lucidum (Ashe) Lelong. Wet woods, swamps, bogs, margins of ponds and streams; CPM, LPR. Incl. P. Sphagnicola Nash--S; P. lucidum Ashe--S,F,G; P. lucidum var. opacum Fern.--F; P. dichotomum L.--R, in small part; Dichanthelium dichotomum (L.) Gould var. dichotomum, in small part.

27d. P. dichotomum L. var. ramulosum (Torrey) Lelong. Low woods, swamps, borders of streams and ponds; throughout. P. microcarpon Muhl.--S,F; P. nitidum Lam. var. ramulosum Torr.--G; P. dichotomum L.--R, in part; Dichanthelium dichotomum (L.) Gould var. dichotomum, in part.

27e. P. dichotomum L. var. nitidum (Lam.) Wood. Essentially same habitats as var. ramulosum; CPM, LPR, reportedly also in Noxubee and Oktibbeha Cos. P. nitidum Lam.--S,F,G; P. dichotomum L.--R, in small part; Dichanthelium dichotomum (L.) Gould var. dichotomum, in small part. This var. which is fairly distinct in the n. part of its range intergrades largely with the preceding var. in our range.

28. P. tenue Muhl. Moist to dry, sandy, open woods, pine savannahs, bogs, disturbed sites; mostly CPM and LPR, NCP. Incl. P. albomarginatum Nash--S,F,G; P. flavovirens Nash--S; P. trifolium Nash--S,F; P. ensifolium Baldw.--G, in part; Dichanthelium dichotomum var. tenue (Muhl.) Gould & Clark. This species exhibits characteristics of P. sphaerocarpon, P. dichotomum var. dichotomum and P. ensifolium.

29a. P. ensifolium Baldwin ex Ell. var. ensifolium. Sheaths glabrous; blades usually puberulent beneath and glabrous or rarely pubescent above. Moist to wet sandy, open pine woods, savannahs, bogs, Sphagnum mats; CPM, LPR. Incl. P. vernale Hitchc. & Chase--S; Dichanthelium dichotomum var. ensifolium (Baldw.) Gould & Clark, in part.

29b. P. ensifolium Baldwin ex Ell. var. curtifolium (Nash) Lelong. Sheaths sparsely spreading-pilose; blades often sparsely pilose on both surfaces or glabrous. Same habitats and range as typical var. P. curtifolium Nash--S,R; Dichanthelium acuminatum (Swartz) Gould & Clark var. implicatum (Scribner) Gould & Clark, in small part.

30. P. chamaelonche Trinius. Moist, open, sandy pinelands, savannahs, moist depressions in sand dunes; CPM, LPR, Green, Harrison, Jackson Cos. Incl. P. glabrifolium Nash--S; Dichanthelium dichotomum var. ensifolium (Baldwin) Gould & Clark, in part; D. dichotomum var. glabrifolium (Nash) Gould & Clark, in part.

31. P. wrightianum Scribner. Low pine savannahs, bogs, margins of ponds, streams and cypress swamps; CPM, LPR, Hancock, Harrison and Jackson Cos. Dichanthelium acuminatum (Swartz) Gould & Clark var. wrightianum (Scribn.) Gould & Clark.

32. P. acuminatum Swartz.

1. Culms and sheaths densely and variously pubescent.
  2. Culms and sheaths densely spreading villous and often also inconspicuously puberulent beneath; blades undersurface softly pubescent 32a. var. acuminatum.
  2. Culms and sheaths ascending to spreading papillose-pilose; blades densely to sparsely appressed-pilose or puberulent beneath.

3. Blades usually more than 6 mm wide, spreading, short-pilose to nearly glabrous above; spikelets 1.5-1.8 mm long . . . . . . . . . 32b. var. fasciculatum.
3. Blades usually less than 6 mm wide, ascending to retrorse, long-pilose or scattered villous above; spikelets 1.1-1.6 mm long.
4. Blades ascending, long-pilose above; spikelets 1.3-1.6 mm long, often broadly obovoid . . . . . . . . . . . . . . . . 32c. var. unciphyllum.
4. Blades ascending to reflexed, glabrous or sparsely villous above; spikelets 1.1-1.5 mm long, ellipsoid . . . . . . . . . 32g. var. leucothrix.
1. Culms and sheaths usually glabrous, occasionally sparsely pilose, especially lowermost ones.
5. Blades often yellowish-green with long papillose cilia at base; spikelets 1.3-1.6 mm long, often obovoid . . . . . . . . . . . . . . 32d. var. lindheimeri.
5. Blades often dark-green or purplish, usually less conspicuously ciliate at base; spikelets 1.1-1.9 mm long, ellipsoid.
6. Panicles narrow, congested; spikelets 1.3-1.9 mm long . . . . . . . . . . . . . . . . 32e. var. densiflorum.
6. Panicles open; spikelets 1.1-1.5 mm long . . . . . . . . . . . . . . . . . 32f. var. longiligulatum.

32a. P. acuminatum Swartz var. acuminatum. Various habitats, especially moist, sandy, open sites, pinelands, savannahs, roadsides; throughout, especially common in s. part of State. P. lanuginosum Ell.--S,R in part; P. lanuginosum var. lanuginosum--F,G; P. auburne Ashe--S,F,G; P. thurowii Scribn. & Smith--S; Dichanthelium acuminatum (Swartz) Gould & Clark var. acuminatum, in part; D. acuminatum var. thurowii (Scribn. & Smith) Gould & Clark.

32b. P. acuminatum var. fasciculatum (Torrey) Lelong. Various habitats, especially dry, open disturbed sites, woodlands, roadsides; throughout. P. lanuginosum var. fasciculatum (Torr.) Fern.--F,G; P. huachucae Ashe--S; P. tennesseense Ashe--S; P. lanuginosum Ell.--R, in part; Dichanthelium acuminatum (Swartz) Gould & Clark var. acuminatum, in part.

32c. P. acuminatum var. unciphyllum (Trinius) Lelong. Dry to moist, open, mostly sandy woods, pinelands, disturbed sites; CPM, LPR, Hancock, Lamar and Stone Cos. P. lanuginosum var. implicatum (Scribn.) Fern.--F,G; P. lanuginosum Ell.--R, in small part; Dichanthelium acuminatum var. implicatum (Scribn.) Gould & Clark; D. sabulorum (Lam.) Gould & Clark var. thinium (Hitchc. & Chase) Gould & Clark, in part.

32d. P. acuminatum var. lindheimeri (Nash) Lelong. Dry, sandy or clayey open areas, woodlands, roadsides, occasionally on moist sites; common throughout. P. lindheimeri Nash--S; P.

lanuginosum Ell--R, in part; P. lanuginosum var. lindheimeri (Nash) Fern.--F,G; Dichanthelium acuminatum var. lindheimeri (Nash) Gould & Clark. This var. intergrades somewhat with var. fasciculatum and var. unciphyllum.

32e. P. acuminatum var. densiflorum (Rand & Redfield) Lelong. Wet to moist, open, sandy areas, savannahs, bogs; this predominantly n. var. occurs uncommonly in CPM, LPR, Jackson, Pearl River, Stone Cos. P. spretum Schultes--S,F,R; P. lanuginosum var. lindheimeri (Nash) Fern.--G, in part; Dichanthelium acuminatum var. densiflorum Gould & Clark. This var. intergrades somewhat with var. longiligulatum more common in our range. It also suggests the more widespread var. lindheimeri occurring usually in drier habitats.

32f. P. acuminatum var. longiligulatum (Nash) Lelong. Low pinelands, pine savannahs, bogs; CPM, LPR, abundant in appropriate habitats. Harrison, Jackson, Lamar, Pearl River, Stone Cos. P. longiligulatum Nash--S,R; P. lanuginosum var. lindheimeri (Nash) Fern.--G, in part; Dichanthelium acuminatum var. longiligulatum Gould & Clark.

32g. P. acuminatum var. leucothrix (Nash) Lelong. Low pinelands, pine savannahs, bogs; CPM, LPR, occurring usually with preceding var., perhaps somewhat less abundantly; CPM, LPR. P. leucothrix Nash--S,F,G,R; Dichanthelium acuminatum var. implicatum Gould & Clark, in small part.

P. acuminatum is probably the most polymorphic and troublesome species in the genus. The present delimitation of recognized vars. does not fully or adequately reflect the intricate subreticulate pattern of morphological variations exhibited in this complex. The glabrous or subglabrous vars. reluctantly included in this species intergrade somewhat with the similarly polymorphic P. dichotomum. Other taxa of subg. Dichanthelium apparently contribute also to the great morphological variety of this ill-defined species. Freckmann (1981) has recently proposed a slightly different treatment of taxa in the P. acuminatum complex.

33a. P. ovale Ell. var. ovale. Spikelets 2.6-3 mm long, sheaths appressed or ascending-pilose. Dry, sandy, open pine-oak woods, woodland borders; this var. occurs primarily in Fla; it has been reported for Miss. but no specimen from the State was located. Incl. P. malacon Nash--S,R, in part; P. commonsianum Ashe--F, in part; Dichanthelium ovale (Ell.) var. ovale. This taxon may be confused with P. consanguineum which is much more densely pubescent throughout and occurs usually in moist pinelands and bogs.

33b. P. ovale var. pseudopubescens (Nash) Lelong. Spikelets 2.1-2.6 mm long, sheaths appressed or ascending pilose, occasionally with smaller hairs intermixed. Same dry, sandy, open habitats as var. ovale; throughout except possibly LBH and YMD. P. commonsianum Ashe--S,F,G,R; P. pseudopubescens Nash--S; P.

villosissimum Nash var. pseudopubescens Fern.--F,G; Dichanthelium ovale var. addisonii (Nash) Gould & Clark.

33c. P. ovale var. villosum (A. Gray) Lelong. Spikelets 2.1-2.5 mm long, sheaths densely spreading pubescent with hairs up to 3 mm long. Same dry, sandy, open habitats as other vars.; throughout except possibly LBH and YMD. P. villosissimum Nash--S,R; P. villosissimum var. villosissimum--F,G; Dichanthelium acuminatum var. villosum (A. Gray) Gould & Clark. This widespread var. grades into the more glabrous var. pseudopubescens. Occasional specimens approach long-spikelet form of P. acuminatum.

34. P. scoparium Lam. Moist to wet, open areas, often on disturbed sites, roadside ditches; common throughout. Dichanthelium scoparium (Lam.) Gould. This robust plant is one of the few distinctive species of the subgenus; occasional small specimens resemble P. acuminatum var. acuminatum of which this taxon appears to be an "enlarged version."

35a. P. oligosanthes Schultes var. oligosanthes. Spikelets ellipsoid to oblong-obovoid, 3.4-4.2 mm long, usually pubescent; blades relatively long and narrow, up to 12 cm long and 8 mm wide. Dry, open, sandy pine-oak woods, clearings, woodland borders; throughout except possibly TRH and YMD. Dichanthelium oligosanthes (Schultes) Gould var. oligosanthes.

35b. P. oligosanthes var. scribnerianum (Nash) Fern. Spikelets broadly obovoid to ellipsoid, 2.7-3.5 mm long, usually glabrous; blades relatively short and wide, up to 10 cm long and 13 mm wide. Dry, open, clayey, loamy or sandy areas, prairies, open woodlands; PR, NPB, Chickasaw, Lowndes and Oktibbeha Cos. P. scribnerianum Nash--S; P. oligosanthes Schultes--G,R, in part; Dichanthelium oligosanthes var. scribnerianum (Nash) Gould. This predominantly midwestern var. intergrades somewhat with var. oligosanthes which occurs mostly in the Coastal Plain.

36. P. ravenelii Scribn. & Merr. Dry, sandy, open pine-oak woods; throughout except possibly YMD and LBH. Dichanthelium ravenelii Gould.

37a. P. commutatum Schultes var. commutatum. Culms and sheaths usually glabrous or sparsely pubescent; blades thin, often over 10 mm wide; spikelets 2.6-3.2 mm long. Mostly shaded, mesic or low woods, hammocks, pine-oak woods, woodland borders; throughout. Incl. P. joorii Vasey--S; P. mutabile Scribn. & J. G. Smith--S,F,G; P. commutatum var. joorii (Vasey) Fern.--F; Dichanthelium commutatum (Schultes) Gould, in large part. This var. is one of the most widespread, common and variable taxon in the subgenus.

37b. P. commutatum var. ashei Fern. Culms and sheaths densely crisp-pubescent; blades thickish, less than 10 mm wide;

spikelets 2.2-2.7 mm long. Occurring in similar habitats as preceding var. but often on more open or disturbed sites, woodland borders, roadsides; same distribution as preceding var. but less common. Coahoma, Newton, Pike and Tishomingo Cos. P. ashei Pearson--S; P. commutatum Schultes--F,G,R, in part; Dichanthelium commutatum Gould, in part. This ill-defined var. is reluctantly recognized; it may consist of an unnatural assemblage of similar forms possibly derived from occasional introgression of other species of the subgenus.

38. P. scabriusculum Ell. Wet to moist, sandy, usually open areas, stream banks, pond margins, pine savannahs, bogs, cypress-gum ponds, swamps, ditches, often in shallow water at least seasonally; CPM, LPR, also Clarke Co. Incl. P. cryptanthum Ashe--S,F; P. scabriusculum var. cryptanthum (Ash) Gleason--G; Dichanthelium scabriusculum (Ell.) Gould & Clark. Occasional weak forms of this robust grass with slender spikelets have been referred by some to P. cryptanthum; they suggest robust variants of P. dichotomum.

39. P. clandestinum L. Moist, usually sandy, open or shaded sites, low woods, stream banks, woodland borders, roadside ditches; primarily n.e. part of State, TRH, NPB, NCP. Dichanthelium clandestinum (L.) Gould. This plant approaches closely the northern P. latifolium of mesic woods; it resembles also the smaller coastal P. scabriusculum which has smaller, ovoid, glabrous spikelets.

40. P. boscii Poiret. Mesic to dryish woods, usually shady; throughout, more common northward. Incl. P. boscii var. molle (Vasey) Hitchc. & Chase--S.F; Dichanthelium boscii (Poiret) Gould & Clark. Most specimens of this widespread and variable species are more or less densely and variously pubescent; occasional glabrous specimens with shorter spikelets resemble closely the more northern P. latifolium occurring in similar habitats.

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NOTES ON THE GENUS *CLERODENDRUM* (*VERBENACEAE*). XXVII

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*CLERODENDRUM* Burm.

Additional bibliography: Arthur, Sympos. Phytochem. 241. 1954; Kow, Pharmacog. Stud. Crude Drugs 60. 1966; W. Afr. Journ. Biol. Appl. Chem. 11: 66. 1967; Mold., Phytologia 61: 164--188. 1986.

*CLERODENDRUM INGRATUM* Lauterb. & K. Schum.

Inflorescence issuing from the axils of fallen leaves, dichasial, regularly twice dichotomous, few-flowered; peduncles 5--6 cm. long; cymes about 8 cm. long; pedicels 5--10 mm. long; calyx infundibular, herbaceous, at first green, later red, about 14 mm. long, the tube 7 mm. long, externally glabrous, divided to about the middle, the lobes oblong-triangular, apically acute; corolla elongate, at first yellowish, later white, in all about 2 cm. long, externally sparsely puberulent, the largest lobe 12 mm. long; stamens long-exserted, about 3.2 cm. long, inserted 2.8 cm. above the base of the corolla-tube; style long-exserted; ovary 2 mm. long; fruit drupaceous, at first dark-green but finally blue-black.

This species is based on *Lauterbach 810* from cultivated ground in front of Singapore House, Finschhafen, Territory of New Guinea, collected on September 25, 1890. Lauterbach & Schumann (1900) remark that "Bei erster Betrachtung erinnert diese Art in der Tracht an *Cl. inerme* Gärtn., sie ist aber schon durch die grösseren, tief getheilten Kelche ganz verschieden".

The species has been encountered in dry, open, grassy, and cultivated areas and in the understory of disturbed lowland-type rainforests, in flower in March and July to November, and in fruit in October.

The corollas are said to have been "white" on *Nyman 818*, "yellowish to white" on *Lauterbach 810* and "yellow to pink" on *Havel & Kairo NGF 17288*.

Hartley & his associates (1973) report alkaloids present in the leaves and fruit of this species, based on a number *10218* collection from Markham Valley, New Guinea, but bulk material, they say, was not available for accurate measurement.

Lam (1924) cites *Lauterbach 810*, *Nyman 818*, and *Weinland 245* & *271* from northeastern New Guinea. In his 1919 work he asserts that the species is closely related to *C. kalaotoense* H. J. Lam which has larger leaves, the calyx and corolla-lobes are smaller, and the corolla-tube is externally glabrous.

A key to help distinguish *C. ingratum* from other Indonesian taxa will be found under *C. klemmei* Elm. in the present series of notes.

Material of *C. ingratum* has been misidentified and distributed in some herbaria as *C. disparifolium* f. *eriosiphon* (Schau.) Bakh. and even as *Saxifragaceae*.

Citations: GREATER SUNDA ISLANDS: Kalimantan: *Posthumus 2084* (Bz--

19724). Kangean: *Backer 27509* (Bz--19728, Bz--19729, Bz--19730, Bz--25509, N); *Dommers 30* (Bz--19167, Bz--25499), *31* (Bz--19166), *282* (Bz-19731). Sepandjang: *Backer 28899* (Bz--19726), *29030* (Bz--19725). Sepapan: *Backer 28536* (Bz--19727, Bz--25510). NEW GUINEA: Territory of New Guinea: *Havel & Kairo NGF.17288* (Ld, Mu, Mu); *Lauterbach 810* (Bz--19732--isotype, Ld--photo of isotype, N--photo of isotype).

*CLERODENDRUM INSOLITUM* Mold., Amer. Journ. Bot. 38: 325. 1951.

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Illustrations: Mold. in Humbert, Fl. Madag. 174: 205, fig. 33 (3). 1956.

A small tree; branchlets and twigs slender, obtusely tetragonal, densely tomentulose-villosulous with sordid-brownish hairs on the younger parts, glabrescent on the older parts; nodes sometimes obscurely annulate on the younger twigs; principal internodes 0.5--5.5 cm. long, mostly abbreviated; leaves decussate-opposite; petioles slender, 6--12 mm. long, canaliculate above, densely puberulent or short-pubescent with subincanous hairs; leaf-blades coriaceous, rather grayish-green above, brighter green beneath, elliptic or elliptic-obovate, rarely ovate, 2--9 cm. long, 1.5--4.5 cm. wide, apically mostly rounded and subemarginate, rarely obtuse, marginally entire, basally rounded or obtuse or even acute, very finely and obscurely puberulous above, scattered-pilose with flavescent hairs and densely resinous-granular beneath; midrib rather slender, flat above, prominent and very densely flavidous-pubescent beneath; secondaries slender, 5--7 per side, arcuate-ascending, rather irregularly branched, prominulous above and beneath, arcuately joined in many loops near the margins; veinlet reticulation fine, abundant, prominulous on both surfaces; inflorescence axillary, abundant on the young twigs, a pair at each upper node, 5--7 cm. long, divaricate, 1--3-flowered, conspicuously bracteolose in involucrate fashion; peduncles very slender, 1.4--3.7 cm. long, usually rather densely short-pubescent with flavidous hairs; bracts large, foliaceous, pale reddish-green, membranous, a pair at the apex of the peduncles and a pair subtending each lateral flower when the cyme is 3-flowered, ovate-elliptic, 8--10 mm. long, 5--6 mm. wide, apically blunt or obtuse, marginally entire, basally rounded, sessile, subglabrate above, sparsely pilosulous and resinous-granular beneath, conspicuously venose, the venation slightly prominulous on both surfaces; pedicels filiform, 2--15 mm. long, more or less strigillose or glabrescent; calyx campanulate, membranous, pale reddish-green, 10--14 mm. long, 7--9 mm. wide, venose, minutely and obscurely strigillose or glabrate, more or less resinous-granular on the outside, its rim 4- or 5-lobed, the lobes ovate, erect, about 3 mm. long, apically sharply acute, venose; corolla dark-purple, tubular, about 1.5 cm. long, dorsally densely pubescent with antrorse substrigose hairs, its limb small, 7--8 mm. wide, the lobes 2--4 mm. long, dorsally strigose-pubescent; stamens dark-purple; style and stigma pale-yellow; fruiting-calyx hardly accrescent, inflated, membranous, about 15 mm. long and 11--12 mm. wide, very minutely strigillose-puberulent or glabrate; fruit more or less woody, 4-celled, each cell 1-seeded, the seeds attached at the middle of the central angle of the cell.

This endemic species is based on *Humbert 20756* from siliceous sand in a shady littoral forest at Vinanibe, near Fort Dauphin, Madagascar, at 5--50 m. altitude, collected on April 2, 1947, and deposited in the Paris herbarium. The species is known only from sand-dunes and other sandy coastal areas. A key to help distinguish it from the other known Madagascar taxa will be found under *C. baronianum* Oliv. in the present series of notes (58: 184--190).

Citations: MADAGASCAR: *Decary 4221* (P), *4288* (P); *Humbert 20756* (E--photo of type, F--photo of type, Ld--photo of type, N--photo of type, P--type).

*CLERODENDRUM INTERMEDIUM* Cham., Linnaea 7: [105] (sphalm. "150")--106. 1832.

Synonymy: *Clerodendron paniculatum* Perrottet, Mém. Soc. Linn. Paris 3: 110. 1824 [not *C. paniculatum* L., 1767]. *Volkameria inermis* Blanco, Fl. Filip., ed. 1, 511. 1837 [not *V. inermis* L., 1753]. *Bolkameria casopanguil* Blanco, Fl. Filip., ed. 2, 356. 1845. *Volkameria casopanguil* Blanco ex Fern.-Villar & Naves in Blanco, Fl. Filip., ed. 3, 4: pl. 173. 1880. *Clerodendron intermedium* Cham. apud Jacks. in Hook. f. & Jacks., Ind. Kew., imp. 1, 1: 561. 1893. *Volkameria inermis* (haud L.) Blanco ex H. Hallier, Meded. Rijks Herb. Leid. 37: 80 in syn. 1918. *Clerodendron blumeanum* Hallier f. ex E. D. Merr., Enum. Philip. Flow. Pl. 3: 402 in syn. 1923 [not *C. blumeanum* Schau., 1847]. *Clerodendron squamatum* H. Lam ex E. D. Merr., Enum. Philip. Flow. Pl. 3: 402 in syn. 1923 [not *C. squamatum* Vahl, 1791]. *Clerodendron intermedium* C. & S. ex Mold., Alph. List Inv. Names Suppl. 1: 6 in syn. 1947. *Clerodendron intermedium* Champ. apud Masamune, Sci. Rep. Kanazawa Univ. 4: 49 sphalm. 1955.

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Buitenz., ser. 3, 3: 93, 109, & ix. 1921; E. D. Merr., Bibl. Enum. Born. Pl. 517. 1921; E. D. Merr., Enum. Philip. Flow. Pl. 3: 400 & 402. 1923; Stapf, Ind. Lond. 6: 544. 1931; Crevost & Pételot, Bull. Econ. Indo-chine 37: opp. 1296. 1934; Juliano & Guerrero, Philip. Agr. 24: 22--26. 1935; Madrid Moreno, Declar. Virt. Arb. Pl. 131, 132, & 174. 1936; Mold., Alph. List Comm. Names 2--4, 10, 13, 15, 17--19, 23, & 27. 1939; Mold., Prelim. Alph. List Inv. Names 7, 18, 21, 22, & 53. 1940; Worsdell, Ind. Lond. Suppl. 1: 238. 1941; Mold., Alph. List Inv. Names 6, 16, 19, 20, & 56. 1942; Mold., Known Geogr. Distrib. Verbenac., ed. 1, 58, 62--66, 72, & 90. 1942; Mold., Phytologia 2: 100. 1945; Mold., Alph. List Cit. 1: 5, 135, 194, 222, 225, & 320. 1946; Hill & Salisb., Ind. Kew. Suppl. 10: 55. 1947; Mold., Alph. List Inv. Names Suppl. 1: 6. 1947; Mold., Alph. List Cit. 2: 462, 463, 556, & 561 (1948), 3: 707, 727, 740, 765, 837, 840, 842, 859, 960, & 969 (1949), and 4: 1019, 1061, 1104, 1111, 1123, 1140, 1161, 1198, & 1240. 1949; Mold., Known Geogr. Distrib. Verbenac., ed. 2, 133, 141, 143, 145, 146, 159, & 182. 1949; Quisumb., Philip. Dept. Agr. Tech. Bull. 16: 1045. 1951; Masamune, Sci. Rep. Kanazawa Univ. 4: 49. 1955; Mold., Résumé 172, 174, 183, 188, 192--194, 216, 237, 260, 265, 267, 269, 391, 392, & 450. 1959; Rennó, Levant. Herb. Inst. Agron. Minas 149. 1960; Hansford, Sydowia Ann. Myc., ser. 2, Beih. 2: 694. 1961; Mold., Résumé Suppl. 3: 21. 1962; Mold., Biol. Abstr. 47: 6794. 1966; E. D. Merr., Fl. Manila, imp. 2, 401--403. 1968; Mold., Résumé Suppl. 16: 12. 1968; Mold., Fifth Summ. 1: 292, 313, 315, 322, 359, 398, 440, 448, 452, & 456 (1971) and 2: 732, 733, & 867. 1971; Altschul, Drugs Foods 247. 1973; Gibbs, Chemotax. Flow. Pl. 3: 1752. 1974; Hsiao, Fl. Taiwan 4: 420 & 423 (1978) and 6: 121. 1980; Mold., Phytol. Mem. 2: 281, 304, 306, 313, 349, & 538. 1980; Mold., Phytologia 50: 253. 1982; H. N. & A. L. Mold. in Dassan. & Fosb., Rev. Handb. Fl. Ceyl. 4: 448. 1983; Raj, Rev. Palaeobot. Palyn. 39: 358 & 374. 1983; Mold., Phytologia 57: 339 (1985), 58: 195--199, 287, 345, & 416 (1985), and 61: 88, 101, & 166. 1986.

Illustrations: Maund, Botanist 1: pl. 13, 1837; Fern.-Villar in Blanco, Fl, Filip., ed. 3, 6: pl. 173. 1880; Crevost & Pételot, Bull. Econ. Indo-chine 37: opp. 1296. 1934.

A small, erect, branched bush or shrub, 1--2 m. tall, or small tree to 5 m. tall; bark greenish; inner bark pale-green or dark-greenish; sapwood green-whitish; stems tetragonal or subterete, about 1 cm. in diameter at breast height or "a few inches thick, branched from below the middle; main branches widely spreading, recurved, re-branched; wood very soft and pulpy, white; pith large, brown; bark lateritious, yellow-gray on the branches and green beneath the epidermis; branchlets and twigs rather stout, to 2.5 cm. in girth, suberect, very medullose, green or brown, obtusely or acutely tetragonal, very minutely and obscurely pulverulent-puberulent; nodes annulate, the lower ones marked with a narrow band of hirsute hairs; principal internodes 4.5--6 cm. long; leaves decussate-opposite, horizontal; petioles green, stout, 2.3--7.5 cm. long or "occasionally a yard long" (fide Elmer), the lowest 1 cm. often collapsing on larger leaves, very obscurely pulverulent-puberulent or glabrous; leaf-blades chartaceous or subcoriaceous, broadly ovate, 7--30 cm. long, 6.5--26 cm. wide, apically abruptly acute or subacuminate, marginally denticulate, basally deeply cordate, shiny and darker green above, obscurely pulverulent or glabrous and often abundantly light-dotted above, sometimes strigillose with distantly scattered hairs, obscurely pulverulent and densely squamulose beneath; midrib stoutish or slender, flat or subimpressed above, prominent beneath; secondaries slender, 5--7 per side, the 2--4 lowest issuing palmately from the leaf-base, flat or subprominulent above, prominulent beneath; vein and veinlet reticulation comparatively distant and angular, obscure or the larger parts subprominulent above, conspicuous but not at all prominulent beneath; inflorescence terminal, erect, paniculate, 18--30 cm. long, 15--20 cm. wide, composed of 6 or 7 pairs of lax, divaricate cymes, many-flowered, all parts fiery-red or miniaceous in bud; peduncles and sympodia continuous with the twigs and similar in all respects, variable in length; pedicels slender, variable, 1--13 mm. long, glabrate; bracts large and foliaceous, oblong-elliptic, 1--4.5 cm. long, 3--20 mm. wide, long-stipitate, a pair subtending the inflorescence; bractlets oblong or lanceolate to broadly linear, numerous, to 1 cm. long and 2 mm. wide; prophylla oblong or linear, to 5 mm. long; flowers odorless; calyx-lobes red "to black" (fide Elmer), ovate, apically acute, about 1/5 the length of the corolla-tube; corolla bright-red, the tube slender, about 1 cm. long, the limb 5-lobed, the lobes oblong, subequal, spreading; stamens red or purplish, about 2 cm. long, deflexed or recurved; fruiting-calyx enlarged, star-shaped, red, 1 cm. wide, spreading or reflexed; fruit drupaceous, round or depressed-globose (oblate), at first green, later blue, 6--10 mm. long and wide, enclosed when immature, composed of 4 pyrenes which are chartaceous and 1-seeded.

Merrill (1923) says of this species that it is found "Throughout the Philippines in thickets, secondary forests, and open damp places at low and medium altitudes, often common" and that it occurs also in Formosa, Borneo, Celebes, and Sumatra. He continues: "Bakhuizen, perhaps correctly, reduces this to *Clerodendron squamatum* Vahl". Actually, *C. squamatum* Vahl is a synonym of *C. kaempferi* (Jacq.) Sieb. and is quite distinct. On his collection *no. 19* Merrill notes: "widely distributed in damp open places in Luzon".

Collectors have encountered *C. intermedium* in damp soils in old clearings and open places in general, secondary forests, thickets along the edges of lakes, wet stony soil of wooded ravines and parang, on hillsides, near rivers, and along paths in forested valleys and streams, at 20 to 3500 feet altitude, in anthesis in every month of the year, and in fruit in January, April, May, and October. MacDaniels refers to it as "common in pasturelands, occasionally cultivated" in Luzon; Cana calls it a "weed". Gates refers to it as a "tree" in Luzon and Tiong describes it as "a 6-foot ornamental tree" in Sabah.

The corollas are said to have been "red" on *Clemens 17072, MacDaniels 113, Termiji SAN.81251,* and *Williams 2584,* "reddish" on *Tiong SAN.88038,* "scarlet" on *Walker 7450,* "blood-red" on *Ramos & Edaño, Herb. Philip. Bur. Sci. 47107,* "fiery-red" on *Hallier 4090a,* "fiery-red or miniaceous" on *Elmer 13641* and "red and white" on *Wenzel 3292.*

Common and vernacular names reported for this species are "alocasoc", "aloksok", "aguargai", "asuañgai", "balantana", "bantana", "cali-cali", "casopanggil", "casopangil", "casupanguil", "colocolog", "dagtung", "dayugdug kilat", "fun nam", "humang", "igiñga", "kalalauan", "kasopangil", "kasopáñgil", "kássũ pánggil", "kasupángil", "katuñgátun", "kolokolog", "laroan anito", "laroan-anito", "libintano", "macalalauang", "makakalalawang", "mayitum", "mô dỏ", "pacipis", "pakapis", "salinguák","talinongay", and "volcameria casopanguil".

Madrid Moreno (1936) refers to the species as medicinal. Altschul (1973) asserts that the leaves, "with coconut oil", are applied as a plaster to treat headaches, citing, as authority, *Gutiérrez 61-19*. Gibbs (1974) reports the presence of cyanogenesis in the stems, but not in the foliage.

Hansford (1961) reports the species attacked by the fungus, *Meliola clerodendri* P. Henn. in the Philippine Islands, based on *Stevens 337* & *1985*.

Vidal (1885) cites *Cuming 481* from the Philippines. The *Reasoner Bros. s.n.*, cited below, was collected from plants cultivated in Florida, but originally from the Philippines.

Among the inaccuracies and errors in the literature of *Clerodendrum intermedium* may be mentioned that the original Chamisso (1832) reference is cited to page "150" by Dietrich (1843), Jackson (1893), Merrill (1918), and Hsiao (1975) because of a printer's error in designating the first page of the discussion by Chamisso -- the page number should have been printed "105" and is correctly cited as such by Hallier (1918) and Merrill (1923). Hallier, however, erroneously cites the Miquel (1858) reference to this species as "1856" -- pages 705--880 of Miquel's work were not issued until April 8, 1858. The *Cuming 481*, cited below, is sometimes incorrectly cited as "*Cumming 1481*".

The illustration of *C. intermedium* in Maund (1837), hand-colored, shows the corollas scarlet in color in the New York Botanical Garden library copy, but only as pink in the herbarium copy.

Bolster, in the notes accompanying his collection, cited below, refers to the leaves with "lower lobes 4 cm. longer", implying lobed leaf-blades as in *C. paniculatum* L., but I have never seen any lobes on the leaf-blades of *C. intermedium*. Perhaps he meant to say "lower leaves 4 cm. longer". It should be noted that *Elmer 13641* and *Hutchinson, Philip. For. Bur. 4827* show remarkable resemblance to *C. bethunianum* Low, an obviously very closely related species.

Blanco (1837) states that the young shoots and flowers of *Clerodendrum intermedium* are dried and powdered and the powder then placed in the navel and/or umbilical cord of the mother to combat the effects of a baby's death in the womb. "Tiene el olor fastigioso, y los indios la usan bastante en la esta muerta la criatura en el vientre. Su raiz se dice ser purgante tomada en peso de una dracma; pero creo que es falso. Siempre estacon flores."

Masamune (1955) erroneously places *C. intermedium* in the synonymy of *C. japonicum* (Thunb.) Sweet -- along with *C. squamatum* Vahl, *C. viscosum* Vent., and *C. infortunatum* L.!

An interesting example of the difficulty in distinguishing some species of this group in the genus is seen in the case of the *Tsang, Tang, & Fung 7674* collection -- it was apparently first identified as

C. *paniculatum* L,, later corrected to C. *squamatum* Vahl, then to C. *japonicum* (Thunb.) Sweet, then, still later, to C. *kaempferi* (Jacq.) Sieb., and, finally, to C. *intermedium* Cham.

Keys to help distinguish C. *intermedium* from other Chinese and other cultivated taxa in this genus will be found under C. *canescens* Wall. (58: 416) and C. *bethunianum* Low (58: 195--198). Another key that may prove useful is provided by Hsaio (1978) to distinguish it from other Taiwanese species known to him. Slightly modified by me, this is his key:

1. Twining shrubs........................................C. *thomsonae*.
1a. Erect shrubs.
  2. Inflorescence axillary, 3-flowered; calyx-rim truncate.C. *inerme*.
  2a. Inflorescence terminal, in many-flowered cymes or panicles; calyx lobed.
    3. Inflorescence in globose cymose heads; bracts foliaceous.
      4. Calyx and bracts shorter than or as long as the fruits, with large peltate glands..........................C. *philippinum*.
      4a. Calyx and bracts much longer than the fruits, without peltate glands....................................C. *canescens*.
    3a. Inflorescence composed of loose cymes or elongated thyrsi; bracts small, linear.
      5. Leaf-blades with many sand-like glands beneath.
        6. Leaf-blades marginally shallowly toothed, not lobed; inflorescence bright-red......................C. *intermedium*.
        6a. Leaf-blades 3--5-lobed; inflorescence orange-red.......... C. *paniculatum*.
      5a. Leaf-blades without sand-like glands beneath.
        7. Leaf-blades elliptic-lanceolate; corolla-tube short, to 1 cm. long..................................C. *cyrtophyllum*.
        7a. leaf-blades ovate to elliptic; corolla-tube oblong, to 3.5 cm. long.
          8. Branchlets, leaves, and inflorescence densely covered with rust-colored tomentum.............C. *trichotomum* var. *ferrugineum*.
          8a. Branchlets, leaves, and inflorescence glabrous or slightly brownish-puberulent.
            9. Sepals reddish; leaf-blades ovate, pubescent........... C. *trichotomum*.
            9a. Sepals greenish; leaf-blades ovate-lanceolate, subglabrous..................C. *trichotomum* var. *fargesii*.

Because of the confusion in herbaria and literature, it seems worthwhile to quote here Chamisso's original (1832) detailed description and discussion of C. *intermedium*: "caule acute quadrangulo, foliis profunde cordatis ovatis acuminatis acutis subangulatis mucronato-dentatis, supra pilosis, subtus squamatis, panicula terminali glabriuscula e cymis bisbifidus ramulis multifloris constante laciniis calycinis ovatis acutis glabris brevibus quinquies brevioribus tubo corollae vix viscidulo-puberulo, genitalibus corollam plus duplo superantibus. E Luçonis retulimus. Inter C. *squamatum* Vahl (HW. no. 11688 spec. Klein Marmelon Ind. orient. et *Volkameria Kaempferi* Jacq.

ibid. 11683. spec. hort.) et C. *paniculatum* L. (HW. 11689) ambit, proximum superiori, a quo calycibus potissimum differt, floribus insuper multo gracilioribus dimidio fere minoribus, caule acutangulo et foliis non orbiculato, sed ovato-cordatis, antice longius productis, margine conspicius grosse dentatis, dentibus obtusangulis mucronulatis. C. *squamato* nempe laciniae calycinae subpetaloideae, coloratae, lanceolatae, sub anthesi quatuor lineas longae longioresque dimidium tubum corollinum aequant vel superant. Nostro vero vix lineam sunt longae, tubo corollino gracili quinque lineas circiter longo, limbo laciniis oblongis obtusis patente, diametro vix longitudinem tubi aequante, genitalium exserta parte fere pollicari. Similius est floribus C. *paniculato,* qui vero tota inflorescentia uberius viscidulo-puberula et corollae longius tubulosae; diversissimum ab illo foliis. Specimina nostra sunt summitates caulium herbaceae, acutangulae, fistulosae, fere glabrae, ad nodos ut affinium specierum barbatae, paucis foliorum superiorum paribus instructae. Inferiora desunt. Tale folium superius minusque ab insertione petioli ad apicem 3½ poll. metitur, cui longitudini accedit mensura loborum deflectorum 9-lineari, maxima latitudine 2-poll. 9-lin., petiolo 9-lineari. Consistentia, pili superioris paginae, squamulae inferioris omnino laudatarum specierum. Inflorescentia prorsus eadem. Bracteae ramos suffulcientes, superiores saltem, spathulatae, integerrimae; similes at minores ad bifurcationem ramorum. Calyx fructifer auctus, stellatus, diametro 5-lineari. Fructibus bididymus, e quatuor quasi globulis conferruminatis constans, diametro circiter trilineari, reticulatus, glaber; bacca tetrapyrena, pyrenis consistentia chartacea monospermis."

Blanco's *Volkameria inermis* was described by him (1837) as follows: "Volcameria sin espinas. Tallo de recho cuadrado, salpicado de pequeños puntos salientes. Hojas opuestas, alguna vez en estrella de tres en tres, algo acorazonadas, con dientes puntiagudas en las orillas, pelosas por arriba, y con pequeños puntos borrosos á modo de serrin. Peciolos largos. Flores terminales, en panojas umbeladas. Involucro de la umbela parcial, una hojuela con piececito, lanceolada, con tres nervios y barbas blandas en la base. Cal. inferior, tubulado con cinco dientes del color de la corola, y en la madurez grande, revuelto acia abajo. Cor. bilabiada, con el tubo mui largo cilindrico, garganta desnuda, y el labio superior con dos lacinias divergentes: el inferior con unas rayas blancas y con tres lacinias casi iguales. Estam. cuatro, que se inclinan á un mismo lado, fijos cerca de la garganta de la corola, larguisimos casi iguales; pero en la insercion los dos mas altos que los otros. Ant. hechadas sobre los filamentos. Estilo del largo de los estambres. Estigma bifido. Baya deprimida con cuatro lobulos, y un aposento, que contiene cuatro huesecillos, y en cada uno una semilla. = Esta planta conocida y notable por la multitud de sus flores encarnadas, se eleva á la altura de seis ó siete pies. Tiene el olor fastidioso, y los indios la usan bastante en la medicina. Sus cogollos y flores se aplican machacadas al ombligo de la muger parturiente, cuandro esta muerta la criatura en el vientre. Su raiz se dice ser purgante tomada en peso de una dracma; pero creo que es falso. Siempre estacon flores. *T, Casopangil, Laroan Anito, Macalalauang, Igiñga. B, Asuangai, Pacapis, Colocolog, Alocasoc." In his

1845 edition he adds "Esta especie y la siguiente, mas bien del género *Clerodendron*?" In the Fernandez-Villar edition (1880) he cites *Cuming 481* and states that living plants were observed by him in Luzon, Mindanao, Panay, Cebu, and Jolo in the Philippines.

Merrill (1908) cites *Fénix 4145* from Camiguin and comments that the plant is "Very common and widely distributed in the Philippines; endemic, but with very closely allied forms found in Formosa and in Celebes." Actually, however, at least some of the plants in Formosa and Celebes seem to be conspecific. In his 1918 work he cites *Merrill Sp. Blanc. 43*, collected by Quisumbing at Los Baños, Laguna Province, Luzon, on June 25, 1914, as a good illustrative collection, commenting, again, that "This species is common and widely distributed in the Philippines at low and medium altitudes and is commonly known to the Tagalogs as casopanguil. There is no doubt whatever as to the identity of Blanco's *Volkameria casopanguil*, and further no doubt whatever as to its identity with *Clerodendron intermedium* Cham., the type of which was from Luzon, either the Province of Cavite or Batangas."

Backer (1916), in his discussion of what he called *C. squamatum* Vahl, very truly remarks that "Veranderlijk wat betreft de lengte van kelk en kroonbuis. De javaansche exemplaren behooren alle tot de varieteit *japónicum* Hasskarl, waarbij de kelk 10--17 mM hoog is en de kroonbuis 15--20 mM lang. Op Sumatra en ook elders vindt men den typischen vorm, waarbij de kelk 8--10 mM, de kroonbuis 18--25 mM lang is. Op de Philippijnen treft men, behalve deze beide vormen, nog een tusschenvorm aab." His *C. squamatum* we now call *C. kaempferi* (Jacq.) Sieb., his var. *japonicum* is *C. japonicum* (Jacq.) Sieb., and his "intermediate" Philippine form is *C. intermedium* Cham. or *C. bethunianum* Low.

Hallier (1918) cites *Beccari 817* and *Buitendijk s.n.* from Sumatra, *Elbert 3413* and *Weber s.n.* from Celebes, *Elmer 13641* from Mindanao, *Celestino 7335* and *Elmer 9763* from Negros, and *Cuming 481, Hallier 4090* & *4090a,* and *Merrill 19* from Luzon, also reporting its use there in the treatment of headaches.

Hsiao (1932) cites *Hsieh 20* from Taiwan, noting that the species is found only in the southernmost part of the island, but also in "The Philippines and Borneo".

Material of *Clerodendrum intermedium* has been misidentified and distributed in some herbaria as *C. bethunianum* Low, *C. japonicum* (Thunb.) Sweet, *C. kaempferi* (Jacq.) Sieb., *C. paniculatum* L., *C. squamatum* Vahl, and *Volkameria kaempferi* Jacq. On the other hand, the *Bawan & Borromeo, Philip. For. Bur. 24284, Edaño, Philip. Bur. Sci. 24845 26959, Edaño, Philip. Nat. Herb. 3524, Elmer 9763* & *14504, Foxworthy, Philip. Bur. Sci. 786, Herb. Philip. Bur. Sci. s.n., Mangubat, Philip. Bur. Sci. 383, McGregor 221* & *Philip. Bur. Sci. 1725, Mearns 23* & *24, Merrill 3153, Meyer, Philip. For. Bur. 2177,* and *Santos 4193,* distributed as *C. intermedium,* actually are *C. bethunianum* Low, while *Fisher 35509* and *Mello Barreto 4387* are *C. bungei* Steud., *Herb. Usteri s.n.* [23/XII/02], *Mello Barreto 4386, Mendoza 1518,* and *Philip. Nat. Herb. 18525* are *C. kaempferi* (Jacq.) Sieb., and *DeVore & Hoover 177* and *Loher 4423* are *C. puberulum* Merr.

Citations: CHINESE COASTAL ISLANDS: Hainan: *Tsang, Tang, & Fung*

*7674* (N). PHILIPPINE ISLANDS: Alabat: *Ramos & Edaño, Philip. Bur. Sci. 48241* (Ca--321725). Basilan: *DeVore & Hoover 60* (W--449588). Luzon: *Ahern's Collector s.n.* [Merrill, Dec. Philip. For. Fl. 35] (It, Mi, Os, W--447322); *N. J. Andersson s.n.* [Manila, Jan. 1853] (S, S); *Bacani, Philip. For. Bur. 16503* (Bz--20636); *Baltazar s.n.* [F. C. Gates 7907] (Mi); *Bartlett 14174* (Mi); *Borden, Philip. For. Bur. 1324* (W--449981); *Cana s.n.* [Dec. 20, 1930] (Du--222740); *Castillo, Philip. Bur. Sci. 22745* (Bi, W--897931); *Clemens 17072* (Ca--285317); *Elmer 5728* (N, W--852967), *6581* (W--853631), *8084* (Bz--20635, N), *17610* (Bi, Bz--20628, N, W--1237205); *Eschscholtz s.n.* [Manila] (L); *Fénix. Philip. Bur. Sci. 28050* (W--1293796); *Fox, Philip. Nat. Herb. 4666* (Mi); *F. C. Gates 5287* (Ws); *Haenke 572* (N), *573* (N); *Holman 72* (Gg--32019); *MacDaniels 113* (Ba); *E. D. Merrill 19* (Bz--20634, N, W--435019), *1850* (W--436803), *2717* (W--437685); *Miranda s.n.* [May 1910] (Mi); *Quisumbing 289* (Mi), *651* [Merrill Sp. Blanc. 43] (Bz--20629, N, W--903710), *2164* (Ok--17322), *2267* (Ok--17112); *M. Ramos 1889* (Bz--20633), *Philip. Bur. Sci. 2643* (Br, L), *Philip. Bur. Sci. 8098* (L); *Ramos & Edaño, Philip. Bur. Sci. 45357* (Ca--308765), *Philip. Bur. Sci. 47107* (Ca--309735); *C. B. Robinson, Philip. Bur. Sci. 6824* (Bz--20637); *Rodbertus s.n.* [Manila] (B); *F. L. Stevens 669* (Ur); *E. H. Walker 7450* (W--2159176); *Whitford 483* (W--851631), *854* (W--851806); *Wilkes s.n.* [Mts. Luzon] (T, W--40645); *R. S. Williams 2063* (N, N); *Wöhler 49* (S); *Wood, Philip. For. Bur. 13058* (Cm). Masbate: *E. D. Merrill 3065* (W--438035). Mindanao: *Ahern 327* [field no. 27] (W--445667, W--445668), *327Q* (Bz--20630, Bz--20631); *Bolster 241* (Ca--183429); *Elmer 13641* (Bi, Bz--20624, Ca--272949, L, N, Ut--33527, W--1172299); *Hutchinson, Philip. For. Bur. 4827* (N, W--708951); *Wenzel 3292* (Bz--20632, Ca--356194); *C. M. Weber 1101* (Cm); *R. S. Williams 2584* (N). Mindoro: *Bartlett 13431* (Mi). Negros: *Usteri s.n.* [23/XII/02] (N, N). Panay: *C. B. Robinson, Philip. Bur. Sci. 18113* (W--568629). Island undetermined: *Cuming 481* (L, L, X); *Née 11* (Q), *23* (Q). GREATER SUNDA ISLANDS: Celebes: *Buwalda 3800* (Bz--72914); *Donggala 70* (Bz--20648). Sabah: *Kokawa & Hotta 4822* (Sn--100162); *Termiji SAN.81251* (Sn--46720); *Tiong SAN.88038* (Sn--55673). Sumatra: *Bartlett 8700* (Mi); *Bünnemeijer 3110* (Bz--20695, Bz--20696). CULTIVATED: California: *Walther s.n.* [Sept. 1928] (Gg--159825). Florida: *Reasoner Bros. s.n.* [Oneco 1914] (Ar--19851). Germany: *Herb. Hort. Bot. Berol. s.n.* [1837] (B), *s.n.* [Aug. 1844] (B). Honduras: *P. C. Standley 56847* (A, F--582156, Ld--photo, N--photo, W--1409428). Philippine Islands: *Cana s.n.* [College Campus, Dec. 20, 1930] (Hp); *Garcia s.n.* [Manila J. Bot.] (V); *Wichura 1796* (B). LOCALITY OF COLLECTION UNDETERMINED: *Marcovicz s.n.* [27.VII.26] (L). MOUNTED ILLUSTRATIONS: Crevost & Pételot, Bull. Econ., Indochine 37: opp. 1296. 1934 (Ld); Maund, Botanist 1: pl. 13. 1837 (N).

*CLERODENDRUM INTERMEDIUM* f. *ALBIFLORUM* Mold., Résumé Suppl. 3: 21 nom. nud. 1962; Phytologia 12: 477. 1966.

Bibliography: Mold., Résumé Suppl. 3: 21. 1962; Hocking, Excerpt. Bot. A,11: 103. 1966; Mold., Biol. Abstr. 47: 6794. 1966; Mold., Phytologia 12: 477. 1966; Mold., Fifth Summ. 1: 315 (1971) and 2: 867. 1971; Mold., Phytol. Mem. 2: 306 & 538. 1980.

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

The form is based on an unnumbered Francesco Guerrero [sphalm: "Fuerrero"] collection from Arayat, Panpanga Province, Luzon, Philippine Islands, collected in 1927 and deposited in the University of California herbarium at Berkeley. The collector notes: "En uno de las cajas que v. recibirá del transporte Thomas incluí dos plantas para que v. me dijese si el '*Clerodendron*' de flores blancas es una simple variedad de la '*intermedium*' muy conocido; pero lo que en realidad es para mí de mucho interés es el '*Hibiscus*' de flores de color de púrpurea que me remitieron de Arayat como remedio contra la tos."

Nothing further is known to me of this taxon.

Citations: PHILIPPINE ISLANDS: Luzon: F. *Guerrero s.n.* [Arayat, Panpanga Prov., 1927] (Ca--323811--type).

*CLERODENDRUM INVOLUCRATUM* Vatke, Linnaea 43: 537 [as "*Clerodendron*"]. 1882; Mold., Known Geogr. Distrib. Verbenac., ed. 1, 53 & 90. 1942.

Synonymy: *Clerodendron involucratum* Vatke, Linnaea 43: 537. 1882. *Dirichletia involucrata* J. G. Baker, Journ. Linn. Soc. Lond. Bot. 22: 482. 1887. *Dirichletia sphaerocephala* J. G. Baker, Journ. Linn. Soc. Lond. Bot. 25: 321--322. 1890. *Dirichletia involucratum* Baker apud Verdcourt, Kew Bull. Misc. Inf. 1953: 119 in syn. 1953.

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Illustrations: Mold. in Humbert, Fl. Madag. 174: 183, fig. 29 (7--9). 1956.

A shrub, 2 m. tall, or small tree, sometimes merely suffrutescent; branches medium-stout, obtusely tetragonal, compressed at the nodes, grayish, minutely puberulent or glabrescent; branchlets and twigs numerous, slender, often short, mostly obscurely tetragonal, very densely puberulent with flavidous or cinereous hairs on the youngest parts, less densely so on the older parts, often somewhat compressed at the nodes; nodes sometimes more or less annulate; principal internodes mostly much abbreviated on the twigs, 0.2--3.7 cm. long, elongate to 7 cm. on the branches; leaves decussate-opposite or subopposite, caducous; petioles rather slender, 6--18 mm. long, often more or less recurved, densely puberulent, canaliculate above; leaf-blades membranous, rather uniformly dark-green on both surfaces or somewhat lighter beneath, oblong or elliptic, 3.5--10.5 cm. long, 2.5--6 cm. wide, apically acute or short-acuminate, marginally entire, basally (sometimes unequally) acute or short-acuminate, densely velutinous-puberulent or short-pubescent on both surfaces or only sparsely so above in age, or canescent-tomentose beneath; midrib slender, flat above, prominent beneath; secondaries slender, 6--9 per side, arcuate-ascending, flat above, prominulous beneath, not distinctly anastomosing; inflorescence axillary, capitate, normally 2 per node at or near the top of the twigs; peduncles slender or stoutish, 2.5--6 cm. long, densely or rather sparsely flavidous-puberulent; cymes conspicuously involucrate, 1.5--2.5 cm. long, 3--5 cm. wide, densely many-flowered, capitate; bracts foliaceous, ovate, to 2.5 cm. long and 2 cm. wide, puberulent on both surfaces, apically short-acuminate; pedicels very short or obsolete; calyx infundibular-tubular, about 1.4 cm. long, its tube 5--6 mm. long, externally scattered-pilosulous, the rim deeply 5-lobed, the lobes attenuate-ovate or deltoid, 5--9 mm. long, basally to 1.2 mm. wide, scattered-pilosulous; corolla hypocrateriform, white or pinkish to wine-reddish or rose, the tube extremely slender, 2--3 cm. long. about ¼ longer than the calyx, externally pilose above the calyx, the throat not dilated, the limb small, only about 5 mm. in diameter, the lobes densely or sparsely pilose on both surfaces, the 2 posterior ones shorter; stamens somewhat exserted; filaments glabrous; anthers oblong, about 1 mm. long, basally bifid; fruiting-calyx somewhat enlarged and indurated.

This species is endemic to Madagascar and is based on *Hildebrandt 3438* from near Mojanga in western Madagascar, collected in May, 1880, and deposited in the Kew herbarium. *Dirichletia involucrata* is based on *Baron 391a* and *D. sphaerocephala* on *Baron 5425*, both from Madagascar, the latter from the northwestern section of the island; *D. involucrata* is not a transfer of the *Clerodendron involucratum* of Vatke, but is an entirely new name, based on a different type.

Vatke (1882) comments that his species is "*C. stenantho* Klotzsch... proximum, corollae partibus multo minoribus, indumento foliorumque figura diversum"; *Clerodendrum stenanthum* is now known as *C. mossambicense* Klotzsch.

Although *Clerodendrum involucratum* is only known from Madagascar, the Index Kewensis lists it as from "trop. Afr." It has been encountered by collectors in forest-savanna country, in primary forests, on dunes, and on dry gneiss hills, at 810 m. altitude, in flower in February, March, and May.

The corollas are described as having been "white" on *Decary 19019*, "rose" on *Hildebrandt 3438* and *Perrier 16616*, "wine-reddish" on *Decary 18893*, and "reddish-violet" on *Croat 30576*.

A key to help distinguish this species from other Madagascar taxa in this genus will be found under *C. baronianum* Oliv. in the present series of notes (58: 184--190).

Material of *C. involucratum* has been misidentified and distributed in some herbaria as *Dirichletia* sp. in the *Rubiaceae*.

Citations: MADAGASCAR: *Baron 160* (K), *5425* (P); *Bernier s.n.* [Ambongo 1846] (P); *Croat 30576* (N); *Decary 7314* (P, W--2494791), *14404* (P), *18893* (P), *19019* (P); *Grevé 214* (P); *Hildebrandt 2923* (Mu--1621), *3438* (E--photo of type, F--photo of type, K--type, L--isotype, Ld--photo of type, Mu--isotype, N--photo of type, P--isotype), *3923* (K, L, P); *Perrier 455* (P), *10218* (N, P), *10227* (P), *16616* (P): *Pervillé 623* (N, P); *Scott Elliot 2033* (E--photo, F--photo, K, Ld--photo, N--photo);

*Service Forestier* 25 (P), 27 (P), 73 (P).

*CLERODENDRUM JAPONICUM* (Thunb.) Sweet, Hort. Brit., ed. 1, 1: 322. 1826.

Synonymy: *Go too vulgo go too giri* Kaempfer, Amoen. Exot. 861. 1712. *Volkameria japonica* Thunb., Nov. Act. Soc. Sci. Upsal. 3: 208. 1780. *Volkameric iaponica* Thunb., Fl. Iap. 255. 1784. *Volkameria inermis, foliis cordatis, ovatis, acutis, dentatis; racemis secundis* Thunb. ex Poir. in Lam., Encycl. Meth. Bot. 8: 689 in syn. 1808. *Clerodendrum kaempferi* Fisch. ex Steud., Nom. Bot. Phan., ed. 1, 207 nom. nud. 1821 [not *C. kaempferi* (Jacq.) Sieb., 1830]. *Clerodendron kaempferi* Fisch. ex Morr., Ann. Soc. Roy. Agr. Bot. Gandav. 1: 17 in syn. 1845. *Clerodendron kämpferi* Fisch. apud Walp., Repert. Bot. Syst. 6: 691 in syn. 1847. *Clerodendron squamatum* var. *japonicum* Hassk., Retzia 1: 63. 1855. *Clerodendron squamatum* ♂ *japonicum* Hassk., Retzia 1: 61. 1855. *Clerodendron singalense* Miq., Fl. Ned. Ind. Suppl. Sumatra 568. 1860. *Clerodendron imperialis* Carr., Rev. Hort. 46: 110. 1874. *Clerodendron japonicum* (Thunb.) Mak., Bot. Mag. Tokyo 17: 91. 1903. *Clerodendron kaempferi* "Sieb. herb. ex Miquel" apud Mak., Bot. Mag. Tokyo 17: 91 in syn. 1903. *Tei Too* Kaempf. apud Mak., Bot. Mag. Tokyo 17: 91 in syn. 1903. *Clerodendron japonicum* Mak. apud Prain, Ind. Kew. Suppl. 3: 44. 1908. *Clerodendron esquirolii* Lévl., Feddes Repert. Spec. Nov. 11: 302. 1912 [not op. cit. 298. 1912]. *Clerodendron darrisii* Lévl., Feddes Repert. Spec. Nov. 11: 301. 1912. *Clerodendron leveillei* Fedde ex Lévl., Fl. Kouy-Tchéou 442. 1915. *Clerodendron squamatum* var. *japonicum* Hassk. ex Backer, Tropische Natuur 5: 89. 1916. *Clerodendron coccineum* H. J. Lam, Verbenac. Malay. Arch. 296. 1919 [not *C. coccineum* D. Dietr., 1842]. *Clerodendron kaempferi* "Fisch. ex Steud." apud Bakh. in Lam & Bakh., Bull. Jard. Bot. Buitenz,m ser. 3, 3: 109 in syn. 1921. *Clerodendron darranii* Lévl. ex P'ei, Mem. Sci. Soc. China 1 (2): 141--143. 1932. *Clerodendron japonicum* (Thunb.) Sweet ex Mold., Suppl. List Inv. Names 2 in syn. 1941. *Clerodendron imperiale* Carr. ex Mold., Alph. List Inv. Names Suppl. 1: 6 in syn. 1947. *Clerodendrum imperialis* Carr. apud Hara, Enum. Sperm. Jap. 1: 187 in syn. 1948. *Clerodendron kaempferi* Steud. spud Hara, Enum. Sperm. Jap. 1: 187 in syn. 1948. *Clerodendrum japonicum* (Thunb.) Makino apud Hara, Enum. Sperm. Jap. 1: 187 in syn. 1948. *Clerodendron japonicum* (Thub.) Sw. apud Matuda, Amer. Midl. Nat. 44: 576. 1950. *Clerodendron paniculatum* (non L.) Hook. & Arn. apud Masamune, Sci. Rep. Kanazawa Univ. 4: 49 in syn. 1955 [not *Clerodendrum paniculatum* L., 1767]. *Clerodendron japonicum* (Thunb.) Mak. ex Mold., Résume 265 in syn. 1959. *Clerodendron japonicum* Sweet ex D. R. W. Alexander, Hong Kong Shrubs 28 in syn. 1971. *Clerodendrum japonicum* Sw. ex Mold., Phytol. Mem. 2: 392 in syn. 1980. *Clerodendrum darrisii* Levl. apud Lauener, Notes Roy Bot. Gard. Edinb. 38: 484 in syn. 1980. *Clerodendrum esquirolii* Lévl. apud Lauener, Notes Roy. Bot. Gard. Edinb. 38: 484 in syn. 1980. *Clerodendrum leveillei* [Fedde ex] Lévl. apud Lauener, Notes Roy. Bot. Gard. Edinb. 38: 484 in syn. 1980. *Clerodendron squamatum* var. *javanicum* Teijsm., in herb.

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[to be continued]

## BOOK REVIEWS

Alma L. Moldenke

"HENDERSON'S DICTIONARY OF BIOLOGICAL TERMS" Ninth Edition by Sandra Holmes, xi & 510 pp. Van Nostrand Reinhold Company, New York, N. Y. 10003. 1986. $15.95 paperbound & $42.50 clothbound.

This new edition comes in two forms with the same preface of a list of abbreviations, units and conversions, Greek alphabet and Latin and Greek noun endings, the good updated (where needed) definitions and the appendices of older plant and animal classification and common chemical elements. I have not seen the clothbound edition, but my paperback one is printed on the poorest newspaper stock with very small margins and print, making reading physically taxing to students who are the main users of this book.

"EVOLUTION BY SEXUAL SELECTION THEORY - Prior to 1900" edited by Carl Jay Bajema, xiii & 379 pp., 30 b/w fig. & 2 tab. A Hutchinson Ross Benchmark Book from Van Nostrand Reinhold Inc., New York, N. Y. 10003. 1984. $47.50.

The Benchmark Papers in Systematic and Evolutionary Biology reprint classic scientific papers. This one has 10 pre-Darwinian selections by T. Hobbes, Wm. Harvey, J. Rousseau, E. Darwin, etc., has 3 from C. R. Darwin's writings from "Origin" and from "Descent of Man" along with A. R. Wallace's "Mimicry". T. Belt's "Mimetic Insects" and G. Mivart's painstaking critique of "Descent". and has 3 after Darwin's death on the controversies over sexual selection by G. W. & E. G. Peckham, A. R. Wallace and T. J. Cunningham. This one publication includes the gist of this important biological literature that would occupy a few whole book shelves. The editor has provided valuable explicative comments for each section of these excerpts. "Sexual selection has come to be viewed by most biologists as a special category of natural selection". This book belongs on the pertinent library shelves of biological institutions, museums and universities.

"FLORA OF THE GREAT PLAINS" by the Great Plains Floral Association with Ronald L. McGregor, coordinator, & T. M. Barkley, editor, vii & 1392 pp. & 2 b/w maps. University Press of Kansas, Lawrence, Kansas 66045-8350. 1986. $55.00.

I am glad that the introduction mentions Rydberg's flora as "the classic treatment" which dates from 1932 and has since been reprinted by Dover Publications. This new book encompasses much more work by many persons since it includes all the local, county and state flora and herbaria records from tne many state colleges and universities of the Great Plains region, mostly assembled since Rydberg's day. This area includes (1) all of Kansas, Nebraska, North and South Dakota, (2) eastern Montana, Wyoming, Colorado and New Mexico, (3) northern Oklahoma and the Texas panhandle, (4) southern Alberta, Saskatchewan and Manitoba, and (5) a western strip of Minnesota, Iowa and Missouri. This regional flora is "thought to be recent and adventive in origin. Nearly all our species have extensive ranges beyond our borders". This book starts with a workable key for the native and naturalized pteridophytes, gymnosperms and spermatophytes in 160 families. The copy is on the small side but very neat. I noticed on page 704 that the specific name of *Verbena hastata* is misspelled. This book will become very important on all area campuses for botany and ecology field courses and for earnest naturalists.

"GEOLOGY OF THE GREAT BASIN" by Bill Fiero, xv & 197 pp., 35 color photo, 43 b/w photo., 78 line-draw. maps, 4 charts, & 4 diag. University of Nevada Press, Reno, Nevada 89557-0076. 1986. $22.5- clothbound, & $14.50 paperbound.

For the Nevadan resident, student and visitor, for the geology buff and student, and for the appreciator of books with beautiful nature illustrations, this book has much to offer on all these scores about this fascinating unique Great Basin. The author interprets the rock positions, compositions and signs from the earliest of times in sequential order to the present in easily comprehensible language. He includes a chapter on the national monuments and state parks that display significant geological features.

"TREES OF THE GREAT BASIN - A Natural History" by Ronald M. Lanner, xvi & 215 pp., 48 b/w line-draw., 51 color pl. & 2 maps. University of Nevada Press, Reno, Nevada 89557-0076. 1984. $19.50 hardcover & $12.50 paperbound.

The author, a long active field dendrologist, surely loves his subject and this area! Each of the 47 native trees illustrated with excellent drawings and beautiful color plates, has special localities marked, varieties described, interplay with other plant and animal organisms effectively explained, means of dispersal, and perhaps most important, access to water, their routes of entrance into the Great Basin whose rivers and temporary lakes, etc., have no surface outlet to the sea. The Great Basin "trees are hardy, smaller and less varied than those of the west.....and fewer than those to the east, yet providing a modicum of food, forage and game and most of the water for the area....The Great Basin is really a land of many basins separated by ranges of hills and mountains." Even though the book is expressedly "written for the western nature enthusiast", it should prove highly useful for ecology, field and tree identification courses, and biologists in general.

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# STUDIES ON THE ALGAL FLORAS INHABITING DIFFERENT WATER SOURCES IN EGYPT
# 2. LAKES AND SPRINGS

BY

**Wafaa S.Abou El-Kheir Ph.D. and Laila Mekkey M.Sc.**
**University College for Girls, Ain Shams University Egypt.**

## INTRODUCTION

In Egypt there are ten main lakes varying in their kind of water. Five of these lakes namely: Bardawiel, Manzala, Burullus, Temsah, and the Bitter lakes have marine waters. Whereas the waters of lakes Edku, Mariut and Abbasa are of the brackish type. The only fresh water lake at present is lake Nasser, for lake Qarun is now saline (Abou El-Kheir, 1986). Egyptian springs occur in the oases and deserts. They are also classified according to water kind into fresh, brackish, and saline springs.

No serious efforts have been done to investigate the algal communities inhabiting these water bodies especially springs (Oyoon) which are, up till now, largely neglected. Lake Qarun received more attention than lakes Mariut and Edku where as other lakes received almost no attention.

Works dealing with the algal flora of springs are: Hume (1906) who enumerated 41 diatom species, 27 green and 3 blue-green ones collected from Oyoon Mousa and some Wadis in Sinai peninsula. He stated that Mastogloia smithii and Epithemia gibba (diatoms) are common, and stated also that green algae, particularly the desmids are predominant, whilst the blue-greens are poorly represented. El-Nayal (1935) enumerated 19 species of algae (diatoms and blue-greens) collected from Ein El-Mahareek, Ein Mex Behari and Ein Sirgan in Kharga Oasis. In 1978 Shaaban and El-Habibi studied the algal flora of certain wells in Kharga Oasis. Shaaban (1985) identified 69 species belonging to 35 genera of algae collected from Siwa Oasis (Oyoon and Lakes). He stated that the most common and widely distributed variety is Gomphosphaeria aponina v. aponina. Kobbia (1981) recorded 25 algal species from salt marshes in Ghrabniate in the north-western costal region of Egypt. He found that the blue-greens are the best represented group quantitatively and qualitatively, and the highest phytoplankton biomass was restricted to Oscillatoria limosa, Lyngbya agardhii, Plectonema roseolum, Ulothrix zonata, Achnanthes hungarica and Chromulina ovalis.

In (1986) Abou El-Kheir and Ismail stated that the lack of planktonic and benthic algal flora in Silene spring in El-Fayum is due to the fact that the source of water is the ground deep water and the fact that the rate of flow of water is so fast. These two reasons make the chance for algal community development so little.

The first work on the algal flora of Egyptian lakes was that done by Zanhlbruckner (1904) on lake Mariut and Mallaha at Alexandria. He identified 3 blue-greens including one new species and a new variety. West (1909) identified 66 algal species from Birket Qarun. He stated that greens are poorly represented whereas blue-greens and diatoms are very prominant. In 1935 El-Nayal identified 135 species of algae collected from various localities in Egypt, principally Abbassia, Giza, lake Qarun, lake Temsah, and lake Manzala. Ghazzawi (1939) studied the phytoplankton of the Suze-Canal and found an increase in the abundance of planktonic diatoms. Abdin (1948 and 1954) studied the algal flora of the Aswan reservoir. In 1958 Aleem recorded 128 fossil diatom species from the old lake Morries (lake Qarun at present) in El-Fayum. He found that the most common species are mainly fresh-water type. Salah (1960) outlined that there are species in lake Mariut and lake Edku (at Alexandria) which can live in either salt or brackish waters, and some are common to both types of water. Nasr et al. (1961) pointed that the kind and distribution of algae is greatly affected by the change of salinity of water in lake Edko. Kaleafah (1964) found Enteromorpha in nearly all parts of lake Mariut whether fresh or brackish, rich or poor in nutrients. In 1970a Nosseir and Abou El-Kheir studied the effect of dissolved nutrients on the algal flora of lake Qarun. They found that the species which are numerous and tolerant are of the marine type. In (1970b) the same authors identified 66 algal species belonging to 31 genera in lake Nasser, and stated that the species which are numerous are of fresh water type. Ehrlich (1975) worked on the diatoms from the surface sediments of Bardawil lake. El-Saadawi et al. (1976) worked on lake Qarun and identified 16 species of diatoms as new records to this lake. Shaaban et al. (1983) in their work on the Mediterranean coast of Egypt (Port-Said, Ras El-Barr, Abu-Qir and Sidi Gaber) found that the algal flora consist of 30 species belonging to macro-greens, reds and browns, but the bulk was nearly of the chlorophyta. Abou El-Kheir and Ismail (1986) studied the extant algal flora of lake Qarun. They also stated that the high salinity affected the algal flora: being rare.

The present study is concerned with the algal flora of lakes and springs in different regions in Egypt. Also with the investigation of the relationship between the algal distribution and the environmental factors. It is also an attempt to find out the difference between the algal floras of lakes and springs which have a somewhat similar salt content.

## MATERIAL AND METHODS

Thirteen samples were collected from waters of lakes and springs (Oyoon). The lakes are: lake Qarun in El-Fayum, lake Temsah at El-Ismailia and lake Abbasa in El-Sharkia while the springs are: Ain Helwan in Helwan suburb and Ain El-Sira in Cairo (see Fig. 1). Further details concerning the kind of water and the number of samples taken from each water source are listed below:

| Regions | Date of collection | Source of water | Kind of water | No. of samples |
|---|---|---|---|---|
| Helwan | 9/3/1979 | Salt spring (Ain Helwan) | Brackish | 2 |
| Cairo | 9/3/1979 | Satl spring (Ain El-Sira) | Brackish | 2 |
| El-Ismailia | 30/3/1979 | Lake Temsah | Marine | 3 |
| El-Sharkia | 8/2/1980 | Lake Abbasa | Brackish | 2 |
| El-Fayum | 2/7/1980 | Lake Qarun | Salt lake (Marine) | 4 |

Brackish water samples contain from 150-250 mg/L. chlorides. Marine water samples contain over 250 mg/L. chlorides. The temperature of the water of all samples was recorded, and pH and chemical analysis of all samples were determined. Intensive microscopic examination of all samples have been done to investigate the algal taxa present.

## RESULTS

Microscopic examination of the samples showed that they all contain Bacillariophyta. Chlorophyta was met with in 9 samples, Cyanophyta in 4, Xanthophyta, Euglenophyta and Phaeophyta in one sample each, but Rhodophyta in 2 samples. The 13 samples contain 151 algal taxa belonging to 48 genera representing 7 algal groups, (see table 1). This table shows also that Bacillariophyta is best represented in the lakes, while Chlorophyta and Cyanophyta are best represented in the springs. Xanthophyta, Euglenophyta and Phaeophyta were found only in the brackish lake Abbasa, while Rhodophyta was found in the saline lake Qarun. From tables 2 and 3 it is clear that Chlorophyta (except Cladophora sp.) and Cyanophyta are absent from Ain El-Sira and lake Qarun where the salinity is much higher than that in the other samples. In Ain Helwan Terpsinöe americana (diatoms) represents a new record to Egypt, and it was found only in the two samples collected from this spring. Ectocarpus was found predominant in sample No. 13 from lake Temsah where the nutrients (except chlorides) were relatively low, and it is a new record to this lake. In the samples taken from lake Qarun Rhodochorton purpureum (Rhodophyta) was found dominant, and it is a new record to Egypt. Polysiphonia sp. was found predominant and Goniotrichum elegans was found dominant and the two taxa are new to lake Qarun (both are Rhodophyta). In lake Abbasa Tribonema sp. (Xanthophyta) and Spirogyra sp. (Chlorophyta) were predominat. Cladophora sp. was found predominant and dominant in most of the samples taken from springs and lakes (respectively).

Samples no. 3 and 4 taken from the mineral spring "Ain El-Sira" is the poorest of all samples in the algal flora and Bacillariophyta is the only group found. Although it has the highst values of chlorides (highly saline) yet the fresh water form Nitzschia palea genuina f. minor was dominant whereas brackish - marine form Amphora Coffaeiformis boreales was predominant.

## DISCUSSION

The present study includes 13 samples, six of them are brackish (chlorides content above 150 mg/L). The word brackish strictly means between fresh and salty water (see Kolbe, 1927 and Lund, 1965), however, most of the brackish samples in this study have chlorides content like that of marine water i.e. above 250 mg/L. But since these samples were collected from isolated inland sources of water and lie at considerable distances from seas, they were therfore considered brackish and not marine. They also maintain algal elements that are mainly brackish and fresh water forms.

Although lake Qarun lies at considerable distances from seas and has, at present, highly saline waters yet it is considered marine and not brackish because it maintains, at present, a mainly marine algal flora. The presence of this type of flora in this inland lake is due to the transfer of Mediterranean sea-waters from near Alexandria to the lake for reasons given by Abou El-Kheir (1986).

The results given in tables 1 and 2 show that Bacillariophyta is best represented in marine waters and is poorly represented in highly saline samples (samples no. 3 and 4), despite the fact that these samples contain high values of all nutrients (except $PO_4$). In these two highly saline samples no Chlorophyceae and Cyanophyceae were found. This is in agreement with Abou El-Kheir and Ismail (1986) who stated that high salinity in lake Qarun was accompanied by reduced algal flora. Chlorophyta is again like Cyanophyta; being well represented in brackish waters (see tables 2 and 3). These results are to some extent in agreement with results obtained by Angot and Robert (1966) who stated that high salinity is favourable for diatoms and unfavourable for Cyanophyta and Chlorophyta. But are not in agreement with results obtained by Iltis (1973) who stated that blue-greens tolerate variation of salinity, or with those obtained by Kobbia (1981) who stated that the dominance of blue-greens in salt marshes is most probably due to the high tolerance of salinity compared to other species. And is not in agreement with Seenayya (1972) who stated that blue-greens have high ability to develop in extremely wide range of ecological conditions. The ability of numerous species of blue-green algae to flourish under high salinity and temperature variations had been shown by Levandowsky (1972) and Shubert (1976), however this does not apply to blue-green species recorded in the present work. Fogg et al. (1973) showed that the halophilic blue-green algal speies which can grow at high salt concentrations are probably capable to do so due to their prokryotic organization and the absence of large sap vacules. This may explain the presence of Schizothrix calcicola minuta as a common species in sample no.11 from lake Temsah.

Round (1973) and Abou El-Kheir and Mekkey (1986b) stated that sodium is important for the development of Cyanophyta.This not in agreement with the present results, since, samples no. 5 and 8 from lake Qarun and sample no. 3 from Ain El-Sira are the richest samples in sodium content (table 2), however, Cyanophyta is absent from these samples. This may be due to high chlorides content in these samples.

Comparing the results obtained here with those of Abou El-Kheir and Mekkey (1986a) from their work on the River Nile and its derivatives which have fresh waters, it may be said that algae are generally best represented in fresh then brackish and finally marine waters. The details of this comparison show that Bacillariophyta occurs in all sources of water, but is best represented in fresh water sources followed by marine ones. While Cyanophyta and Chlorphyta are best represented in fresh water sources, poorly represented in brackish and nearly absent in marine ones.

## SUMMARY

151 species of algal taxa are recorded from the three studied lakes and the two springs. Temperature, pH and chemical analysis for all samples were determined. Bacillariophyta was found in all samples, Cyanophyta and Chlorophyta in the brackish ones and absent from the high salty ones. Xanthophyta, Euglenophyta, Phaeophyta and Rhodophyta are met with but are quite few in number and not in all samples. Algal flora is generally best represented in fresh waters followed by brackish then marine. Bacil-

lariophyta is more tolerant to salinity than other algal groups. Salinity is a determining factor for the growth of algae especially Cyanophyta and Chlorophyta. Two taxa are recorded new to the algal flora of Egypt, namely: Terpsinöe americana (Bacillariophyta) and Rhodochorton purpureum (Rhodophyta).

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**Table (1):** Number of taxa of various divisions of algae recorded in water samples taken from the studied lakes and springs: A.H. = Ain Helwan, A.S. = Ain El-Sira, Q.F. = Qarun, El-Fayum, A.Sh. = Abbasa, El-Sharkia, T.IS. = Temsah El-Ismailia, B = Brackish, M = Marine.

| Algal Divissions | Regions sample No. water type | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | A.H. | | A.S. | | Q.F. | | | | A.Sh. | | T.IS. | | |
| | B | | B | | M | | | | B | | M | | |
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 |
| Bacillariophyta | 19 | 12 | 2 | 5 | 20 | 28 | 33 | 15 | 8 | 18 | 26 | 18 | 36 |
| Chlorophyta | 4 | 2 | - | - | - | 1 | 1 | 1 | - | 2 | 2 | 1 | 1 |
| Cyanophyta | 5 | 3 | - | - | - | - | - | - | - | 2 | 3 | - | - |
| Euglenophyta | - | - | - | - | - | - | - | - | - | 1 | - | - | - |
| Xanthophyta | - | - | - | - | - | - | - | - | 3 | - | - | - | - |
| Paeophyta | - | - | - | - | - | - | - | - | - | - | - | - | 1 |
| Rhodophyta | - | - | - | - | 3 | 3 | 3 | 3 | - | - | - | - | - |

**Table (2):** Values of pH, temperature, and other nutrients in the studied samples from lakes and springs A.H = Ain Helwan, A.S. = Ain El-Sira, A.F. = Qarun El-Fayum A.Sh. = Abbasa, El-Sharkia, T.IS. = Temsah, El-Ismailia, Nut. = Nutrients (p.p.m.).

| Sample No. | Springs | | | | Lakes | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | A.H. | | A.S. | | Q.F. | | | | A.Sh. | | I.IS. | | |
| Nut. pH Temp. | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 |
| pH | 8 | 8 | 7.7 | 7.7 | 6.8 | 7 | 6.8 | 7.2 | 6.5 | 6.5 | 6.5 | 6.5 | 6.5 |
| Temp. °C | 26 | 26 | 17 | 18 | 35 | 38 | 34 | 38 | 17.5 | 17 | 28 | 25 | 24 |
| $NO_3$ | 5.3 | 2.2 | 55.6 | 0.5 | 0.7 | 1.25 | - | - | 8.7 | 4.8 | 8.2 | 8 | 21.5 |
| $PO_4$ | 0.3 | - | 3.1 | 0.8 | 1.7 | 4.9 | 26 | 6.1 | 6.1 | 0.9 | 1.7 | 1.4 | 2.8 |
| Cl | 1663.8 | 2000.1 | 50728.2 | 4370 | 12390 | 12460.8 | 11221.8 | 2318.7 | 1663.8 | 212.4 | 13983 | 814.2 | 10867.8 |
| Na | 241.5 | 575 | 10301.4 | 2070 | 2127.5 | 1150 | 684.2 | 2300 | 287.5 | 1437.5 | 218.5 | 586.5 | 533.6 |
| Ca | 2.4 | 2.4 | 12.7 | 8.1 | 5.8 | 4.5 | 4.3 | 7.7 | 0.1 | 0.1 | 3.3 | 1.0 | 3.4 |
| Mg | 1.8 | 1.8 | 34 | 7.3 | 4 | 10.2 | 10.8 | 6.9 | 1.7 | 0.2 | 11.7 | 0.6 | 6 |
| K | 40.8 | 39 | 507 | 101.4 | 179.4 | 46.8 | 54.6 | 46.8 | 7.8 | 15.6 | 62.4 | 39 | 54.6 |
| $CO_3$ | - | - | - | - | - | - | - | - | - | - | 280 | - | - |
| $HCO_3$ | 132.2 | 30.5 | 61 | 71.2 | 167.8 | 152.5 | 183 | 137.3 | 183 | 1901.1 | 30.5 | 198.3 | 101.7 |

**Table (3):** Algal taxa distribution in the samples taken from lakes and springs: A.H. = Ain Helwan, A.S. = Ain El-Sira, Q.F. = Qarun El-Fayum, A.Sh. = Abbasa El-Sharkia, T.IS. = Temsah El-Ismailia C = Common, d = dominant, p. = predominant.

| Algal taxa | Springs | | | | Lakes | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | A.H | | A.S | | Q.F. | | | | A.Sh | | T.IS. | | |
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 |
| Bacillariophyta: Centrales: | | | | | | | | | | | | | |
| 1. Biddulphia polymorpha(Grun.)Wolle | + | + | | | + | | | | | | | | |
| 2. Cyclotella bodanica lemanensis O.M. | | | | | | + | + | | | | | | |
| 3. C. comensis Grun. | | | | | | | + | | | + | | | |
| 4. C. gothica A.Cl. | | | | | | | + | | | | | | |
| 5. C. meneghiniana genuina A.Cl. | | | | | | | | | | + | + | | + |
| 6. C. meneghiniana plana Fricke | | | | | | | | | | | | + | |
| 7. C. ocellata Pant. | + | | | | | | | | + | | + | + | |
| 8. Melosira fennoscandica | | | | | | + | | | | | | + | + |
| 9. M. granulata E. | | | | | | + | + | | | | | | |
| 10. M. granulata angustissima O.M. | + | | | | | | | | | + | + | | + |
| 11. M. islandica typica A.Cl. | | | | | | | | | | + | | | |
| 12. M. Jurgensii bothnica Grun. | | | | | | + | + | + | | | | | |
| 13. M. varians Ag. | | | | | | | | | + | + | | | |
| 14. M. dubia Kz. | | | | | | | | | | | + | | + |
| 15. Paralia genuina A.Cl. | | | | | | | | | | | + | | |
| 16. P. sulcata crenulata Grun. | | | | | | | | | | | | | + |
| 17. Terpsinöe americana (Bail) R. | + | + | | | | | | | | | | | |
| 18. Triceratum antediluvianus (E.) Grun. | | | | | + | | + | + | | | | | |
| 19. T. reticulum f. trigora | | | | | | + | + | | | | | | |
| 20. Stephanodiscus astraea Niagarae | | | | | + | + | + | | | | | | |
| Pennales: | | | | | | | | | | | | | |
| 21. Achananthes brevipes angustata (G.)Cl. | + | + | | | + | + | + | + | | | | | |
| 22. A. brevipes intermedia Kz. | + | + | | | | | | | | | + | | + |
| 23. A. brevipes elliptica Cl. | | | | | | | | | | | + | | |
| 24. A. brevipes typica Cl. | | | | | | | | | | | + | | + |
| 25. A. coarctata constricta krass. | | | | | | | | | | | + | | + |
| 26. A. delicatula genuina A.Cl. | | | | | | | + | + | | | | | |
| 27. A. delicatula subcapitata(Ost.)A.Cl. | | | | | | + | + | + | | | | | |
| 28. A. Schmidtiana Krenn. | | | | | | | | + | | | | | |
| 29. A.septata linearis A.Cl. | | | | | | | | | | | + | | |
| 30. Amphiprora alata genuina A.Cl. | | | | | | | | + | | | | | |
| 31. A. paludosa punctulata Grun. | | | | | | | | | + | | | | + |
| 32. Amphora acutiucscula Kz. | | | | | | | | | | | | | + |
| 33. A. coffaeiformis borealis | | | | + | | | | | | | | | |
| 34. A. coffaeiformis salina(W.Sm.)A.Cl. | | | + | + | + | + | + | | | | | | |
| 35. A. eunotic Cl. | | | | | | | | | | | | | + |
| 36. A. libyca typica A.Cl. | | | | | | | | | | | | | + |
| 36. A. libyca typica A.Cl. | | | | | | | | | | | | | + |
| 37. A. terroris E. | | | | | | | | | | | + | | |
| 38. A. turgida A.Cl. | + | | | | | | | | | | | | |
| 39. Bacillaria paradoxa Gmel. | | | | | | | | | + | | | | |

**Table (3): (Cont.)**

| Algal taxa | Springs | | | | Lakes | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | A.H | | A.S | | Q.F. | | | | A.Sh | | T.IS. | | |
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 |
| 40. Cocconeis disculus minor Font. | | | | | | | + | + | | | | | |
| 41. C. placentula euglypta (E.) Grun. | | | | | | + | + | + | + | | | | |
| 42. C. placentula genuina May | + | | | | | | | | | | | | |
| 43. C. placentula intermedia (Her&Per)Hust. | | | | | | | | | | | + | | + |
| 44. C. placentula lineata A.Cl. | | | | | | | | | | | | + | |
| 45. C. scutellum Ehr. | | | | | | | | | | | + | | + |
| 46. Denticula tenuis frigida (Kz.)Grun. | | | | | | | | | | | | + | |
| 47. Diatoma elongatum subsalsum A.Cl. | | | | | | | | | | | | | + |
| 48. Dimeregrama fulva (Greg.)Ralfs | | | | | + | + | + | | | | | | |
| 49. D. minor nana | | | | | + | + | + | | | | | | |
| 50. Diploneis elliptica genuina f. minor | + | + | | | | | | | | | | | |
| 51. Fragilaria capucina aretica A.Cl. | + | + | | | | | | | | | | | |
| 52. F. vaucheriae genuina (V.H.)A.Cl. | + | | | | | | | | | | | | |
| 53. F. vaucheriae gracilior | + | | | | | | | | | | | | |
| 54. F. vireacene lanceola | | | | | + | | | | | | | | |
| 55. Gomphonema gracile intricatiforme May | | | | | | | | | | + | + | | |
| 56. G. lanceolatum insigne genuinum | | | | | | | | | | | | + | |
| 57. G. olivaceum tenellum Kz. | | | | | | | | | | | | + | |
| 58. G. montanum genuina May | | | | | | | | | | + | | | |
| 59. G. parvulum exilissimum Grun. | | | | | | | | | | + | | | |
| 60. Grammatophora marina (Lyngb.)Kz. | | | | | + | + | + | + | | | | | |
| 61. G. marina adrialica | | | | | | + | + | | | | | | |
| 62. G. oceanica macilenta | | | | | + | | | | | | | | |
| 63. Gyrosigma acuminatum (W.Sm.)A.Cl. | + | + | | | | | | | | | | | |
| 64. G. spencerii smithii (Grun.)A.Cl. | | | | | | | | | | | + | | + |
| 65. Licmorphora abbreviata Ag. | | | | | + | + | + | | | | | | |
| 66. L. ehrenbergii genuina A.Cl. | | | | | | + | | | | | | | |
| 67. L. gracilis anglica (Kz.) Per. | | | | | | | | | | | | | + |
| 68. L. tincta nubecula (Kz.) Grun. | | | | | + | | | | | | | | |
| 69. Mastogloia smithii genuina f. minor | | | | | | + | | | | | | + | |
| 70. Navicula ambigua diminuta | | | | | | | | | | + | | | |
| 71. N. ammophila genuina A.Cl. | | | | + | | | | | | | | | + |
| 72. N. avenaceae Breb. | | | | | | | | | | + | + | + | |
| 73. N. cryptocephala perminuta Grun. | | | | | | | | + | | | | | |
| 74. N. Cryptocephala Subsalina Hust. | + | + | | | | + | + | + | | | | | + |
| 75. N. jaagi Meist. | | | | | | | + | | | | | | |
| 76. N. lanceolata genuina A.Cl. | | | | | | | + | | | | | | |
| 77. N. modica | | | | | | | | | | | | | + |
| 78. N. mutata typica A.Cl. | | | | | | | | | | | | | + |
| 79. N. pupula genuina Grun. | | | | | | | | | | | | | + |
| 80. N. radiosa cuneata | | | | | | | | + | | | | | |
| 81. N. viridula capitata Mag. | | + | | | | + | | | | | | + | + |
| 82. Nitzschia amphibia acutiuscula | | | | + | | | | | | | + | | |
| 83. N. apiculata (Greg.) Grun. | + | + | | | + | + | + | + | | + | + | | + |
| 84. N. dissipreta genuina A.Cl. | | | | | | | | | | | + | | |
| 85. N. granulata Grun. | + | | | | | | | | | | | | |
| 86. Hantzschia genuina A.Cl. | | | | | | | | | | | + | | |

**Table (3): (Cont.)**

| Algal taxa | Springs | | | | Lakes | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | A.H | | A.S | | Q.F. | | | | A.Sh | | T.IS. | | |
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 |
| 87. N. intermedia Hant. | | | | | | | | | + | | + | | |
| 88. N. obtusa scalpelliformis Grun. | | | | | | | + | | | | + | | |
| 89. N. obtusa vulgaris Grun. | | | | | | | | | | | + | | |
| 90. N. palea genuina f. minuta | | | + | | | | | | | | | | |
| 91. N. paradoxa genuina Grun. | | | | | | | | | | | | + | |
| 92. N. punctata aurta Grun. | | | | | | + | + | | + | | | | |
| 93. N. sigma clausii (Htz.) Grun. | + | + | | | | | | | | | | | |
| 94. N. sigma clausii f. major | + | | | | | | | | | | | | |
| 95. N. sigma interceedens Grun. | | | | | | | + | | | | | | |
| 96. N. Sigma major | | | | | | | | | | | | + | |
| 97. N. smithii genuina Grun. | | | | | | | | | | | | + | |
| 98. N. socialis genuina Grun. | | | | | | | + | + | | | | | |
| 99. N. thermalis genuina May. | | | | | | | | | | | | + | |
| 100. N. thermalis intermedia Grun. | | | | | | | | | | + | + | | |
| 101. N. tryplionella crassa (Pant.) A.Cl. | | | | | | | | | | | | + | |
| 102. N. vermicularis genuina A.Cl. | | | | | | | | | | + | + | + | |
| 103. N. vermicularis lamprocampa | | | | | | | | | + | | | | |
| 104. Pinnularia spitzbergensis f. continua | | | | | | | | | | | + | | |
| 105. Pleurosigma formosum W.Sm. | | | | | | | | | | | | | + |
| 106. Rhoicosphenia curvata marina(W.Sm.) Grun. | | | | | | | | | | | | + | |
| 107. Ropalodia gibba genuina Grun. | | | | | | | | | | + | | | |
| 108. R. gibba ventricosa (Kz.) Grun. | | | | | | | | | | + | | | + |
| 109. R. gibberula constricta W.Sm. | | | | | + | + | | + | | + | | | |
| 110. R. gibberula producta (Grun.)A.Cl. | | | | | | | | | | | | + | |
| 111. R. giberula vanheurchii | | | | | | | | | | + | | | |
| 112. R. musculus | | | | | | | | | | + | | | |
| 113. Sceptroneis australis borealis f.angustata | | | | | + | + | + | | | | | | |
| 114. Steriatella unipunctata (Lyn.)A.Cl. | | | | | | | | | | | | | + |
| 115. Surierella fossilis A.Cl. | | | | | | | | | | | | | + |
| 116. S. laevis A.Cl. | + | + | | | | | | | | | | | |
| 117. S. turgida A.S. | | | | | | | | | | + | | | |
| 118. Synedra acus genuina May | | | | | | | | | | | | | + |
| 119. S. affinis | | | | | | | | | | | | | + |
| 120. S. berolinensis Lemm. | | | | | | | | | | | | | + |
| 121. S. crystalline smithii Grun. | | | | | | | + | + | | | | | |
| 122. S. fulgen (Grev.) S.Sm. | | | | | + | | | | | | | | |
| 123. S. tabulata fasciculata(Kz.)Hust. | | | | | | | | | + | | | | |
| 124. S. tabulata lamprocampa Hantz. | | | | | | | | + | | | | | |
| 125. S. tenera genuina A.Cl. | | | | | | + | + | + | | | | + | |
| 126. S. ulna danica (Kz.) Grun. | | | | | | + | + | + | + | | | | + |
| 127. S. ulna pxythynchus (Kz.) Hust. | | | | | | | | | | | | | + |
| Chlorophyta | | | | | | | | | | | | | |
| 128. Ankistrodesmus spirales fosciculatus | | | | | | | | | | | | | + |
| 129. Chlorococcum humicola | + | | | | | | | | | + | + | + | |
| 130. Cladophora sp. | c | p | | | d | d | d | | | | p | | |

Table (3): (Cont.)

| Algal taxa | Springs | | | | Lakes | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | A.H | | A.S | | Q.F. | | | | A.Sh | | T.IS. | | |
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 |
| 131. Enteromorpha hexuosa pausirzschria | p | + | | | | | | | | | | | |
| 132. Mougeotia sp. | c | | | | | | | | | | | | |
| 133. Spriogy a sp. | | | | | | | | | | p | | | |
| Cyanophyta: | | | | | | | | | | | | | |
| 134. Anabena constricta | | | | | | | | | | + | | | |
| 135. Heterothrix mucicola | | | | | | | | | | + | | | |
| 136. Lyngbya majuscula | c | c | | | | | | | | | | | |
| 137. L. martensiana | | | | | | | | | | | c | | |
| 138. Oscillatoria amphibia | + | | | | | | | | | | | | |
| 139. O. limosa | d | | | | | | | | | | | | |
| 140. O. okeni | | | | | | | | | | | + | | |
| 141. O. ornata | + | + | | | | | | | | | | | |
| 142. O. tenuis | | | | | | | | | | | + | | |
| 143. Schizothrix calcicola minuta | d | d | | | | | | | | | c | | |
| Euglenophyta: | | | | | | | | | | | | | |
| 144. Euglena oxyuris | | | | | | | | | + | | | | |
| 145. Phacus anomala | | | | | | | | | + | | | | |
| 146. P. curvicauda | | | | | | | | | + | | | | |
| Santhophyta: | | | | | | | | | | | | | |
| 147. Tribonema sp. | | | | | | | | | | d | | | |
| Phaeophyta | | | | | | | | | | | | | |
| 148. Ectocarpus sp. | | | | | | | | | | | | | p |
| Rhodophyta: | | | | | | | | | | | | | |
| 149. Goniotricium elegans | | | | | | d | d | d | d | | | | |
| 150. Polysiphonia sp. | | | | | | p | p | p | p | | | | |
| 151. Rhodochorton purpureum | | | | | | d | d | d | d | | | | |

# Streptopogon rzedowskii sp. nov.

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México, D. F.

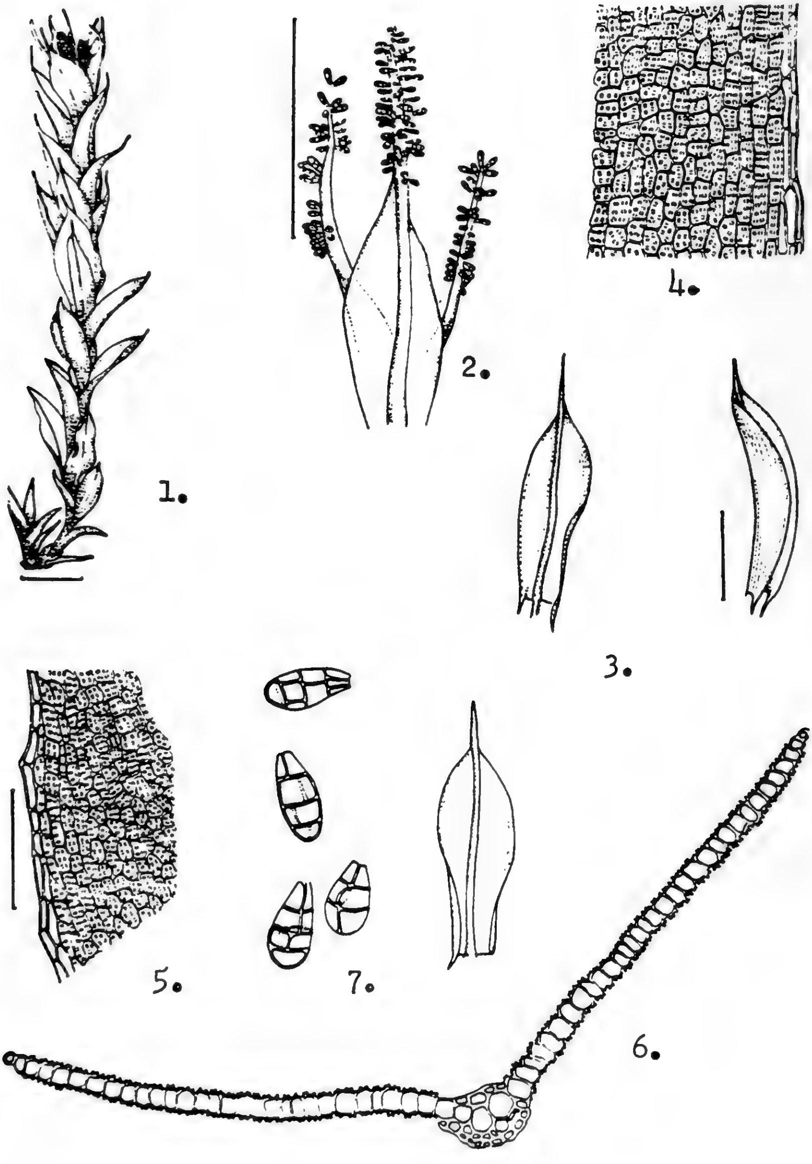
Distinquitur ex multis clavatis gemmis haurientibus et ad costam exsertam, et ad costae dorsum, et, raro, ad caules: etiam ex foliarum cellulis quae multas papillas habent: denique ex longis levibus cellulis marginis.

Stems cylindrical, without a differentiated center, sometimes with axillary hairs. Leaves oblong, 2.5 x 1.0 mm. shortly decurrent. Costa prominent, with 2 stereid bands and 3-4 large guide cells, percurrent to excurrent, 75-85 µ at base, arista sometimes about as long as the lamina. Margin of smooth, elongated cells, subdenticulate (rarely serrate) in the upper half. Cells in upper lamina 20-22 µ x 15-22 µ, in mid-lamina 17-20 - 7.5-10 µ (both pluri-papillose with C-shaped papillae), Basal cells hyaline, lax, hexagonal, 55-70 x 10-22 µ, with smooth walls. Rhizoids smooth. Gemmae brown, of 6-10 cells, smooth, attached to the arista, the back of the costa, or sometimes to the stem by 1-2 hyaline cells leaving papilla-like fragments when the gemmae break loose. Sporophyte unknown.

TYPE: Sobre humus, lugares sombreados y húmedos. Bosque de *Pinus hartwegii*. 20 km. E. de Amecameca, 19°15' N, 98°37' W. Mexico. A Cárdenas 3943, Noviembre 21, 1984 (type, MEXU; isotype, TENN).

Acknowledgements. Thanks are due Dr. Claudio Delgadillo M. for assistance with the description and the illustrations; and to CONACYT for financial assistance under project PCECBNA-030184.

Fig. 1-7 *Streptopogon rzedowskii* Cardenas. 1. Habit, moist. 2. Propaguliferous leaves. 3. Vegetative leaves. 4. Median leaf cells. 5. Upper leaf cells. 6. Cross-section of leaf. 7. Gemmae. Figs. 1-3, scale = 1 mm. Figs. 4-7, Scale = 0.1 mm.


1.
2.
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6.
7.

# TAXONOMIC STUDIES ON *ASTER* L. (COMPOSITAE)

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## ABSTRACT

Variation in a set of 41 characters from vegetative morphology, stem anatomy, epidermal trichomes of the outer involucral bracts and achenes, pappus type as well as the distribution of trichome types and forms of calcium oxalate crystals in the different parts of ray and disc florets was recorded comparatively for each of 37 species and infra-specific taxa of *Aster* L. The data-matrix was used to construct a non-indented dichotomous key to these taxa.

## INTRODUCTION

*Aster* L. is the type genus of Compositae(Asteraceae), comprising ca. 500 species of which nearly 50% are concentrated in North America. Despite recent intensive efforts by numerous authors (e.g. Fernald, 1950; Munz. 1968; Merxmuller, Schreiber and Yeo, 1976; Lippert, 1973 and 1980; Rommel 1977 and 1979), the circumscription of *Aster* remains a subject for much taxonomic controversy. Relationships of *Aster* to other genera (e.g. *Erigeron*, *Tripolium*, *Galatella*, *Calimeris*, *Sericocarpus*, *Callistephus*, *Amellus*, *Biotia*, *Eremiastrum*, *Heliastrum*, *Corethrogyne*, *Machaeranthera*, *Olearia*) have for long been a source of wide discrepancies between taxonomic accounts of the family (e.g. Hoffmann, 1894; Bentham and Hooker, 1876; De Candolle, 1836; Lindley, 1853). While some authors regrarded some or all of these genera as separate from *Aster*, others treated them wholly or partly as its subgenera. Furthermore, within *Aster* the species continue to be notoriously difficult to identify. It is believed that this difficulty is due primarily to the almost total lack of comparative observations recorded consistently for each species. The present study attempts, therefore, to construct an identificatory key based on the widest possible range of comparative aspects of variation exhibited by a reasonably representative sample of the genus *sensu lato* (see Table 1).

## OBSERVATION

No *a priori* limitations have been imposed on the sources of observations; provided the range of variation in a character lends itself to accurate definition into

**Table 1:** List of 37 taxa of Aster sensu lato included in the present study.

| No. | taxa | No. | taxa |
|---|---|---|---|
| 1. | Aster acris L. | 28. | A. sagittifolius. Wedemyer f. hirtellus (Lindl.) Shinners. |
| 2. | A. acuminatus Michx. | 29. | A. salicifolius. Ait. |
| 3. | A. adscendens lindl. | 30. | A. simplex Willd. |
| 4. | A. alpinus L. | 31. | A. spectrabilis Ait. |
| 5. | A. allaicus Willd. | 32. | A. suamatus (Sprengel) Hieron. |
| 6. | A. amellus L. | 33. | A. subulatus Michx. |
| 7. | A. bellidiastrum Scopa. | 34. | A. tenebrosus Burgess |
| 8. | A.chinensis L.(=Callistephus) | 35. | A. tripolium L. |
| 9. | A. cinereus kotsch. | 36. | A. umbellatus Mill. |
| 10. | A. cordifolius L. | 37. | A. undulatus L. |
| 11. | A. divaricatus L. | | |
| 12. | A. ericoides L. | | |
| 13. | A. Laevis L. | | |
| 14. | A. lateriflorus (L.) Britt. | | |
| 15. | A. linosyris Bernh. | | |
| 16. | A. longicaulis Desf. ex DC. | | |
| 17. | A. lowrieanus Porter. | | |
| 18. | A. macrophyllus L. | | |
| 19. | A. nemoralis Ait. | | |
| 20. | A. novae-angliae L. | | |
| 21. | A. novi-belgii L. | | |
| 22. | A. Patens Ait. | | |
| 23. | A. prenanthoides muhl. | | |
| 24. | A. punctatus Waldst et kit. | | |
| 25. | A. puniceus L. | | |
| 26. | A. radula Ait. | | |
| 27. | A. sagittifolius Wedemyer. | | |

a number of character states, it has been included among the list of attributes (Table 2) forming the basis of the intended key. It is evident from Table 2 that the 41 characters have been taken from such diversified sources as gross vegetative morphology, stem anatomy, epidermal trichomes and mesophyll structure of the outer involucral bracts and achenes, pappus type, and the distribution of epidermal trichome types and forms of calcium oxalate crystals in the different parts of ray flowers (RF) and disc flowers (DF). The comparative recording of all 41 characters for each of the 37 Aster species and infraspecific taxa is given in Table 3. Although all characters are easy to observe, some are illustrated in Figs. 1-23.

## THE KEY

There follows a non-indented dichotomous key to the 37 taxa of Aster under investigation. This is by no means intended to be the last word on the identification of asters, but merely an example of how to overcome the seemingly unsurmountable identificatory problems involved with relatively large assemblages of species from this genus, through the consistent recording of characters in the fashion shown in Table 3. Furthermore, the data-matrix presented in Table 3 is a permanent record of the species and their characters. Such data-matrix can be easily expanded to cover a much wider range of characters and/or species. The following key has been synthesized manually, but the data-matrix on which the key is based may also be subjected to some of the computer programmes designed for key construction, thus saving the greater part of the time and effort expended on the process.

**Table 2:** List of 41 characters recorded comparatively for 37 taxa of Aster sensu lato. Symbols (+ , −) or serial numbers are assigned to character-states and used to denote them in the data-matrix (in Table 3). * = a character-state is missing or inapplicable.

| | | |
|---|---|---|
| 1. | Stem: | Present +/ absent (dwarf) −. |
| 2. | | Schiszogenous canals in cortex,present +/ absent − (inapplicable if stem absent). |
| 3. | | schizogenous canals in phloem, present +/ absent − (inapplicable if stem absent). |
| 4. | | pith solid +/ hollow − (inapplicable if stem absent). |
| 5. | | pith parenchymatous +/ lignified − (inapplicable if stem absent). |
| 6. | Indumentum: | glabrous +/ grey-canescent −. |
| 7. | Leaves: | margin entire +/ not so −. |
| 8. | | petiolate 1/ sessile 2/ decurrent 3. |
| 9. | | length/breadth ratio of blade (L/B ratio). |
| 10. | | apex acute 1/acuminate 2/obtuse 3. |
| 11. | Bracts: | one-nerved +/ many-nerved −. |
| 12. | | vein(s) branched +/ unbranched −. |
| 13. | | fibres in mesophyll abundant +/few or absent −. |
| 14. | | glandular hairs present +/absent −. |
| 15. | | eglandular hairs present +/absent −. |
| 16. | | appendaged hairs present +/ absent −. |
| 17. | | entangled hairs present +/absent −. |
| 18. | Capitula: | solitary terminal +/in aggregates −. |
| 19. | | corymbose +/ otherwise − (inapplicable if solitary terminal *). |
| 20. | Pappus: | apex 2-celled +/ more than 2-celled −. |
| | Ray flowers: | (R.F.): |
| 21. | | glandular hairs on petals present +/ absent −. |
| 22. | | eglandular hairs on petals present +/ absent −. |
| 23. | | glandular hairs on achene present +/ absent −. |
| 24. | | eglandular biseriate hairs on achene present +/ absent −. |
| 25. | | rosette crystals in testa present +/ absent −. |
| 26. | | pirsmatic crystals in testa present +/ absent −. |
| 27. | | rosette crystals in achene present +/ absent −. |
| 28. | | prismatic crystals in achene present +/ absent −. |

29. rosette crystals in style present +/ absent −.
30. prismatic crystals in style present+/ absent −.

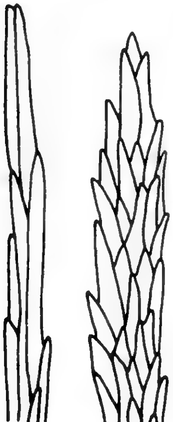
Disc flowers (D.F.):

31. glandular hairs on petals present +/ absent −.
32. eglandular hairs on petals present+/ absent −.
33. staminal auricle present +/ absent−.
34. glandular hairs on achene present +/ absent −.
35 eglandular biseriate hairs on achene present +/ absent −.
36. rosette crystals in testa present +/ absent −.
37. prismatic crystals in testa present +/ absent −.
38. rosette crystals in achene present+/ absent −.
39. prismatic crystals in achene present +/ absent −.
40. rosette crystals in style present +/ absent −.
41. prismatic crystals in style present +/ absent −.

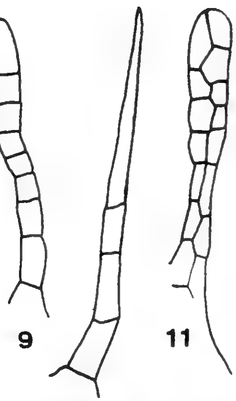
Table 3: Comparative observations on 41 characters recorded for 37 species of *Aster*. Columns 1 - 41 correspond to characters 1 - 41 in Table 2 respectively.
\+ is assigned to the first state of a qualitative character and
\- to its second state as listed in Table 2; * = missing or inapplicable.

| SPECIES | CHARACTERS | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 | 22 | 23 | 24 | 25 | 26 | 27 | 28 | 29 | 30 | 31 | 32 | 33 | 34 | 35 | 36 | 37 | 38 | 39 | 40 | 41 |
| 1. Aster adscendens | + | + | - | + | - | + | + | 2 | 10.5 | 1 | + | + | + | + | + | + | - | - | - | - | + | - | + | - | - | + | + | + | + | + | + | - | - | + | - | + | + | + | - | - | - |
| 2. A. acris | + | + | - | + | - | + | + | 2 | 6.8 | 1 | + | + | + | + | - | - | - | - | + | - | - | - | + | - | - | + | + | - | - | - | - | - | - | + | - | + | + | + | + | - | - |
| 3. A. amellus | + | - | - | + | + | + | + | 1 | 3.9 | 1 | + | + | + | - | + | + | - | - | + | - | + | + | + | - | + | + | + | + | + | - | + | - | - | + | - | + | + | + | + | + | - |
| 4. A. acuminatus | + | + | + | + | + | + | - | 3 | 2.6 | 2 | + | - | + | + | + | - | - | - | + | - | + | - | - | + | - | + | - | + | - | - | + | - | - | + | + | - | + | - | + | - | + |
| 5. A. altaicus | - | + | - | - | + | + | + | 2 | 4.4 | 3 | - | + | - | + | + | + | - | + | * | + | + | - | + | - | - | + | + | + | - | - | + | - | + | + | - | - | + | - | + | - | + |
| 6. A. alpinus | - | + | - | - | + | + | + | 2 | 5 | 3 | + | + | + | - | + | - | - | + | * | - | + | - | + | - | + | - | + | - | + | + | + | - | + | + | - | + | + | + | + | + | - |
| 7. A. bellidiastrum | - | - | - | - | + | + | - | 1 | 2.5 | 3 | - | + | - | - | + | - | - | + | * | - | + | - | + | - | + | + | + | + | - | + | + | - | - | + | - | + | + | + | + | - | + |
| 8. A. chinensis | + | - | - | + | [illegible] | + | + | 2 | 6.1 | 3 | - | + | - | - | + | + | - | + | * | + | - | - | + | - | + | + | + | + | - | - | - | - | - | + | - | + | + | + | + | + | + |
| 9. A. cinereus | + | - | - | + | - | - | + | 3 | 4.8 | 1 | + | - | + | - | + | - | + | - | + | + | * | * | * | * | * | * | * | * | * | * | + | - | - | + | - | - | + | + | - | + | - |
| 10. A. divaricatus | + | - | + | + | + | + | - | 1 | 1.6 | 1 | + | + | + | - | + | + | - | - | - | - | + | - | + | - | - | + | + | + | + | - | + | - | - | + | - | - | + | + | + | + | + |
| 11. A. ericoides | + | - | - | + | + | + | + | 2 | 17.8 | 1 | + | + | + | + | + | + | - | - | - | + | + | - | + | - | - | + | + | + | - | - | + | - | + | + | - | - | + | + | - | + | + |
| 12. A. laevis | + | - | - | + | + | + | + | 2 | 5.5 | 1 | + | + | + | - | + | + | - | - | - | + | + | - | + | - | - | + | + | + | + | + | + | - | - | + | - | - | + | + | + | + | + |
| 13. A. lateriflorus | + | - | - | + | + | + | - | 3 | 3 | 1 | + | + | + | - | + | + | - | - | - | + | + | - | + | - | - | + | - | + | - | + | + | - | - | + | - | - | + | + | + | - | + |
| 14. A. lowrieanus | + | - | - | + | + | + | - | 1 | 3 | 2 | + | + | + | - | + | + | - | - | - | + | + | - | + | - | + | + | + | - | - | + | + | - | - | + | - | - | - | + | + | + | - |
| 15. A. linosyris | + | + | - | + | + | + | + | 2 | 18.5 | 1 | - | - | - | + | + | - | - | - | + | + | * | * | * | * | * | * | * | * | * | * | - | - | - | + | - | - | + | - | - | - | + |
| 16. A. longicaulis | + | + | - | + | + | + | + | 2 | 5.2 | 1 | - | + | - | + | + | + | - | - | + | + | + | - | + | - | + | + | + | - | - | + | + | - | - | + | - | + | - | + | - | - | - |
| 17. A. macrophyllus | - | + | + | + | + | + | - | 1 | 1.7 | 2 | + | - | + | + | + | - | - | - | - | + | - | - | + | - | - | + | + | - | + | - | - | - | - | + | - | - | + | + | - | + | - |
| 18. A. nemoralis | + | + | - | - | + | + | + | 3 | 3.9 | 1 | + | - | - | - | + | + | - | - | - | + | + | - | - | + | - | + | - | + | + | - | + | - | + | - | + | - | + | - | + | + | + |
| 19. A. novae-angliae | + | - | + | + | + | + | + | 2 | 6.8 | 1 | + | + | + | + | + | + | - | - | - | + | + | - | + | - | - | + | - | + | - | - | + | - | - | + | - | - | + | + | - | + | [illegible] |
| 20. A. novi-belgu | + | - | + | + | + | + | + | 2 | 5.5 | 1 | + | + | - | - | + | + | - | - | - | + | + | - | + | - | - | + | + | - | + | + | + | - | + | + | - | - | + | + | - | + | + |
| 21. A. radula | + | + | - | + | + | + | - | 3 | 4.2 | 2 | + | + | + | - | + | + | - | - | + | + | - | - | - | - | + | + | + | - | + | - | - | - | + | - | - | - | + | + | - | + | + |
| 22. A. prenanthoides | + | + | - | + | + | + | - | 2 | 5.3 | 2 | + | - | + | - | + | + | - | - | - | + | + | - | + | - | + | + | + | + | + | + | + | - | + | + | - | - | + | + | - | + | + |
| 23. A. patens | + | + | - | + | - | + | + | 2 | 2.1 | 1 | + | + | + | + | + | + | - | - | - | - | + | - | + | - | - | + | - | - | + | - | + | - | + | + | - | - | + | + | - | + | + |
| 24. A. punctatus | + | - | - | + | - | + | + | 2 | 12.7 | 1 | + | + | + | + | + | + | - | - | - | + | - | - | + | - | - | - | + | - | - | - | - | - | - | + | - | + | + | - | - | + | - |
| 25. A. puniceus | + | + | - | + | + | + | - | 2 | 8.4 | 1 | + | + | + | - | + | + | - | - | - | + | + | - | + | - | + | - | + | - | - | - | + | - | - | + | - | - | + | + | - | + | - |
| 26. A. spectabilis | + | - | - | + | - | + | - | 2 | 7 | 1 | + | + | - | + | + | - | - | - | + | * | * | * | * | * | * | * | * | * | * | * | * | * | * | * | * | * | * | * | * | * | * |
| 27. A. salicifolius | + | + | - | + | + | + | - | 2 | 7.4 | 1 | + | + | + | + | + | + | - | - | - | - | + | - | + | - | - | + | + | - | - | + | + | - | + | + | - | - | + | + | - | + | + |
| 28. A. sagittifolius | + | - | - | + | + | + | + | 2 | 6 | 1 | + | + | + | - | + | + | - | - | - | - | + | - | + | - | - | + | + | - | - | - | + | - | - | + | - | - | + | + | - | - | - |
| 29. A. sagittifolius F. hirtellus | + | - | - | + | + | + | - | 1 | 2.4 | 2 | + | + | + | - | + | + | - | - | + | - | + | - | + | - | - | + | + | - | + | - | + | - | + | + | - | - | - | + | - | + | - |
| 30. A. subulatus | + | - | + | + | + | + | + | 2 | 6 | 3 | + | + | - | + | + | + | - | - | - | + | + | - | + | - | - | + | - | - | - | - | + | - | - | + | - | - | + | - | - | - | - |
| 31. A. squamatus | + | + | - | - | + | + | + | 2 | 7.5 | 1 | + | + | + | + | - | + | - | - | - | + | + | - | + | - | - | + | - | - | - | - | + | - | - | + | - | - | + | + | - | - | - |
| 32. A. simplex | + | + | - | + | + | + | + | 2 | 7.6 | 1 | + | + | + | + | + | + | - | - | - | - | + | - | + | - | + | + | + | - | - | - | + | - | + | + | - | + | + | + | - | + | - |
| 33. A. tripolium | + | + | - | - | + | + | + | 2 | 17.8 | 1 | - | + | - | - | + | - | - | - | + | + | + | - | + | - | - | - | - | - | + | - | + | - | + | + | - | + | + | + | - | + | + |
| 34. A. tenebrosus | + | - | - | + | + | + | - | 1 | 0.86 | 3 | + | + | + | - | + | + | - | - | + | - | - | + | - | - | - | + | + | - | + | - | + | + | - | - | - | - | + | + | - | + | - |
| 35. A. undulatus | + | - | - | + | - | + | + | 1 | 1.1 | 1 | + | + | + | - | + | + | - | - | - | - | + | - | + | - | - | + | - | - | - | - | + | - | - | + | - | - | + | - | - | - | - |
| 36. A. umbellatus | + | - | - | - | - | + | + | 3 | 3.1 | 1 | - | + | - | + | + | - | - | - | + | + | + | + | + | - | - | + | + | - | + | - | + | - | - | + | - | - | + | + | - | + | - |
| 37. A. cordifolius | + | + | - | - | + | + | - | 1 | 2 | 1 | + | + | + | - | + | + | - | - | - | + | + | - | - | - | + | + | + | - | - | - | + | - | - | - | - | + | + | + | - | - | + |

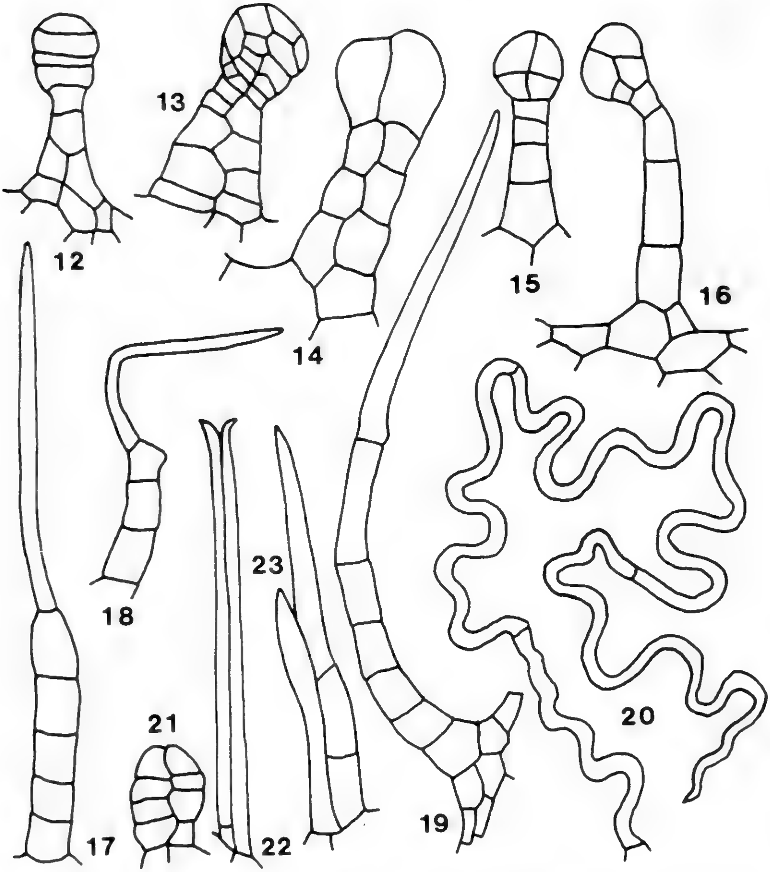

**Figs. 1–6. Morphology of outer involucral bracts.** Figs. 1–3, one-nerved; Figs. 4–6, many-nerved; Figs. 3 & 6, with patches of fibres in mesophyll.




**Figs. 7 & 8. Pappus Hairs.** Fig. 7, 2-celled apex; Fig. 8, many-celled apex.




**Figs. 9–11. Petal Hairs.** Figs. 9 & 10, eglandular. Fig. 11, glandular.




**Figs. 12-20. Epidermal trichomes of outer involucral bracts.** Figs. 12-16, glandular hairs; Figs. 17 & 18, appendaged hairs; Fig. 19, eglandular hair; Fig. 20, entangled hair.

**Figs. 21-23. Hairs on achenes.** Fig. 21, glandular; Figs. 22 & 23, biseriate **egladular.**

**A non-indented dichotomous key to the 37 taxa of *Aster* under investigation**

| | | |
|---|---|---|
| 1. | Plants grey-canescent, with entangled hairs ................................ | *A. cinereus* |
| | plants glabrous, without entangled hairs ................................ | 2 |
| 2. | Capitula solitary terminal .......... | 3 |
| | Capitula in aggregates .............. | 6 |
| 3. | Bracts several-nerved, with fibrous mesophyll; canals in cortex ......... | *A. alpinus* |
| | Bracts uninerved, without fibres; no canals in cortex .................... | 4 |
| 4. | Anthers auricled, bracts with glandular hairs ..................... | *A. altaicus* |
| | Anthers not auricled, bracts without glandular hairs ...................... | 5 |
| 5. | Leaf-margin entire, pappus apex 2-celled. | *A. chinensis* |
| | Leaf-margin toothed, pappus apex with more than 2 cells .................. | *A. bellidiastrum* |
| 6. | Pith hollow ......................... | 7 |
| | Pith solid ......................... | 11 |
| 7. | Cortex without canals; pith lignified | *A. umbellatus* |
| | Canals in cortex; pith parenchymatous | 8 |
| 8. | L/B ratio of leaves at least 17 ..... | *A. tripolium* |
| | L/b ratio 2-8 ....................... | 9 |
| 9. | Bracts with simple veins and no fibres; achenes with biseriate eglandular hairs; anthers auricled ............ | *A. nemoralis* |
| | Bracts with branched veins and fibres; achenes without biseriate eglandular hairs; anthers not auricled ......... | 10 |
| 10. | Leaves sessile; glandular hairs on leaves, bracts and achenes .......... | *A. squamatus* |
| | Leaves petioled; eglandular hairs on leaves and bracts; achenes glabrous.. | *A. cordifolius* |
| 11. | Rays with eglandular hairs .......... | 12 |
| | Rays without eglandular hairs ....... | 13 |
| 12. | Leaf margin entire, apex acute ...... | *A. amellus* |
| | Leaf margin toothed, apex obtuse .... | *A. tenebrosus* |

| | | |
|---|---|---|
| 13. | All achenes with eglandular biseriate hairs .............................. | A. acuminatus |
| | No eglandular biseriate hairs on achenes .............................. | 14 |
| 14. | L/B ratio of leaves 17 or more ...... | 15 |
| | L/B ratio 11 or less (13 in A. punctatus)......................... | 16 |
| 15. | Bracts with 1 simple vein, fibres and appendaged hairs; anthers auricled; rosettes in achene and style of D.F.. | A. ericoides |
| | Bracts with many branched veins, no fibres and no appendaged hairs; anthers not auricled; no rosettes in achene and style of D.F. .................... | A. linosyris |
| 16. | Plant stemless ....................... | A. macrophyllus |
| | Stem present ......................... | 17 |
| 17. | Leaves conspicuously petioled ....... | 18 |
| | Leaves sessile or decurrent ......... | 21 |
| 18. | Pappus apex 2-celled; rosettes in testa; rosettes and prismatics in style of R.F. ...................... | A. lowrieanus |
| | Pappus apex ∞-celled; no rosettes in testa; no crystals in style of R.F... | 19 |
| 19. | Rosette crystals in all achenes, and in style of R.F. .................... | 20 |
| | Rosettes absent in the same organs... | A. undulatus |
| 20. | Anthers auricled; prismatics in achenes .............................. | A. divaricatus |
| | Anthers not auricled; no prismatics in achenes .......................... | A. sagittifolius f. hirtellus |
| 21. | Anthers auricled ..................... | 22 |
| | Anthers not auricled ................ | 27 |
| 22. | Glandular hairs on petals and achenes absent, no prismatics in style ...... | A. radula |
| | Glandular hairs on petals and achenes present; prismatics in style present. | 23 |
| 23. | Pappus apex 2-celled; bracts without glandular hairs ..................... | 24 |
| | Pappus apex ∞-celled; bracts with glandular hairs ..................... | 25 |

| | | |
|---|---|---|
| 24. | Leaf-margin entire; bract with branched vein and no fibres .................. | *A.novi-belgu* |
| | Leaf-margin dentate;bract with simple vein and fibres ..................... | *A.prenanthoides* |
| 25. | L/B ratio 2; pith lignified ......... | *A. patens* |
| | L/B ratio 7 or more; pith parenchymatous ...................... | 26 |
| 26. | Leaf-margin dentate; no rosettes in achene , prismatics in style present | *A.salicifolius* |
| | Leaf-margin entire; rosettes in achene present; no prismatics in style...... | *A. simplex* |
| 27. | Capitula in corymbose arrangement.... | 28 |
| | Capitula not corymbose .............. | 30 |
| 28. | Leaf-margin dentate; no canals in stem ... | *A. spectabilis* |
| | Leaf-margin entire; canals in cortex. | 29 |
| 29. | Bracts 1-nerved with fibres,glandular and appendaged hairs absent on bracts and petals; pappus apex ∞-celled... | *A. acris* |
| | Bracts ∞-nerved and no fibres, glandular and appendaged hairs on bracts; petals with glandular hairs; pappus apex 2-celled ................ | *A. longicaulis* |
| 30. | Pappus apex ∞-celled ............... | 31 |
| | Pappus apex 2-celled ................ | 32 |
| 31. | Canals in cortex present; pith lignified,bracts with glandular hairs | *A. adscendens* |
| | No canals in stem; pith parenchymatous; bracts without glandular hairs....... | *A.sagittifolius* |
| 32. | Bracts with glandular hairs ......... | 33 |
| | Bracts without glandular hairs ...... | 35 |
| 33. | L/B ratio of leaf 12 or more, petals without gland. hairs; no canals in phloem; pith lignified ............. | *A. punctatus* |
| | L/B ratio of leaf less than 7;petals with gland. hairs; canals in phloem; pith parenchymatous ................. | 34 |
| 34. | Leaf-apex acute; bracts with fibres.. | *A.novae-angliae* |
| | Leaf-apex obtuse; fibres absent...... | *A. subulatus* |
| 35. | Leaf-margin entire; rosettes in style of R.F. ........................... | *A. laevis* |
| | Leaf-margin dentate; no rosettes in style of R.F. ...................... | 36 |

36. L/B 3; prismatics in testa, achene & style. *A. lateriflorus*
    L/B 8.4, rosettes in testa, achene & style. *A. puniceus*

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# NEW SPECIES OF GIGANTOPTERIDACEAE

# FROM THE LOWER PERMIAN OF TEXAS

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In their article on Upper Paleozoic floral zones and floral provinces, Read and Mamay (1962) recognized two new species of Permian plants, which they designated as "Gigantopteris new species A" and "Gigantopteris new species B". Inasmuch as that article was of biostratigraphic rather than taxonomic nature, the two new plants served a useful purpose as easily recognizeable guide fossils, notwithstanding the absence of formal names or diagnoses. However, Permian paleobotany has experienced a resurgence in the past decade or so, and recently published references to these unnamed plants indicate the need for formal nomenclatural designations. Accordingly the names *Cathaysiopteris yochelsonii*, n. sp. (for *Gigantopteris* n. sp. B) and *Zeilleropteris wattii*, n. sp. (for *Gigantopteris* n. sp. A) are proposed here.

*CATHAYSIOPTERIS YOCHELSONII* Mamay, n. sp.

*Gigantopteris* new species B. Read and Mamay, 1964, p. K15, pl. 19, fig. 2.

Specific diagnosis: Leaves large (to 20cm long), petiolate, dichotomously divided; the two laminar lobes oblong, of equal length (to 18 cm above the point of division of the midrib), to 6 cm wide at the broadest point, with outer sides slightly wider than the inner; margins sinuous to crenate, with sinuses 4 to 15 mm apart; apices of lobes acute with blunt tips; leaf bases acute. Petioles short, stout. Veins pinnate, in three orders. Midrib stout, to 3 mm wide, forking once, well above the laminar base; divisions of the midrib (primary veins) straight, forming an acute angle (app. 30 degrees), each extending to the tip of a laminar lobe. Secondary veins stout, opposite or alternate, slightly decurrent in distal parts of the leaf but mostly straight and parallel; secondaries departing at angles of 30 to 80 degrees with the primary veins, those toward the laminar apex creating the narrowest angle; secondaries 6 to 18 mm apart, each terminating undivided at the convexity of a marginal crenation. Tertiary veins delicate, produced from both sides of the secondaries or directly from the primaries, those of secondary origin departing at angles of 50 to 75 degrees, with the narrowest angles generally formed in distal parts of the leaf, and those of primary origin departing at perpendicular to slightly obtuse angles; tertiaries to 8 mm long, mostly 4 to 6 mm, alternate to opposite, closely spaced at intervals of approximately 0.5 mm, essentially straight and parallel, joining sutural veins at approximately equal intervals; tertiaries mostly undivided but occasionally dichotomizing once, most commonly toward leaf margins and usually occurring shortly beyond the point of departure from the secondary; tertiaries never anastomosing or fasciculate. Sutural veins delicate, one departing immediately above each secondary and bisecting the angle between the secondary and primary, arching outward, then following a straight course parallel to and halfway between the two adjacent secondaries, and terminating undivided at the margin in a sinus or marginal concavity. Those tertiaries proximal to a sutural vein are derived from a secondary vein; the first few distal tertiaries are derived from the primary vein and are succeeded by tertiaries of secondary origin.

Holotype: USNM 41776, Paleobotanical collections of the U.S. National Museum; Read and Mamay, 1964, pl. 19, fig. 2.

Paratypes: USNM 406021-406027.

Geographic, stratigraphic source of type specimens: Quarry on C.O. Patterson property 6 mi. SW of Lawn, southern part of Taylor Co., Texas; SW ¼, S. 436 of M.P. King Survey. Shale in the lower part of the Vale Formation, Clear Fork Group, Leonardian Series, Lower Permian.

Derivation of name: The specific name refers to E.L. Yochelson, who found the holotype.

Comments: The presence of a sutural vein in a system otherwise entailing three orders of venation, the simplicity and close spacing of the tertiary veins, and the long, very narrow meshes between the tertiaries are characteristics of *Cathaysiopteris yochelsonii* that closely resemble the venation of *C. whitei* (Halle) Koidzumi from the Lower Permian of China and Japan, originally described by Halle (1927) as *Gigantopteris whitei*;these resemblances exclude all other gigantopteridaceous species from comparative consideration. The two species are distinguished from each other, however, by the following differences in venation: thesecondary veins of *C. yochelsonii* persist without dividing, to the leaf margin, while those of *C. whitei* lose their identity a short distance from the margin by dividing into several fine, forking veinlets that continue to the margin; the secondary veins of *C. yochelsonii* create angles of 30 to 80 degrees with the primaries, while those of *C. whitei* are mostly perpendicular; angles ofdeparture of the tertiaries measure from 50 to 75 degrees in *C. yochelsonii*, but they are only 30 degrees or so in *C. whitei*; in *C. yochelsonii* each sutural vein originates immediately above the point of origin of the subjacent secondary, but in *C. whitei* the sutural veins originate midway between adjacent secondaries.

Because of the limited and fragmentary nature of available material of these species, a satisfactory comparative appraisal of their gross leaf architecture is not possible. The probability exists, however, that two fundamentally different leaf forms are represented by the fossils. The Texas specimens are all incomplete but the better specimens suggest the dichotomously divided lamina of an otherwise undissected leaf; one specimen of C. whitei, on the other hand, is pinnately compound (Asama, 1959, p. 66).

ZEILLEROPTERIS WATTII Mamay, n. sp.

Gigantopteris new species A. Read and Mamay, 1964, p. K15, pl. 19, fig. 1.

Specific diagnosis: Leaves large (to 32 cm long, 27 cm wide), petiolate, dichotomously divided; the two laminar lobes broad, oblong, of equal length (to 25 cm above the point of division of the midrib), to 13 cm wide at the broadest point, with both sides equally developed; margins very shallowly sinuous or crenate with sinuses 7 to 25 mm apart; apices of the lobes acute with rounded tips; leaf bases rounded. Petiole short, stout (to 6 mm wide). Veins pinnate, in four orders. Midrib stout, to 6 mm wide, forking once, approximately 5 cm above the laminar base; divisions of the midrib (primary veins) stout, separating at an acute angle (app. 50 degrees), slightly bent admedially for a short distance above the point of division, each extending to the tip of a laminar lobe. Secondary veins stout, opposite to alternate, arising 1.0 to 2.5 cm apart, narrowly decurrent for a short distance from the primary, then bending sharply outward, proceeding undivided in a straight course to the laminar margin and usually terminating at the convexity of a crenation; basal secondaries slightly obtuse, the angles of departure decreasing distally to approximately 50 degrees; secondaries parallel near the primaries, becoming more distant toward the margins. Tertiary veins delicate, arising from both sides of the secondaries or directly from the primaries, those of secondary origin narrowly decurrent, then describing angles of 60 to 80 degrees, those of primary origin perpendicular to slightly obtuse; tertiaries alternate to opposite, to 1 cm long, mostly 3 to 7 mm, spaced 3 to 6 mm apart, slightly curved toward leaf apex, parallel, becoming divided toward ends into several quaternary veins that dichotomize sparingly, fuse with similar veins from adjacent and opposing tertiaries or join a weakly developed, zigzag intersecondary sutural vein to form small, narrow, triangular to polygonal meshes. Quaternary veins mostly less than 2 mm long, spaced 0.5 to 1.0 mm apart, forming angles of 35 to 70 degrees; quaternaries dichotomizing sparingly, anastomosing rarely; tips of ultimate veinlets meeting those from the adjacent tertiary or from tertiaries of primary origin at a zigzag, weak or nearly obscure intertertiary sutural vein, forming many narrow, triangular to polygonal meshes. Sutural veins generally less robust than the quaternaries; one intertertiary sutural vein departing directly above each tertiary, bisecting the angle between the tertiary and secondary, arching outward, and joining the intersecondary sutural vein.

Holotype: USNM 41775, Paleobotanical collections of the U.S. National Museum; Read and Mamay, 1964, pl. 19, fig. 1.

Paratypes: USNM 406028-406032.

Geographic, stratigraphic source of type specimens: Old roadcut 225 yards west of U.S. Highway 183-283, 0.4 mi. south of Lake Kemp spillway, 6 mi. north of Mabelle, Baylor Co., Texas. Siltstone in upper part of the Lueders Limestone, Wichita Group, Leonardian Series, Lower Permian.

Derivation of name: The specific name refers to A.D. Watt, who found the holotype.

Comments: With its four orders of venation and both intersecondary and intertertiary sutural veins, the Texas material is clearly referable to the genus Zeilleropteris, proposed by Koidzumi (1936) in his article describing the family Gigantopteridaceae. The type species, Z. yunnanensis Koidzumi, and Z. yujiaensis (Huang) Li and Yao (1983) are the only previously named species of this genus; both are from the Permian of China. Zeilleropteris wattii closely resembles the Chinese species, and only minor differences are apparent in the venation patterns. The type specimen of Z. yunnanensis, first illustrated by Zeiller (1907, fig. 15, 15a), has neither midrib nor margin, and shows only a small area of the leaf, bounded by parts of four secondary veins. The sutural veins are visible, however, and they appear to be straight, while those of Z. wattii are zigzagged; additionally, the meshes of Z. yunnanensis are narrower and directed forward at narrower angles than those of Z. wattii. Z. yujiaensis, originally described by Huang (1980, p. 558, fig. 37) as Gigantonoclea yujiaensis, also differs from Z. wattii in having straight or only weakly curved sutural veins in contrast to the zigzag pattern in Z. wattii. Further, Huang illustrated a nearly complete leaf, showing a large, undivided lamina with irregularly lobed margins. This is in marked contrast to the dichotomous leaf form of Z. wattii, best seen in USNM 406028.

Recognition of the new taxa Cathaysiopteris yochelsonii and Zeilleropteris wattii provides a significant point of generic comparisons between the Permian floras of North America and Asia. The presence of the distinctive venation patterns of Cathaysiopteris and Zeilleropteris in such distantly separated regions is phytogeographically noteworthy. However, these similarities are not paralleled in distribution of gross leaf morphologies. Compound leaves have not been found in the American gigantopterids. Their leaves are undivided, as in Delnortea abbottii Mamay, Miller, Rohr, and Stein (1986), or dichotomously divided, as in Gigantopteridium americanum (White) Koidzumi (1936), Cathaysiopteris yochelsonii, and Zeilleropteris wattii. Among the Asiatic members of Gigantopteridaceae, on the other hand, only one (Aipteris hirsuta Sikstel, 1962) shows foliar dichotomy; all the others are either undivided or pinnately compound.

The summary effects of the nomenclatural adjustments presented here are to establish the presence in North America of two genera of Gigantopteridaceae previously known only in Asia, and to emphasize that the genus Gigantopteris, as treated by Koidzumi (1936), Asama (1959), and others, is not presently known to occur in North America.

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# NOTES ON THE GENUS *CLERODENDRUM* (*VERBENACEAE*). XXVIII

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*CLERODENDRUM* Burm.

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*CLERODENDRUM JAPONICUM* (Thunb.) Sweet

Additional bibliography: Thunb., Fl. Iap. 255. 1784; J. F. Gmel.

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Illustrations: Kwa-wi [transl. Savatier], Arbor 2: pl. 10. 1759; Banks, Icon. Sel. Pl. Jap. Kaempf. pl. 58. 1791; Morr., Ann. Soc. Roy. Agr. Bot. Gand. 1: pl. 3 (in color). 1845; Caspary, Dissert. Inaug. Nect. pl. 3, fig. 31. 1848; Regel, Gartenfl. 5: pl. 178 (in color). 1856; Carr., Rev. Hort. 46: 110/111 (in color). 1874; Regel, Gartenfl. 29: pl. 24 (in color). 1880; Baines, Garden Lond. 19: 453. 1881; Nicholson, Illust. Dict. Gard. 2: 341. 1887; Lubbock, Seedlings 2: 373. 1892; "W. W.", Garden Lond 42: 563. 1892; Useful Pl. Jap. 2: pl. 500 (in color). 1895; Apgar, Ornament. Shrubs U. S. fig. 509. 1910; E. H. Wils., Arnold Arb. Exped. China pl. 216. 1912; Mak., Illust. Fl. Jap. [893]. 1924; Mak., Illust. Fl. Nipp. 186. 1940; Mold. in Gleason, New Britt. Br. Illust. Fl. 3: 138. 1952; Hara & al.,Spring Fl. Sikkim Himal. pl. 221 (in color). 1963; Corner & Watanabe, Illust. Guide Trop. Pl. 758. 1969; Duke & Ayensu, Med. Pl. China 2: 638. 1985.

A semi-woody, regular bush, erect shrub, or undershrub, 0.5--2.8 m. tall, often low and single-stemmed, ornamental, or a small tree, 3--5 m. tall, sometimes a climber [fide *Chung 2351*], ill-smelling; branches, when present, rather thick, puberulent when young; bark gray, smooth, rarely with conspicuous lenticels; branchlets stout, very medullose, very obtusely or acutely tetragonal, green or reddish-green, often deeply sulcate between the angles in drying, brownish when dry, densely puberulent, sparsely lenticellate; pith lamellate; nodes annulate, the larger ones marked with a narrow circumferential band of villous tomentum; principal internodes 3.8--11 cm. long; leaves large, decussate-opposite; petioles stout, 1.5--22 cm. long, cylindric, basally ampliate, often red, puberulent, often collapsing at the base and sulcate above in drying; leaf-blades thinly chartaceous, very dark-green on both surfaces, usually brunnescent or nigrescent in drying, ovate or broadly ovate to orbicular or suborbicular to obcordate, 7--25 cm. (or more) long, 7--25 cm. wide, apically acute or short-acuminate, marginally remotely serrate or glandular-denticulate throughout with appressed crenate teeth and very shallow sinuses, basally deeply cordate or auriculate, sparsely setulose or strigillose above or glabrate except for the puberulent venation, minutely puberulent along the venation and very densely lepidote-squamulose beneath with rather large, thick, round, light- or golden-yellow peltate scales; midrib slender or stoutish, often red, flat and often more or less densely pulverulent-puberulent above, prominent beneath; secondaries slender, 4--9 per side, often red, flat above, prominent beneath, the lowest 2 or 4 issuing palmately from the very base of the lamina, without axillary glands, ascending, not much arcuate; vein and veinlet reticulation rather sparse, the larger veins (tertiaries) issuing from the lowest pair of secondaries prominulent beneath, the remainder mostly obscure on both surfaces; inflorescence supra-axillary and terminal, mostly forming a large, rather open, villous terminal panicle to 30 cm. long and wide; axillary peduncles divaricate, about 6 cm. long, reddish; cymes very wide-spreading, long-stipitate, 11--25 cm. long, loosely many-flowered, 4--8 cm. wide, solitary and opposite in the uppermost leaf-axils; terminal panicle very lax, often massive with greatly elongated reddish-tinged sympodia and 4--6 pairs of widely divergent, loosely and comparatively few-flowered cymes; main peduncles stoutish, 4.5--15.5 cm. long, puberulent, often sulcate in drying, brown or buff to purplish; pedicels very slender, 7--27 mm. long, puberulent; bracts conspicuous, a pair subtending each pair of cymes in the terminal panicle, large and foliaceous, oblong or elliptic to ovate, long-stipitate, to 4 cm. long and 1.5 cm. wide; bractlets oblong or linear, numerous, to 2 cm. long and 2.5 cm. wide, often red, puberulent; prophylla linear, elongate, 4--10 mm. long, red-tinged, puberulent; flowers ill-smelling or odorless [depending on time of day?], showy; calyx campanulate, deeply 4-fid (practically to the base), the lobes thin-textured, bright-red or scarlet, triangular-lanceolate or triangular, 10--17 mm. long, basally 4--7 mm. wide, apically shortly or attenuately acuminate and subulate-tipped, lepidote and puberulent; corolla hypocrateriform, mostly brightly deep-red or scarlet, in all 2--3 cm. long, the tube cylindric, 1.5--2 cm. long, about 2 mm. wide, slightly curvate, externally sparsely villous, the limb rather irregularly 5-lobed, 1.5--2.5 cm. in diameter, the lobes elliptic or oblong, 8--12 mm. long, 3 mm. wide; stamens 4, unequal, inserted in the upper part of the corolla-tube, exserted 1.5 cm. from the corolla-mouth; filaments slender, 4--5 cm. long, slightly villous; anthers versatile; style slender, 4--8 cm. long, exserted, 3 times (or more) as the corolla-tube, glabrous; stigma minute; ovary superior, 4-celled; ovules pendulous; fruit drupaceous, at first enclosed by the mature calyx whose lobes finally become reflexed, black, edible.

This much misunderstood species is based on a collection made by Thunberg in Japan, of which I have examined photographs of both the holotype and an isotype (cited below).

Because of the confusion which has surrounded this species, I am reproducing herewith the most excellent (although misidentified) and very typical illustration given of it by Morren in 1845. The original specimens of Fischer's "*Clerodendron Kaempferi*", which Morren's plate depicts, deposited in the Leningrad herbarium, have also been examined personally by me. Thunber (1784) avers that the species was originally introduced into Japan from Korea.

Collectors have found this plant growing in moist areas, on grassy hillsides, along roadsides and on riverbanks, in cafetal and cultivated ground, in shade or partial shade, in heavy humus or loam, at the margins of forests or thickets, and in secondary deciduous woods on yellow argillaceous soil, at altitudes of 16--1360 m., in flower in February and from April to September, and in fruit in October. In Burma Belcher reports it growing "solitary in thick scrub on hillsides", while in Kwangtung it is reported to be "fairly common as scattered shrubs in dry sandy soil". In Veracruz (Mexico) it is said to be "abundant in yellowish-red rocky soil in high subevergreen secondary forests", obviously introduced and naturalized.

The corollas are described as "red" by Walker (1976) and on *Chiao*

*Pl. 3.*


[from Morren, Ann. Soc. Roy. Agr. Bot. Gand. 1: pl. 3 (in color). 1845]

*1495, Chung 2893, Esquirol 123, Herb. Canton Chr. Coll. 12540, Herb. Nanking Univ. 14694, Hernandez & al. 175, Peng & al. 541, Steward & Cheo 669, Tsang 21068, Tsang & al. s.n., Tsing 2123, Vazquez 398,* and *Ying 853*, "deep-red" on *Chung 4042*, "bright-red" on *Ching 1900, King 1010, Walker & al. 6186*, and *Williams 9632*, "scarlet" by Fang (1944) and Hara (1963) and on *Smith 1* and *Wilson 4555*, "purple" on *Chung 2351*, and "yellow" on *Murça Pires & Black 1308*.

*Clerodendrum japonicum* appears to be native to Nepal, Assam, Upper Burma, and China, naturalized in Japan, Indochina, the Ryukyu Islands, Indonesia, Surinam, Brazil, Mexico, and elsewhere. It is often cultivated in tropical and subtropical regions, and under glass elsewhere. The Surinam record is based on several collections in the Utrecht herbarium from the forest near the Agricultural Experiment Station at Paramaribo, where, presumably, it had been cultivated and later escaped and became naturalized. In Maryland the record is based on a collection from "in the woods near Chevy Chase" made by D. A. Bisset on September 20, 1912, deposited in the U. S. National Arboretum herbarium.

Loudon (1830) asserts that the species was introduced into cultivation in England in 1820 from Japan; Sweet (1827) gives the date of introduction as 1823, but in the 1830 edition of his work adds that the flowers are "wh[ite]" -- probably the white-flowered form described hereinafter

Walker (1976) says of the species "Native of Malaya or southern Asia, thus misnamed '*japonica*'" and that it is only introduced in Okinawa. P'ei (1947) records it from Szechuan. Masamune (1955) and Sonohara & his associates (1952) also claim that in Okinawa it is only introduced. Rao & Verma (1969) list it from Assam, but it seems most probable that, in this case, they are referring, instead, to C. *philippinum* Schau. Matuda (1950) found C. *japonicum* in cultivation in Escuintla, Guatemala, as well as in Chiapas, Mexico. King refers to it as a "not common shrub", apparently wild, in Veracruz, Mexico. Babu (1977) reports it cultivated in Dehra Dun, India. Fournet (1978) lists it from Guadeloupe, but as yet I have seen no authentic material of it from that West Indian island.

Common and vernacular names reported for *Clerodendrum japonicum* include "ch'au shi mut li", "chau sze mool lai", "chirinto", "fi giri", "figiri" [=fire-tree], "go too", "go too giri", "hé bāo huā", "higiri", "hi-giri" [=scarlet *Paulownia*], "hi guiri", "Japan clerodendrum", "Japanese gloryberry", "Japanese glorybower", "shuin "t'ung", "tei too", "too guiri", "volkameria du Japon", and "wan hon na wan njari". The numerous other names recorded seem, rather, to apply to C. *kaempferi* (Jacq.) Sieb. or to C. *philippinum* Schau or its f. *multiplex* (Sweet) Mold.

Because of the wide misapplication of the name, *Clerodendrum japonicum*, a brief survey of some pertinent items in the literature follows:

Lamarck (1808) translates Thunberg's original description of *Volkameria japonica* as follows: "C'est, d'après Thunberg, un arbre très élevé, dont la cime est ample, très-glabre; les rameaux paniculés, un peu comprimés a leur partie supérieure, garnis de feuilles alternées, petiolées, ovales, fortement echancrées en coeur à leur base, veinées, acuminées à leur sommet, glabres, plus pâles em dessous; les inférieures longues d'un pied, larges d'environ sept pouces; les supérieures insensiblement plus petites & plus obtuses; le pétiole long de sept pouces aux plus grandes feuilles, & de dix lignes aux plus petites. Les fleurs sont disposées en grappes à l'extrémité des plus jeunes rameaux; les pédoncules partiels simples, unilatéraux, uniflores, droits, longs d'un demi-pouce, accompagnés chacun d'une bractée solitaire, subulée, plus courte que le pédoncule. La calice est rousseâtre, divisé en cinq découpures ecartées à leur base, concaves, lanceolées, terminées par une arête. La corolle est irregulière; le tube cylindrique, de couleur purpurine, une fois plus long que le calice; le limbe à cinq découpures presqu'égales, plus courtes que le tube. Le fruit est une capsule ovale, à quatre sillons, de la grosseur d'une prune, à quatre valves, à deux loges. s'ouvrant transversalment. Cette plante croît au Japon. ♄ (Descrip. ex Thunb.)"

Siebold & Zuccarini (1846) comment that "Schon Willdenow bemerkt, (Spec. plant. III. p. 385) mit Recht, dass die Thunbergische *Volk. japonica* nicht mir der in Gärten unter diesem Namen kultivirten Pflanze zusammengezogen werden könne, und nennt in der Enumeratio hort. berol. p. 659 letztere *Cler. fragrans*. Persoon führt ebenfalls *V. japonica* und *fragrans* gesondert auf. Erst die neueren Schriftsteller ziehen beide wieder zusammen, lassen dagegen aber *Cl. squamatum* oder *Kämpferi* als einige Art bestehen. Allerdings scheinen zwar zwischen dieser und *Volk. japonica* Thunb. nach des Letzteren Beschreibung seine Pflanze einige Verschiedenheiten obzuwalten, aber da Thunberg, Kämpfer a. s. O. zu seiner Pflanze citirt, dessen Beschreibung offenbar auf *Volk. Kämpferi* hinweist (Fi kiri, i. e. ignea kiri, a colore igneo stylos floridos, perianthia ac flosculos tingente), so dürfte dieses die Abweichungen in der Beschreibung ausgleichen und demnach *Cl. squamatum* als identisch mit *Volk. japonica* Thunb. zu betrachten seyn, [sic] *Cler. fragrans* dagegen als eigne Art bestehen, deren Stammform mit einfachen Blüthen jetzt auch schon in Gärten vorkommt. *Cl. squamatum* ist nach Thunberg aus Korea nach Japan verpflanzt, ob *Cl. fragrans* auch in Japan sich finde, scheint noch zweifelhaft. Im Sieboldtschen Herbarium wenigstens fehlt sie."

Backer (1916), in his discussion of what he called C. *squamatum* Vahl, very truly remarks that "Veranderlijk wat betreft de lengte van kelk en kroonbuis. De javaansche exemplaren behooren alle tot de varieteit *japónicum* Hasskarl, waarbij de kelk 10--17 mM hoog is en de kroonbuis 15--20 mM lang. Op Sumatra en ook elders vindt men den typischen vorm, waarbij de kelk 8--10 mM, de kroonbuis 18--25 mM lang is. Op de Philippijnen treft men, behalve deze beide vormen, nog een tusschenvorm aan." His C. *squamatum* we now call C. *kaempferi* (Jacq.) Sieb., the var. *japonicum* is C. *japonicum* (Thunb.) Sweet, and the "intermediate" Philippine form is C. *bethunianum* Low.

Maheshwari (1966) claims that "*Clerodendrum fragrans*, which is accredited to Ventenat.......needs a revision. Moreover, the oldest validly published name for this plant is that of Thunberg, *Volkameria japonica*, of 1784. Huber (in Fl. W. Trop. Africa 2: 443.

1963) believes that its correct nomenclature and synonymy would be as follows: *Clerodendrum japonicum* (Thunb.) Sweet, Hort. Brit. (ed. 1) 322. 1827; Huber, loc. cit. Basionym: *Volkameria japonica* Thunb. Fl. Jap. 255. 1784. Synonyms: *Volkmannia japonica* Jacq. Hort. Schoenbr. 3: 48. t. 338. 1798; *Volkameria fragrans* Vent. Jard. Malm. 2: t. 70. 1804; *Clerodendrum fragrans* Vent. loc. cit. (in syn. under *Volkameria fragrans* Vent. loc. cit.)." Jackson (1893) also reduces *Volkameria japonica* Thunb. to *Clerodendrum fragrans* Vent. This disposition, however, I cannot accept!

My good friend, William T. Stearn, in a letter to me dated February 8, 1966, says: "In Taxon 15 no 1 (Jan. 1966) p. 44 you will find a note by J. K. Maheshwari entitled 'A new combination in *Clerodendrum* L.' in which the name *Clerodendrum japonicum* (Thunb.) Sweet var. *pleniflorum* (Schauer) Maheshwari is proposed for the double-flowered plant usually and rightly known as *C. fragrans* (Vent.) Aiton f. var. *pleniflorum* Schauer. This is the name we have adopted in the Flora of Barbados 357 (1965) and which you have used in your many publications on the *Verbenaceae*. I assume you have seen Thunberg's type of *Volkameria japonica* and that Juel was right in identifying it with *C. squamatum* Vahl. If so, then the name *C. fragrans* stands and *C. japonicum* var. *pleniflorum* drops into synonymy. There is a danger, however, that unless a note is published soon in Taxon correcting Huber and Maheshwari people who do not know any better will follow them...." Howard & Powell (1968) have shown that it is *Volkmannia japonica* Jacq. which belongs in the synonymy of *Clerodendrum philippinum* [the name now used for the old *C. fragrans*], not *Volkameria japonica* Thunb.

A perusal of the literature relating to *Clerodendrum japonicum* reveals, at least in my estimation, that the plant referred to by this binomial by at least the following authors is actually *C. kaempferi* (Jacq.) Sieb.: Backer & Bakhuizen (1965), L. H. & E. Z. Bailey (1941, 1974), Banerji (1965), Hara (1948, 1972), Holthuis & Lam (1942), Hsiao (1944), Lam (1945), Lam & Meeuse (1942), Makino (1903), Mattoon (1958), Ohwi (1965), Pande (1967), and Yamazaki (1966). Further, the following authors erroneously reduce it to synonymy under *C. squamatum* or *C. kaempferi*: Alexander (1971), Corner & Watanabe (1969), Franchier & Savatier (1875), Maximowicz (1886), Synge (1956), and Voss (1895). The Baileys, in their 1976 work, correctly maintain *C. japonicum* and *C. kaempferi* as separate species.

The following authors use "*C. japonicum*" as the valid name for what I regard as correctly called *C. philippinum* f. *multiplex* (Sweet) Mold.: Aiton (1812), Bretschneider (1898), Desfontaines (1815), Huber (1963), Maheshwari (1966), Maheshwari & Chakrabarty (1966), Nielsen (1965), Raizada (1968, 1978), Rau (1969), Saxena (1970), Singh (1972), and Varma (1981). Singh refers to the flowers as "purplish-white" and Varma describes them as "double", which is certainly sufficient evidence that the plant referred to is *C. philippinum* f. *multiplex*, not *C. japonicum*. The illustrations given by Corner & Watanabe and by Maheshwari & Chakrabarty are on this account not included by me in the list of illustrations for *Clero-*

*dendrum japonicum* on a previous page of the present work.

As further examples of the almost hopeless mixups in the given or assumed synonymy of this taxon, may be mentioned the following: Hara (1948, 1972) gives as synonyms of *C. japonicum* the following: *Volkameria kaempferi* Jacq., *V. kaempferiana* Jacq., *Clerodendron squamatum* Vahl, *C. kaempferi* Sieb., *C. imperialis* [sic] Carr., and *C. japonicum* (Thunb.) Mak. Masamune, writing in 1955, places in its synonymy *C. squamatum* Vahl, *C. intermedium* Cham., *C. paniculatum* Hook. & Arn., *C. viscosum* Vent., and *C. infortunatum* "L. ex Maxim."!

Merrill, in a longhand notation in his copy of Loureiro's 1790 work claims that the "*Clerodendrum infortunatum* L." of Loureiro is actually *C. japonicum*, but I feel, from a careful perusal of the description, that it is a combination of *C. kaempferi* and *C. viscosum* - mostly the former. In his 1935 work, in commenting on the "*Clerodendrum infortunatum* (non Linn.) Lour.", said by Loureiro "Habitat Cantone Sinarum", sums up: "Loureiro's description applies unmistakably to the widely distributed species currently known as *Clerodendrum squamatum* Vahl, for which H. Lam cites about twenty synonyms. *Clerodendrum japonicum* (Thunb.) Sweet Hort Brit. 322. 1826, Makino in Bot. Mag. Tokyo 17: 91. 1903 is the oldest binomial, if Dr. Lam be followed in treating this as a collective species, as it was based on *Volkameria japonica* Thunb. which dates from 1784. Doctor Carl G. Alm kindly supplied me with excellent photographs of Thunberg's type with critical notes. Thunberg's statement: 'Arbor vasta, excelsa' is an error; the species is a small shrub. The plant is not 'tota glabra', the branches of the inflorescence being densely hairy and with numerous intermixed glandular hairs but the pilosity is not visible to the naked eye. The leaves are glabrous. This form differs from *C. squamatum* Vahl, among other characters, by its much larger calyxes. The form with smaller calyxes, which is not uncommon near Canton, is *C. kaempferi* (Jacq.) Sieb. (*C. squamatum* Vahl), and this I believe to be specifically distinct from *C. japonicum* (Thunb.) Sweet."

Carrière (1874) gives the following description of his *Clerodendron imperialis*: "Tel est le nom sous lequel on trouve dans quelques établissements horticoles une des plus jolies plantes qu'il soit possible de voir, que nous allons décrire, et qu'on a essayé de rendre par la figure coloriée ci-contre. Ce *Clerodendron imperialis* est-il une espèce, un hybride où une variété, où bien est-il simplement une vieille plante rajeunie dans les dernières années où florissait l'Empire par quelqu'un de ses adeptes, et en vue de s'en faire bien voir? C'est ce que nous ne pourrions dire. Malgré les nombreuses recherches que nous avons faites, les renseignements que nous avons pris, soit auprès des horticulteurs, soit auprès de certains botanistes très-compétents et bien au courant des plantes commerciales, nous n'avons pu rien découvrir de certain au sujet de cette plante qui, nous le répétons, est très-jolis et vraiment digne du nom qu'elle porte. Nous avons bien trouvé décrites et figurées quelques espèces de *Clerodendron* qui, par les fleurs, semblent se rapprocher de la plante dont nous parlons; mais indépendamment qu'aucune n'est parfaitement semblable, les descriptions ne s'accordent pas. Tel est, par example le *Clerod. squamatum*, Vahl.......En effet, si cette figure a quelques ressemblance avec le *Cl. imperialis* il n'en est pas de même en ce qui concerne la description, qui l'indique comme étant un 'arbre branchu' ce qui n'existe pas chez ce dernier. Tout ce que nous savons d'à peu près certain, c'est que M. Chantin, horticulteur.....l'a reçu vers 1865. Nous ne serions pourtant pas trop éloigné je croire que le *Cl. imperialis* est une forme du *Cl. Kaempferi*, bien supérieure toutfois au type duquel il nous parait différer sensiblement. Mais quoi qu'il en soit nous avons cru devoir figurer et décrire cette plant, car en admettant même qu'elle ne soit pas nouvelle, il est toujours avantageux le rappeler ce qui est beau, surtout lorsqu'il s'agit d'une espece peu connue, et c'est ici le cas." He follows this with a full description. Examination of his type illustration shows it to belong in the synonymy of *C. japonicum* and not in that of *C. kaempferi* as previously stated by me (1940).

On the other hand, the illustration given by Hsiao (1944) shows that the plant which he describes as *C. japonicum* is really *C. kaempferi*.

*Clerodendron coccineum* H. J. Lam is based on *Buijsman 74* from near Nongho Djadar, at 1200 m. altitude, Mt. Tengger, Java, collected on July 10, 1907, and on *Herb. Utrecht 49914* from Japan. Lam (1919) notes that "This must be a very beautiful and decorative plant, worth cultivating". The homonymous *C. coccineum* D. Dietr. ["Dietz," on p. 363 of Lam's work] is a synonym of *C. kaempferi*.

Léveillé published the name *Clerodendron esquirolii* for two different plants on two separate pages of his 1912 work. The *C. esquirolii* on page 298 of his work is based on *Esquirol 2802* from "bois de Ta-Tham [Kweichow, China], très ombreux et chaud", collected in May of 1912, with the notation "toute l'inflorescence rouge, lie de vin, feuilles radicales, fleur 1 m. de haut sur tige simple" and proves to be *Tacca chantieri* Andre in the *Taccaceae*; the *Esquirol 3278*, cited by him in his 1915 work, also is *Tacca chantieri*. On the other hand, the *C. esquirolii* proposed on page 302 of the 1912 work is based on *Esquirol 123*, collected in July of 1904 on the "route de Pe-tien à Lo-yen", Kweichow, with the note "arbrisseau de 1--2 m., sans division, sommite ecarlate". It is this one that is *Clerodendrum japonicum* (Thunb.) Sweet.

Léveillé's *C. darrisii* is based on *J. Cavalerie 3490* from Lo-fou, Kweichow, collected in August of 1909, with the notation "arbre".

Fedde noticed the homonymous nature of Leveille's second *C. esquirolii* and proposed the substitute name, *C. leveillei*, for it and this was published for him by Léveillé in his 1914 work [which is dated "1915" by Rehder]. P'ei (1932) comments that "The fragmentary material of *Clerodendron darranii* [sic] Levl. and of *C. Leveillei* Fedde which I have examined in the Herbarium of the Arnold Arboretum, indicates their close alliance to or identity with *Clerodendron paniculatum* L."

*Clerodendron squamatum* var. *japonicum* Hassk. appears to be based on *Backer 18236* from Java, while *C. squamatum* var. *javanicum* Teijsm.

seems to be based on *Teijsmann H.B.2649*, also from Java.

*Clerodendron kaempferi* Fisch. is credited by Jackson (1893) to Morr., Ann. Soc. Gand. 1: 17 (1845) as a synonym of C. *kaempferi* (Jacq.) Sieb., but Fischer's type specimen in the Leningrad herbarium [*Regel, Hort. Bot. Petrop. 61.8* "specimen authenticum"], examined by me, and beautifully represented by Morren's color plate. proves without any doubt to represent C. *japonicum*. Morren (1845) also mistakenly regarded Fischer's binomial as a synonym of C. *kaempferi* for which he used, in his text, the name C. *squamatum* Vahl.

It should also be noted here that the *Volkameria japonica* credited to "Hort. Paris" is a synonym of C. *philippinum* Schau.; that credited to just "Hort." is in part C. *philippinum* and in part C. *trichotomum* Thunb. The *Volkameria japonica* credited to Jacquin and the *V. japonica* credited to Willdenow both belong in the synonymy of C. *philippinum* f. *multiplex* (Sweet) Mold. The *Clerodendrum japonicum* var."*planiflorum*" [=*pleniflorum* ] (Schau.) Maheshwari of Raizada (1978) is also C. *philippinum* f. *multiplex*.

The Sweet reference in the Hortus Brittannicus, so important in the nomenclatural history of this species, has in previous installments of the present series of notes been erroneously cited as occurring on page 322 of part "1", published between July and October, 1826; actually it occurs in part 2, published betweem January and March, 1827. It is correctly dated by Hara (1948), Huber (1963), Pande (1967), Raizada (1968), and Yamazaki (1966).

The Dietrich (1842) work is cited as "1839-52" by Lam (1919) and as "1843" by other workers, but volume 3, which concerns us here, was actually issued between December 29 and 31 of 1842.

Bretschneider (1898) dates the Ventenat work as "1803", but plates 31--84 were actually not effectively published until 1804. Masamune (1955) dates both Maximowicz references to C. *japonicum* "1887", but they were both actually published in 1886; he also misdates the original Hooker & Arnott reference to this species as "1840", when pages 241--336 of this work were actually published already in 1838. Further, he gives the author of a note in Linnaea 7: 105 (1832) as Champion instead of Chamisso. Wallich's Numerical List no. 1799 is mis-dated by Fang (1944) as "1828" instead of 1829. Makino (1903) mis-cites the Siebold (1830) reference to page "51".

More importantly, it should be noted that Makino (1903), Fang (1944), Sonohara & al. (1952), Masamune (1955), Huber (1963), Banerji (1965, 1966), Raizada (1968, 1978), and Walker (1976), among others, cite *Volkameria japonica* as first published in Thunberg's Flora Iaponica in 1784 when actually it was first published by him four years earlier in the Nov. Act. Soc. Sci. Upsal., volume 3.

Hara (1948) credited a "*Clerodendron kaempferi* Steud." to Steud., Nom. Bot., ed. 2, 1: 383 (1840), but there it is actually written as "*Clerodendrum Kaempferi* Fisch." and given only as a synonym of C. *squamatum* Vahl. He cites two illustrations [fig. 2491 (1938) and fig. 557 (1940)] in Japanese works whose titles he gives only in Japanese characters.

Merrill (1946) notes that the original description of *Volka-*

*meria japonica* by Thunberg describes the plant as a "large tree, while it really is only a small shrub, but this does not invalidate the name". He might also have mentioned that Thunberg's original description calls for alternate leaves and a capsular fruit. As pointed out by Howard & Powell (1968), Thunberg's holotype is preserved in the herbarium at the University of Uppsala and casts no doubt on the correct application of the name. That he should have erred about the height of the plant is easily understandable when one recalls that he was held virtually under house-arrest at this time and relied on what was told to him by the actual collector who brought specimens to him.

Keys to help distinguish *Clerodendrum japonicum* from its nearest relatives may be found under *C. bethunianum* Low [58: 195--198], from its Chinese relatives under *C. henryi* P'ei [60: 180--181], and from other Indonesian wild and cultivated taxa under *C. klemmei* Elm. in the present series of notes.

Its closest relative, and the one with which it is most often confused, is undoubtedly *C. kaempferi*. The best way to distinguish the two is by the fact that in *C. japonicum* the calyx during anthesis is 10--15 mm. long and the corolla only to 2.4 cm. long, while in *C. kaempferi* the calyx during anthesis is less than 10 mm. long and the corolla is up to 3.8 cm. long.

Altschul (1973) informs us that the fruit of *C. japonicum* is edible and that the flowers have medicinal properties (this on the authority of *Tsang 21068*). Allen Smith reports that on the island of Ishigaki the plant is "associated with death".

Duke & Ayensu (1985) state that the leaves are applied to boils after the latter have been opened by pricking with a silver needle, while a decoction of the inflorescences are used in China to treat gonorrhea, hematochezia, and nosebleed. They report that the Indonesians use the roots in treating dysentery, the leaf pulp for edema, and add the leaves to bath water in bathing newborn babies; the floral bracts are chewed in treating hematuria and are poulticed in cases of painful arthritis.

Fang (1944) cites *Fang 17194* from Szechuan, China, commenting that the plant is "cultivated commonly in various gardens in western Szechuan. It is highly appreciated for its beautiful scarlet flowers and ample inflorescences as well as for its long flower-season from May to July". His accompanying illustration includes enlargements of the ovary in cross-section and of the leaf scales. Walker (1976) cites *A. Smith 1* and *SIRI.5979* & *6186* from cultivation on Okinawa.

P'ei (1932) cites for typical *C. japonicum* the following Chinese collections: from Chekiang - *Chiao 1495* and *Ching 1900*; from Fukien - *Chang 4139*, *Chung 1672*, *2351*, & *2893*, and *Herb 3395*; from Kwangsi - *Ching 5193*; from Kwangtung - *Levine C.735*, *Peng, Tak, & Kin 541*, *Ts'ang 2123*, and *Ying 853*; from Kweichow - *Cavalerie 3490*; from Szechuan - *Esquirol 123*, *Faber 43*, *Fang 2285*, and *Wilson 4555*; from Yünnan - *Henry 12060*; and from Hainan island - *Ford s.n.*, *Mc Clure 8854*, *Tak 25*, *Tsang, Tak, & Fung s.n.*, and *Wu 1089*.

Lam & Meeuse (1942) cite *Lam 2699* & *2775* from Karakalong, but these collections will probably prove to be C. *kaempferi*; the same applies to the *Banerji 740* cited by Banerji (1965) and the *no. 100* cited by Sharma & Ghosh (1970) from India. The Raizada collection cited by Raizada (1978) and *no. 5218* cited by V. & H. Singh (1972) probably are C. *philippinum* f. *multiplex* (Sweet) Mold.

Material of *Clerodendrum japonicum* has been widely misidentified and distributed in herbaria as C. *kaempferi* (Jacq.) Sieb., C. *paniculatum* L., C. *speciosissimum* Van Geert, and C. *squamatum* Vahl. On the other hand, the *Tsang & al. 7674*, distributed as C. *japonicum*, actually is C. *intermedium* Cham., while *Avery 1238* & *1289*, *Chun & Tso 43442*, and *Tsui 306* are C. *kaempferi* (Jacq.) Sieb., *Gressitt 45* is C. *paniculatum* L., *Lawrence 34* is C. *speciosissimum* Van Geert, and *Maxwell 71-723* is C. *urticifolium* (Roxb.) Wall.

Citations: UNITED STATES: Maryland: *Bisset s.n.* [S.P.I.31706] (Ar--19859). MEXICO: Oaxaca: *Ll. Williams 9632* (N). Veracruz: *Hernandez A. & al. 175* (N); *R. M. King 1010* (Mi); *Matuda 541* (Mh, Mi, N); *Plunkett s.n.* [Cordoba, July 27, 1932] (F--867509, La); *J. Rzedowski 1215* (Ip); *Vazquez T. 398* (N). SURINAM: *Collector indig. 170* (Ld--photo, N--photo, Ut); *Lanjouw 578* (Ld--photo, N--photo, Ut); *Songgrijp 6030* (Ut). BRAZIL: Pará: *Murça Pires & Black 1308* (N). NEPAL: *Pradham & Ihapa 6437* (W--2681510). INDIA: Assam: *Biswas s.n.* [Badamtan] (Bz--20705); *Herb. Hort. Bot. Calcutt. s.n.* [Badamtan, 23/XII/1937] (N, W--1759053). BURMA: Upper Burma: *Belcher 109* (W--2212929), *791* (Ld, W--2213258, W--2213259). CHINA: Chekiang: *Ching 1900* (Ca--291979, W--1246765). Fukien: *Chang 4134* (Ca--303230); *Chung 2351* (Ca--232999, Ca--420366), *2893* (Ca--243695), *4042* (N); *Pi 6133* (Ca--308235). Hunan: *Fan & Li 424* (Bz--19733). Kiangsi: *Lau 4261* (S, W--1752958). Kwangsi: *Ching 5193* (Ca--409668, W--1248668); *Steward & Cheo 669* (Bz--19734, N, S). Kwangtung: *Peng, Tak, & Kin 541* [Herb. Canton Chr. Coll. 12540] (Ca--275183, S, W--1247885); *Tsang 21068* (Ca--11243, I, Mi, N, S). Szechuan: *A. Henry 43* (N). Yünnan: *Chow & Wan 80093* (Ld, Ld, N, Or--159823); *A. Henry 12060* (N). VIETNAM: Tonkin: *Bois 482* (S). JAPAN: Honshu: *Savatier s.n.* [Yedo] (W--2497086); *Siebold s.n.* (Mu--863); *Thunberg s.n.* (N--photo of type, W--photo of isotype). RYUKYU ISLANDS: Ishigaki: *Allan Smith 1* (W--2156856, W--2156857). Okinawa: *Walker, Sonohara, Tawada, & Amano 6186* (W--2093544). GREATER SUNDA ISLANDS: Celebes: *Steup 85* (Bz--20658). Java: *Backer 9621* (Bz--20614), *11455* (Bz--20610), *13264* (Bz--20615), *18236* (Bz--20616, Bz--20617); *Buysman 74* (Ld--photo, N--photo, Ut--43901); *Collector undetermined s.n.* (Bz--20602); *Docters van Leeuwen-Reijnvaan 4594* (Bz--20606, Bz--20607); *Franck 150* (W--1596597); *Herreveld 50* (Bz--20609), *73* (Bz--20608); *Koorders 29461b* [556*] (Bz--20618); *Zollinger 2557* (Bz--20611, Bz--20612). CULTIVATED: China: *Chiao 1495* [Herb. Univ. Nanking 14694] (Ca--325237, W--1427049); *Fang 2285* (N). Germany: *Herb. Reg. Monac. s.n.* (Mu--3842, Mu--3843, Mu--3844); *Kreuzpointer s.n.* [Hort. Bot. Monac. 12 Oct. 1886] (Mu--1639, Mu--1640, Mu--1641); *Volke s.n.* [culta Nordhausen] (Lu, Lu). Java: *Herb. Hort. Bot. Bogor. XV.J.A.XXXII.7* (Bz--26383), *XV.J.A.XXXIII.1* (Bz--26386), *XV,L.8a* (Bz--26482), *XV.L.10* (Bz--26484, Bz--26485, Bz, Bz, Bz); *Horsfield s.n.* [Solon] (Bm); *Teijs-*

*mann 2649 H.B.* (Bz--20603, Bz--20604); *Vatke s.n.* (V, V). Mexico: *F. W. Johnson s.n.* [Cordoba, 9-26-06] (N); *Reko 4626* (Ld--photo, N--photo, W--1084911); *Ll. Williams 9632* (F--897930). Okinawa: *Walker, Tawada, & Amano 5979* (N). Russia: *Collector undetermined s.n.* (L); *Herb. Fischer s.n.* (L); *Regel s.n.* [Herb. Hort. Bot. Petrop. 61.8] (E--photo, Ld--photo, N--photo). LOCALITY OF COLLECTION UNDETERMINED: *Herb. Jacquin f.* (V); *Herb. Mus. Bot. Stockholm s.n.* (S). MOUNTED ILLUSTRATIONS & CLIPPINGS: Carr., Rev. Hort. 46: 110/111. 1874 (Ld, Z); Corner & Watanabe, Illust. Guide Trop. Pl. 758. 1967 (Ld, Z); Duke & Ayensu, Med. Pl. China 2: 638. 1985 (Ld); Fang, Icon. Pl. Omiens. 1 (2): pl. 69. 1944 (It); Mak., Illust. Fl. Nipp. 186. 1940 (Ld, Ld); Mold. in Gleason, New Britt. Br. Illust. Fl. 3: 138. 1952 (Ld); Morr., Ann. Soc. Roy. Agr. Bot. Gand. 1: pl. 3. 1845 (N); Voss in Vilm., Blumengärt. 1: 832. 1895 (Ld); "W. W.", Garden Lond. 42: 563. 1892 (Ld, Z); E. H. Walker, Fl. Okin. South. Ryuk. 891. 1976 (W).

*CLERODENDRUM JAPONICUM* f. *ALBUM* (P'ei) Mold., stat. nov.

Synonymy: *Clerodendron japonicum* var. *album* P'ei, Mem. Sci. Soc. China 1 (3): 144. 1932.

Bibliography: Sweet, Hort. Brit., ed. 2, 416. 1830; p'ei, Mem. Sci. Soc. China 1 (3): 124 & 144. 1932; Mold., Phytologia 60: 181. 1986.

This form differs from the typical form of the species in having the calyx and corolla usually creamy-white.

The form is based on *Tsiang 2506* from North Gate, Kochow, Kwangtung, China, collected in May of 1929, deposited in the herbarium of the Arnold Arboretum, Jamaica Plain, Massachusetts. It is described by the collector as an undershrub, the "leaves deep green above, light green below, flowers white".

A key to help distinguish this taxon from other Chinese taxa will be found under *C. henryi* P'ei in the present series of notes [60: 180--181]. Nothing is known to me of this plant beyond what is stated in the above meager bibliography.

*CLERODENDRUM JAUNDENSE* Gürke ex Mold., Known Geogr. Distrib. Verbenac., ed. 1, 47, 48, & 90 nom. nud. 1942.

This binomial, erroneously used by me in five publications between 1942 and 1980, is a synonym of *C. yaundense* Gürke, which will be discussed later in the present series of notes.

*CLERODENDRUM JOHNSTONI* Oliv. in H. Johnst., Kilim. Exped. Append. 344 nom. nud. 1886; Trans. Linn. Soc. Lond., ser. 2, 2: 346 [as "*Clerodendron*"]. 1887; B. Thomas, Engl. Bot. Jahrb. 68: [Gatt. Clerod.] 10, 16, 18, 42, 75, & 94. 1936.

Synonymy: *Clerodendron johnstoni* Oliv. in H. Johnst., Kilim. Exped. Append. 344. 1886. *Clerodendrum johnstonii* Oliv. apud Snowden, Grass Comm. Mt. Veg. Uganda 60. 1953.

Bibliography: Oliv. in H. Johnst., Kilim. Exped. Append. 344. 1886; Oliv., Trans. Linn. Soc. Lond., ser. 2, 2: 346. 1887; Gürke in Engl., Pflanzenw. Ost-Afr. C: 341. 1895; J. G. Baker in Thiselt.-

Dyer, Fl. Trop. Afr. 5: 293 & 300. 1900; Durand & Jacks., Ind. Kew. Suppl. 1, imp. 1, 101. 1901; Mildbr. in Von Mecklenb., Deutsch. Zentral-Afr. Exped. 2: 282. 1911; DeWild., Bull. Jard. Bot. Brux. 7: 170. 1920; DeWild., Pl. Bequaert. 2: 262. 1922; T. C. E. Fries, Notizbl. Bot. Gart. Berlin 8: 701. 1924; Good & Exell, Journ. Bot. Brit. 68, Suppl. 2: 142. 1930; Chiov., Fl. Somala 2: 363. 1932; Staner in Lebrun, Bull. Agr. Congo Belge 25: 425. 1934; B. Thomas, Engl. Bot. Jahrb. 68: [Gatt. Clerod.] 10, 16, 18, 42, 75, & 94. 1936; Ball, Kew Bull. Misc. Inf. 1937: 24. 1937; Durand & Jacks., Ind. Kew. Suppl. 1, imp. 2, 101. 1941; Mold., Known Geogr. Distrib. Verbenac., ed. 1, 48--50 & 90. 1942; Glover, Prov. Check List Brit. Ital. Somal. 266. 1947; Mold., Alph. List Inv. Names Suppl. 1: 6. 1947; W. Robyns, Fl. Sperm. Parc Nat. Albert 2: 142 & 147, pl. 14. 1947; Mold., Alph. List Cit. 2: 593 & 640. 1948; H. N. & A. L. Mold., Pl. Life 2: 65. 1948; Mold., Alph. List Cit. 3: 729 (1949) and 4: 1097 & 1247. 1949; Mold., Known Geogr. Distrib. Verbenac., ed. 2, 115--117 & 182. 1949; Snowden, Grass Comm. Mt. Veg. Uganda 24, 54, 60, & 94. 1953; J. K. Jacks., Journ. Ecol. 44: 362, 363, & 365--367. 1956; Durand & Jacks., Ind. Kew. Suppl. 1, imp. 3, 101. 1959; Mold., Résumé 141, 143, 144, 146, 149, 265, 272, & 450. 1959; Dale & Greenway, Kenya Trees Shrubs 583--584. 1961; Cuf., Bull. Jard. Bot. Brux. 32: Suppl. 799. 1962;Watt & Breyer-Brandwijk, Med. Poison. Pl. S. East Afr., ed. 2, 1048 & 1372. 1962; F. White & Angus, For. Fl. North. Rhodes. 365 & 367--[369], fig. 65. 1962; J. A. Hutchinson, Journ. Tangan. Soc. 64: 105. 1965; Glover, Gloss. Bot. Kipsig. Names Kenya, ed. 1, 158. 1967; Mold., Résumé Suppl. 15: 5 (1967) and 16: 7. 1968; Glover, Stewart, Fumerton, Martindany, & Andersen, Gloss. Bot. Kipsig. Names, ed. 2, 264. 1969; Gillett, Numb. Check-list Trees Kenya 46. 1970; J. K. Jacks. in Eyre, World Veget. Types 94, 95, 97, 98, & 100. 1971; Mold., Fifth Summ. 1: 229, 232, 233, 235, 240, 249, 448, & 463 (1971) and 2: 867. 1971; Lewalle, Bull. Jard. Nat. Belg. 42 [Trav. Univ. Off. Bujumb. Fac. Sci. C.20]: 128, 137, 7 [230]. 1972; Mold., Phytol. Mem. 2: 218, 222, 223, 225, 230, 238, & 538. 1980; Mold., Phytologia 57: 34 (1985), 58: 441 (1985), 59: 259 & 335 (1986), and 60: 270. 1986.

Illustrations: W. Robyns, Fl. Sperm. Parc Nat. Albert 2: pl. 14. 1947; F. White & Angus, For. Fl. N. Rhodes. [369], fig. 65. 1962.

A branching subscandent or scandent shrub, 1--4 m. tall, or liana, sometimes climbing to the tops of trees, semi-heliophilous, or sometimes a tree, 5--8 m. tall, with soft woolly tomentum; trunk thin; bark gray-brown or grayish; branches more or less tetragonal, densely pubescent; twigs yellow-brown, pilose; leaves decussate-opposite or ternate; petioles elongate, articulate, the basal 5 mm. persisting as a curved, woody spine; leaf-blades large, ovate or ovate-elliptic to oblong, 5--13 cm. long, 3.5--6.5 cm. wide, apically rounded or obliquely subacuminate to cuspidate, marginally entire, basally broadly rounded or cordate, bicolored, grayish-green (dark-brown when dry) and puberulent above, densely pubescent or tomentose and ashy-gray or tawny beneath; inflorescence an ample, terminal, corymbose or corymbiform panicle, more or less dense-flowered, the ramifications robust, oblique, tawny-tomentose, sometimes also with many-flowered cymes in the upper leaf-axils; pedicels short; flowers faintly sweet-smelling; calyx campanulate, green or yellow-green, 3--4 mm. long, externally very tomentose, the teeth ovate, shorter than the tube; corolla hypocrateriform, white or whitish to cream-color, rarely pinkish, the tube 2--3 times as long as the calyx, internally yellow-green and pubescent, the limb 5-lobed, the lobes small, subequal, obovate, 3 mm. long, dorsally pale-green, ventrally white or whitish; stamens about twice as long as the corolla; filaments yellowish-white or white; anthers yellow or yellow-green, later turning brown or dark-brown; style yellowish-white or white; stigma yellow-green or greenish; fruit drupaceous, often galled when immature, the galls sometimes very large.

This species is based on an unnumbered H. H. Johnson collection from 1700 m. altitude on Mount Kilimanjaro, Tanganyika, collected in 1884, and deposited in the Kew herbarium. Good & Exell (1930) claim that C. *johnstoni* is "Very nearly related" to C. *inaequipetiolatum* Good. which, however, has smaller flowers and more hirsute pubescence.

*Clerodendrum johnstoni* has been encountered by collectors in sandy-clay soil in swamps, along roadsides, in bamboo as well as evergreen and gallery forests, arborescent *Acanthus* forests and sclerophyllous woodland, on shady humus-rich grasslands and *Acanthus* steppes, in montane forests and dry openings therein, in rocky places and upland rainforests, and at forest edges, from 200 to 3000 m. altitude, in flower in every month of the year, and in fruit in October and December. Davidse reports it "in open forests with *Podocarpus* predominant and with clumps of bamboo and open heavily grazed areas" in Kenya; in the same country Dale & Greenway (1971) describe it as "Widely spread in secondary scrub in the wetter highlands; 4,000 to 9,000 ft." Magogo describes it as a "common roadside shrub to 6 ft. tall". In Zaire Hauman refers to it as "assez commun". Scott-Elliot found it common on Mt. Ruwenzori at 7000--8000 feet altitude.

Gürke (1895) reports it "In der Kulturzone und dem unteren Urwaldrand aller Landschaften verbreitet, bis 1600 m" in East Africa generally. Maas Geesteranus describes it as "not uncommon" or "fairly common but rarely found flowering" in riparian woodland with *Conopharyngia holstii* along rivers and in clearings mixed with *Pteridium aquilinum* and *Neoboutania macrocalyx*, also in "glades at forest edge with scattered *Acacia lahai* and numerous tall shrubs, in Kenya. In the same country Gillett refers to the plant as "scandent" and found it "frequent in evergreen forest on lava with *Cordia*, *Olea*, etc." The flowers on his *no. 15100* are remarkably small, but this may be due to immaturity -- the collector identified it merely as "*Clerodendrum* aff. C. *johnstonii*".

Cufodontis (1962) lists *Clerodendrum johnstoni* from Kenya, Uganda, Tanganyika, and northeastern Zaire and also (doubtfully) from Ethiopia, observing that it is a "Species montana inter 1300 et 3000 m supra mare vigens vix loco tam demisso inveni potuit". Jackson (1971) avers that it is "one of the climbers in a typical

*Acacia abyssinica* woodland with *Maesa lanceolata* which is the first woody species to appear after fires....At 1700 m. it is associated with *Albizzia*....also in forest climax with *Podocarpus*, *Olea*, and *Syzygium*.....also in broken post-climax forests especially in valleys and on south-facing slopes where the ground is covered with tangled masses of climbers."

Robyns (1947) describes the species as an "Arbuste sarmenteux ou liane, orophile, habitant les lisières des formations forestières de montagne jusque dans l'étage des Bambous, repandu dans le District du Lac Albert et le District des Lacs Edouard et Kivu [in Zaire]. ainsi que dans le Ruanda occidental. En dehors du Congo Belge, cet élément silvicole et à développment variable se rencontre sur les montagnes de l'Afrique tropicale central et oriental."

The corollas are described as having been "white" on *Bequaert 3620, 4268, 5921,* & *5922, Davidse 7053, DeWitte 1448, Germain 1448, Gille 111, Gillett 15100, Lebrun 4414, 4743,* & *5453, Maas Geesteranus 5386, Magogo 1553, Peter 11655* & *42519,* and *Reekmans 1593 2099,* "whitish" on *DeWitte 2225,* "cream" on *Drummond & Hemsley 1275,* "yellowish-white outside, lobes white inside" on *Maas Geesteranus 5757,* and "rose or pink" on *Lebrun 4953.*

Gille describes "opposite stipules" when the leaves are immature -- a character also mentioned by Baker (1890) for *C. involucratum* Vatke. Galled fruit may be seen on the Brussels specimen of *Ghesquiere 5004. Lewalle 2440* has the inflorescences too immature for definite identification; the overall habit seems more like that of a species of *Premna.*

Vernacular names recorded for *Clerodendrum johnstoni* are the following: "gwandra", "ifumbo", "ikwandira", "iramboho", "kiankware", "kisolobi", "mdiruarosh", "mokondogoro", "mukochokocho", "munganyahe", "murigono", "muteangwai", "n'gwadre", "shimbo", "singoronik", "singoruet", "singorwet", and "ukandra".

As to the medicinal uses of this plant among the natives: the leaves and leaf-juice or a teasponful of the powdered bark is used as an expectorant and to treat dyspepsia in Kenya according to Watt & Breyer-Brandwijk (1962). Gille reports that in Zaire "le jus des feuilles est donné en petite quantité une fois per jour, durant trois jours, comme anthelminthique, aux enfants".

Keys to help distinguish *C. johnstoni* from other African species will be found under *C. discolor* (Klotzsch) Vatke [59: 259--260] and *C. dusenii* Gürke [59: 335].

Baker (1900) cites for *C. johnstoni* only *Johnston s.n.* and *Volkens 2072* from Tanganyika and *Scott-Elliot 7691* from Uganda; De Wildeman (1922) cites *Bequaert 3620, 4268,* & *5922* from Zaire. Thomas (1936) cites *Linder 2567, Scheffler 250,* and *Scott Elliot 7691* from Uganda; *Fries 1661* & *1691* and *Troll 5806* from Kenya; *Endlich 359, Johnston s.n., Kandt 90, Keil 96, Merker 717, Meyer 657, Mildbraed 744, Schlieben 3592, Stolz 700, Troll 5642,* and *Volkens 759* from Tanganyika; and *DeWitte 1448* & *2225* and *Linder 2400* from Zaire. I regard *Bequaert 3620, Fries 1691,* and *Volkens 2072* as representing var. *rubrum* Thomas.

Robyns (1947) cites for *C. johnstoni,* from Zaire: *Bequaert 3620*

& *4268*, *DeWitte 1448* & *2235*, *Hauman 202*, *Lebrun 4414*, *4743*, & *4953*, and *Linder 2400*; Dale & Greenway (1961) cite *Battiscombe 68*, *Elliot 283*, *Gardner 1409*, *Moon 748*, and *Scheffler 250* from Kenya; Cufodontis (1962) cites (doubtfully) *Gorin 209* from Ethiopia; Glover (1967) cites *Bally B.4866* and *Kerfoot 2151* from Kenya; and Lewalle (1972) cites *Lewalle 1637* from Burundi.

Material of *Clerodendrum johnstoni* has been misidentified and distributed in some herbaria as *C. thyrsoideum* Gürke, *Ehretia* sp., *Premna* sp., *Psychotria* sp., and even *Viburnum* sp. On the other hand, the *Procter 2621*, distributed as *C. johnstoni*, actually is *Premna chrysoclada* (Bojer) Gürke, while *Loch, Morrison, & Wendelbo 6369* is not verbenaceous.

Citations: ZAIRE: *Bequaert 5921* (Br); *Claessens 42* (Br), *1491* (Br, N), *s.n.* [entre Shangugu et Usambura] (Br); *DeWitte 1448* (Br), *2225* (Br); *Germain 3540* (Br), *4062* (Br); *Ghesquière 5004*(Br); *Gille 111* (Br, Br, Br); *Hauman 202* (Br); *Humbert 7363* (Br); *Jurion s.n.* [Claessens 183] (Br, Br, Br); *Lathouwers I.30* (Br, Br); *Lebrun 3746* (Br, Br, N), *4414* (Br, N), *4953* (Br), *5453* (Br, Br); *W. Robyns 2327* (Br, Br, N); *Schaller s.n.* [alt. 7200 ft.] (Ws), *s.n.* [alt. 9000 ft.] (Ws); *Taton 412* (Br, Br); *Van den Houdt 40* (Br), *119* (Br). BURUNDI: *Lewalle 272* (Gz), *2440* (Ld, Ld); *Reekmans 1593* (E--2209178), *2099* (E--2209185). UGANDA: *Ghesquière 5702* (Br, Br); *Lindblom s.n.* [6.1920] (S); *Purseglove 546* (Br); *Scheffler 250* (S). TANZANIA: Tanganyika: *W. L. Abbott s.n.* [Kilimanjaro, 1890] (W--239906); *Drummond & Hemsley 1245* (S), *1275* (B); *Endlich 359* (Mu); *Merker 717* (B); *Peter 1442* [O.I.35] (B), *1825* [O.I.44] (B), *1919* [O.I.47] (B), *2036* [O.I.50] (B), *8637* [O.III.44] (B), *9559* [O.III.69] (B), *11655* [O.III.125] (B), *17144* [O.IV.76.1] (B), *17146* [O.IV.76.I] (B), *42348* [V.284] (B), *42364* [V.285] (B, B), *42519* [V.288] (B), *42561* [V.290] (B), *51787* [O.III.70] (B), *51788* [O.III.126] (B, B). KENYA: *Davidse 7053* (Ld); *J. B. Gillet 15100* (B, S); *Maas Geesteranus 5386* (Ca--92276, Go, S), *5687* (Ca--92139, Go, S), *5757* (B, Ca--92119, Go, S, W--2247219); *Magogo 1553* (Mu); *Mearns 1942* (W--631899), *1946* (W--631904), *1973* (N, W--631932); *Mettam 229* (Du--289164). MALAWI: *Stolz 700* (B, B, Mu--4226, S). MOUNTED ILLUSTRATIONS: White & Angus, For. Fl. N. Rhodes. [369]. 1962 (Ld).

*CLERODENDRUM JOHNSTONI* VAR. *RUBRUM* Thomas, Engl. Bot. Jahrb. 68: [Gatt. Clerod.] 75. 1936.

Bibliography: B. Thomas, Engl. Bot. Jahrb. 68: [Gatt. Clerod.] 10 & 75. 1936; Mold., Known Geogr. Distrib. Verbenac., ed. 1, 49 & 90 (1942) and ed. 2, 116 & 182. 1949; Mold., Résumé 141, 144, 146, & 450. 1959; Mold., Résumé Suppl. 15: 5. 1967; Mold., Fifth Summ. 1: 212, 229, 235, & 240 (1971) and 2: 867. 1971; Mold., Phytol. Mem. 2: 203, 219, 225, 239, & 538. 1980.

This variety differs from the typical form of the species in having its pubescence red-brown in color.

The variety is based on *Schlieben 4130* from Maskat, at an altitude of 1500 m., Morogoro District, Tanganyika, Tanzania, collected on July 12, 1933, and deposited in the Berlin herbarium, now unfortunately destroyed.

Collectors describe this plant as a scandent, twiggy shrub or small tree, 2--8 m. tall, or liana. with a spreading crown, the woody petiolar spines 1.5 cm. long and upwardly curvate, the inflorescence composed of corymbose cymes, the calyx green, the corolla white, the filaments white, and the anthers blackish. They have found it growing at the edges of woods and in the shade of the understory in rainforests with *Aframomum angustifolium*, in an area of 2500 mm. annual rainfall, at altitudes of 1500--2260 m., in anthesis in January and March to July. Schlieben refers to it as "scattered". Drummond & Hemsley encountered it "in upland rainforest by streams under *Podocarpus, Macaranga, Syzygium*, etc." in Tanganyika.

The corollas are said to have been "white" on *Bequaert 4268, Drummond & Hemsley 2838, Lebrun 4743, Mooney 9224*, and *Schlieben 4130* & *4515*. The only vernacular name recorded for it is "schimbo".

Thomas (1936) cites *Goetze 905, Prince s.n., Schlieben 528, 4130,* & *4515*, and *Troll 5415* from Tanganyika.

Material has been misidentified and distributed in some herbaria as *C. syringaefolium* Baker.

Citations: ETHIOPIA: *Mooney 9224* (S). ZAIRE: *Bequaert 3620* (Br), *4268* (Br); *Ghesquière 4722* (Br, Br); *Lebrun 4743* (Br). TANZANIA: Tanganyika: *Drummond & Hemsley 2838* (B, S); *Goetze 905* (Br, N); *Peter 16505* [0.IV.47] (B); *Schlieben 528* (Br), *4130* (B--isotype), *4515* (B, Br, Mu, N, S); *Volkens 2072* (Br, L). KENYA: *Fries & Fries 1691* (Br).

*CLERODENDRUM JOHORENSE* Mold., Phytologia 33: 373. 1976.

Synonymy: *Clerodendrum oblongifolium* Kochummen, Malays. Forester 41: 29 & [31], fig. 2. 1978. *Clerodendron oblongifolium* Kochm., in herb.

Bibliography: Hocking, Excerpt. Bot. A.28: 260. 1976; Mold., Phytologia 33: 373 (1976) and 34: 265. 1976; Anon., Roy. Bot. Gard. Kew Libr. Awaren. List 6: 26. 1978; Kochummen, Malays. Forester 41: 29 & [31], fig. 2. 1978; Mold., Phytol. Mem. 2: 295, 393, & 538. 1980.

Illustrations: Kochummen, Malays. Forester 41: [31], fig. 2. 1978.

A shrub, to 1 m. tall; stems pale-grayish, tetragonal, often unbranched, ampliate at the nodes; branches and branchlets, when present, apparently very slender, densely puberulent; leaves simple, decussate-opposite; petioles very slender, elongate, 1--5 cm. long, glabrous; leaf-blades thin-membranous ["tenuiter coriacea" fide Kochummen], narrowly elliptic or narrowly oblong to lanceolate or suboblanceolate, 5--20 cm. long, 1--3.5 cm. wide, both apically and basally gradually attenuate, marginally entire, glabrous on both surfaces; secondaries about 14 pairs, arcuate, confluent near the margins, inconspicuous above, distinct beneath; inflorescence terminal, solitary, paniculate, long-pedunculate, densely puberulent, nodding, the panicle 10--30 cm. long, basally to about 10 cm. wide, with about 3 sets of opposite ramifications, each rather long and apically trifurcate, about 7-flowered, densely puberulent throughout; bracts, when present, foliaceous, diminishing in size upwards, subtending the panicle ramifications, small, long-stipitate, elliptic, 1--2 cm. long, to 4 mm. wide; bractlets linear or sublinear, to

4.5 mm. long, puberulent or lightly hirsute [fide Kochummen]; flowers pendulous, about 1.5 cm. long; calyx pale-green, campanulate, about 5 mm. long and wide, externally densely puberulent, 5-lobed, the lobes lanceolate or broadly triangular, flat, about 6.5 mm. long, apically obtuse or acute; corolla infundibular, in bud about 11 mm. long, white, the limb 5-lobate; stamens 4, attached at the base of the corolla-tube, about 5.5 mm. long; filaments 3.5 mm. long; anthers oblong, longitudinally dehiscent; style about 7 mm. long; stigma bifid; ovary cylindric, about 1.5 mm. ["1.5 cm/" fide Kochummen] long, 4-celled, with one ovule in each cell.

This species is based on *R. B. Phillips 1640* from Mount Ophir, Johore, Malaya, collected on April 20, 1972, and deposited in the University of Malaya herbarium at Kuala Lumpur. The type of *C. oblongifolium* is *FRI.5263* from along the Kota Tinggi road, Johore, deposited in the herbarium of the Forest Research Institute at Kepong, Selangor.

This very distinctive species in general greatly resembles *C. nutans* Jack and *C. wallichii* Merr.

The *Cockburn SAN.76818*, distributed as *C. johorense*, actually is *C. elmeri* Merr.

Citations: MALAYA: Johore: *R. B. Phillips 1640* (Ac--photo of type, Kl--16829--type, Ld--photo of type, N--photo of type); *B. C. Stone 10726* (Kl--15628, Ld). MOUNTED ILLUSTRATIONS: Kochummen, Malays. Forester 41: [31]. fig. 2. 1978 (Ld, Z).

*CLERODENDRUM KAEMPFERI* (Jacq.) Sieb., Verh. Batav. Genootsch. [Syn. Pl. Oecon.] 31 ["51"] [as "*Clerodendron*"]. 1830; Mold., Geogr. Distrib. Avicenn. 26 & 37. 1939 [not *C. kaempferi* Fisch., 1821 nom. nud.]

Synonymy: *Volkameria kaempferi* Jacq., Collect. Bot. 3: 207--209. 1789. *Clerodendrum squamatum* Vahl, Symb. Bot. 2: 74. 1791. *Volkameria kaempferiana* Jacq., Icon. Pl. Rar. 3: pl. 500. 1792. *Clerodendrum foliis cordatis, obscurè angulatis; panicula ramis dichotomis, glabris* Vahl ex Poir. in Lam., Encycl. Méth. Bot. 5: 166 in syn. 1804. *Volkameria foliis cordatis, pubescentibus, denticulatis; paniculâ terminali, divericatâ; pedunculis coloratis* Willd. ex Poir. in Lam., Encycl. Méth. Bot. 8: 689 in syn. 1808. *Volkameria foliis cordatis, subrotundis, villosulis; floribus paniculatis, caule erecto* Jacq. ex Poir. in Lam., Encycl. Méth. Bot. 8: 689 in syn. 1808. *Volkameria koemferi* Lam. ex Poir. in Lam., Encycl. Méth. Bot. 8: 689. 1808. *Clerodendrum squamatum* Willd. apud R. Br. in Ait., Hort. Kew., ed. 2, 4: 63. 1812. *Volkameria dentata* Roxb., Hort. Beng., imp. 1, 46 hyponym. 1814; Fl. Indica, ed. 2, imp. 1, 3: 61. 1832. *Volkameria kaempferi* Willd. apud Steud., Nom. Bot. Phan., ed. 1, 207 in syn. 1821; Edwards, Bot. Reg. 8: pl. 649. 1822. *Volkameria kaempferia* Willd. apud Blume, Cat. Gewass., imp. 1, 85. 1823. *Clerodendron squamatum* Vahl ex Spreng. in L., Syst. Veg., ed. 16, 2: 759. 1825 [not *C. squamatum* H. J. Lam, 1923, nor Neal & Metzger, 1934, nor Rock, 1934]. *Volkameria coccinea* Loisel.-Desl., Herb. Amat. 8: pl. 519. 1827. *Clerodendrum squamatum* H. K. ex Loud., Encycl. Pl. 522. 1829. *Clerodendron dentatum* Roxb. ex Wall., Numer. List [49], no. 1799 hyponym. 1829. [to be continued]

# RICCIA HAWAIIENSIS HÜRL., SPECIES NOVA

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Drs. Otto and Isa Degener recently collected a Riccia species on an old lava flow on the island of Hawaii. They kindly sent me their sample for identification. Only two species of this genus are mentioned from the Hawaiian archipelago in the literature: R. rechingeri Steph. on Hawaii (Scott et Miller, 1958; Yoshida et Smith, 1976) and R. sorocarpa Bisch. on Maui (Hoe, 1978), the latter one identified by Mrs. S. Jovet-Ast, Paris, leading specialist of this genus.

According to Mrs. Jovet to whom I sent part of the Degeners' material, the new collection does not correspond to either of the two species although it shows distinct affinities to the plant described and figured by Scott and Miller. Direct comparison with their material was not possible; on the other hand, original material of R. rechingeri was obtained on loan from Conservatoire Botanique, Geneva (G) and from Naturhistorisches Museum, Vienna (W), permitting the conclusion that the plant received from Drs. Degener represents a new species.

Riccia hawaiiensis Hürl. sp. nova (fig. 1)

Frons subdichotoma imperfecte rosulata, rhizoidibus levibus et verruculosis substrato affixa, sicca albida facie dorsali spongiose foveolata, humida viridi-alba, cellis translucentibus 0,08-0,1 mm diametrantibus reticulata, ramis 3-6 mm longis, 0,8-2 mm latis lineari-oblongis, apice rotundatis vel leviter emarginatis, marginibus subhyalinis parce undulatis, sulco mediano distaliter acuto, in sectione transversa duplo latioribus quam crassis, lateribus adscendentibus, marginibus explanatis attenuatis, cellulis epidermidis 20-40 µm altis, parietibus tenuibus sicut in cellulis subepidermalibus, stomatibus simplicibus irregularibus intermixtis, strato chlorophylloso columniformi anguste alveolari e parenchymate basali 2/5 altitudinis frondis oriundo.
Sporangia immersa, c. 0,5 mm diametrantia, sporae brunneae, (64-)67-80(-84) µm diametrantes, anguste (ad 5-7 µm) alatae, facie externa areolatae papillosaeque, areolis 10-12 in diametro, faciebus internis tenuiter areolatae papillis humilibus ornatae.

Punaluu, Kau, island of Hawaii. In radius of 5 square meters on thin layer of earth on old pahoehoe lava flow between

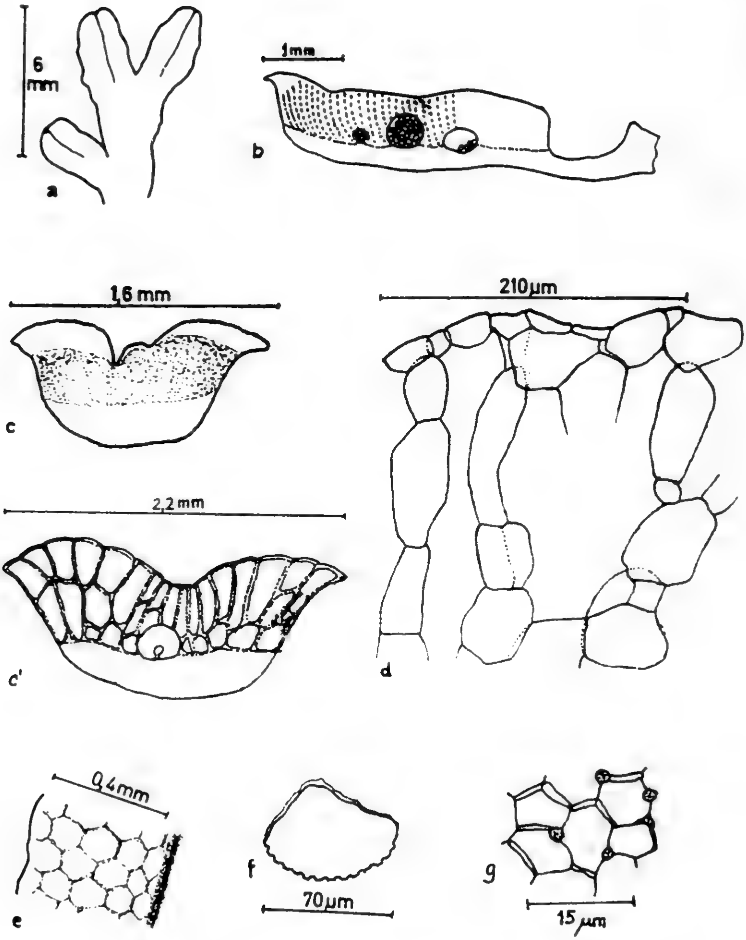


Fig. 1. Riccia hawaiiensis: a) Part of thallus; b) submedian longitudinal section of branch; c, c') transversal sections; d) detail of section near upper epidermis; e) detail of thallus surface with areolation (humid state); f) spore; g) areolation of external spore face.

endemic Portulaca near brackish pond and ocean. Never seen before. Nov. 25, 1985. - Otto and Isa Degener, no. 36.642 (Holotypus Z, Isotypus G, NY, PC and about 50 other institutions). Additional material (no. 36.642 a) was collected at the same station on April 26, 1986 by Otto Degener, Isa Degener and Herbert Mann.

Riccia hawaiiensis definitely belongs to the subgenus Ricciella (A.Br.) Boulay although the air chambers are rather narrow and high. It is closely related to R. rechingeri described originally from the island of Upolu (Samoa) but can be distinguished as follows:

| | R. hawaiiensis | R. rechingeri |
|---|---|---|
| Distal thallus segments | linear-oblong, 0,8-2 mm broad | linear, 0,5-1 mm broad |
| Thallus section | sharply furrowed above towards end, margins attenuate | with broader furrow above, margins rounded |
| Spores | 10-12 areolae on diameter | 8-10 areolae on diameter |

For the time being, the question remains open if the plants collected earlier on the island of Hawaii (Scott et Miller, 1958; Yoshida et Smith, 1976) really belong to R. rechingeri or should also be assigned to R. hawaiiensis. Some facts, especially form and size of the thalli, would favour the latter choice, however, the characters of thallus sections as shown by Scott and Miller's illustration point towards R. rechingeri.

No type of Riccia rechingeri Steph. has been designated so far. The Rechinger collection in Vienna (W) contains two samples, no. 2958 and no. 2967, both collected on August 3, 1905 "am Ufer des ausgetrockneten Sees Lanuanea ca. 700 m". Both samples are also present in Stephani's herbarium in G. As the label of no. 2958 in G contains some diagnostic notes in Stephani's own handwriting, and as the illustrations in his own unpublished "Icones" refer to the same collection number, no. 2958 (G) should be considered as the lectotype (isotype W).

My thanks are due to Drs. Otto and Isa Degener, Waialua, Oahu (Hawaii), for sending me this interesting material and for stimulating comments, to Mrs. S. Jovet for many advice and encouragement including her own sketches, and to the Directors and Curators of the herbaria in G and W for the loan of original material of R. rechingeri.

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NOTHOCESTRUM INCONCINNUM SP. NOV. (SOLANACEAE)
Hawaiian Plant Studies 132

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Nothocestrum inconcinnum sp. nov. (Solanaceae). Fig. 1.

Diagnosis Holotypi: Arbor 5-7 m alta est, novellis dense pilosulis, petiolis 4-10 cm longis dense pilosulis, laminis 10-18 × 5-74 cm oblong-ellipticis basi rotundata infra dense pilosis, pedicellis 6-18 mm longis, calycibus 14-18 mm longis anguste ellipsoideis pilosulis, 4 lobis 2-6 mm longis lanceolatis, corollis luteis tubo 12 mm longo, dimidio apicali dense adpresse hirsutulo, 4 lobis 7 × 4.5 mm ellipticis, 4 staminibus, antheris 4 mm longis inclusis.

Diagnosis of Holotype: Tree 5-7 m tall; young shoots densely pilosulous; leafy branchlets pilosulous, 2-6 mm in diameter, terete; internodes 1-5 cm long; nodes slightly enlarged; leaf scars 3.5-5 mm in diameter, orbicular, elevated, stramineous; bundle scars 3; leaves alternate; petioles 4-10 cm long, densely pilosulous; blades 10-18 × 5-7.4 cm, leathery, oblong elliptic, the apex narrowly obtuse, the base rounded, but the sides unequal, the margin entire and even or sinuous, above pilosulous on and near the midrib and partially on the secondaries, but glabrous elsewhere, below densely softly pilose; flowers single and lateral at leafy nodes; pedicels 6-18 mm long, curved, densely pilosulous; calyx 14-18 mm long, narrowly ellipsoid, densely ascending pilosulous, the 4 lobes 2-6 mm long, lanceolate, unequalconnivent; corolla yellow, the tube 14 mm long, narrowly tubular, the apical half densely appressed ascending hirsutulous; the 4 lobes 7 × 4.5 mm, elliptic, the margins inflexed; stamens 4; filaments 8 mm long; anthers 4 mm long, elliptic oblong, included.

Holotypus: Hawaiian Islands, Kauai Island, Waimea Drainage Basin, west side, July 3 to Aug. 18, 1917, C. N. Forbes 812.K (BISH).

Discussion: For Notocestrum inconcinnum the nearest relative is N. peltatum Skottsb., of Kauai, a species with the petioles 1.2-3.5 cm long, densely tomentose; blades 6-11 × 3.5-6 cm, peltate, ovate to ovate oblong, the apex obtuse or slightly emarginate, the base peltate, rounded, the halves symmetrical, above puberulous on the midrib, below tomentose to subglabrate; flower up to 10 at an axil; pedicels 3-6 mm long, tomentose; calyx 8-12 mm long, tomentose; the lobes 1.5 mm long, hemispheric; corolla tube 12-13 mm long, and the lobes 5-6 × 5 mm. N. inconcinnum has the pedicels 4-10 cm long, densely pilosulous; blades 10-18 × 5-7.4 cm, the petiole basifixed, the apex narrowly obtuse, the base rounded, but the halves unequal, above pilosulous on and near the midrib, below densely softly pilose; flowers solitary; pedicels 6-18 mm long, densely ascending pilosulous; calyx 14-18 mm long, the lobes 2-6 mm long, lanceolate; corolla tube 25 mm long, and the lobes 7 × 10 mm.

The new epithet is the Latin adjective, inconcinnus, asymmetric, and it is chosen with reference to the uneven blade base.

Legend

Fig. 1. Nothocestrum inconcinnum St. John, from the holotype. a, stem, x 2; b, lower leaf surface, X ½; c, d, flower, X 2; e, fruit, X 6.

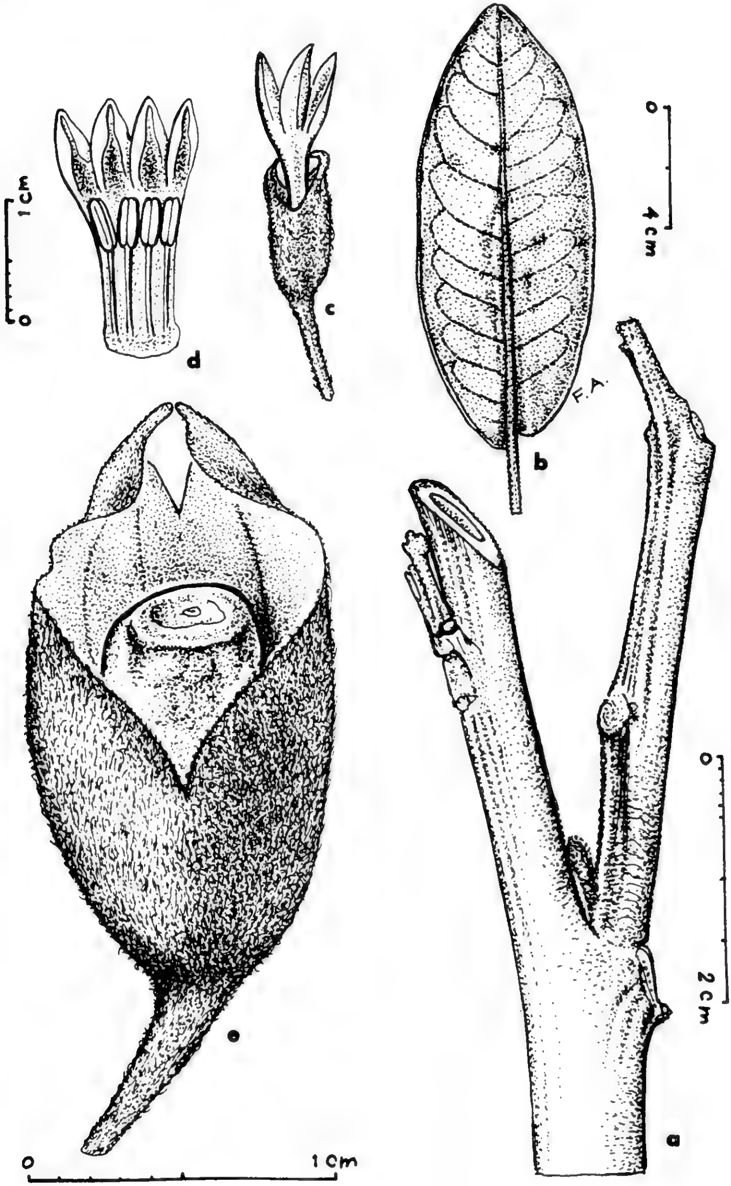


Fig. 1. Nothocestrum inconcinnum St. John

# THE MAIN TAXONOMIC VIEW POINTS ON THE INTRA- AND THE INTERRELATIONSHIPS OF MELANTHIOIDEAE (LILIACEAE)

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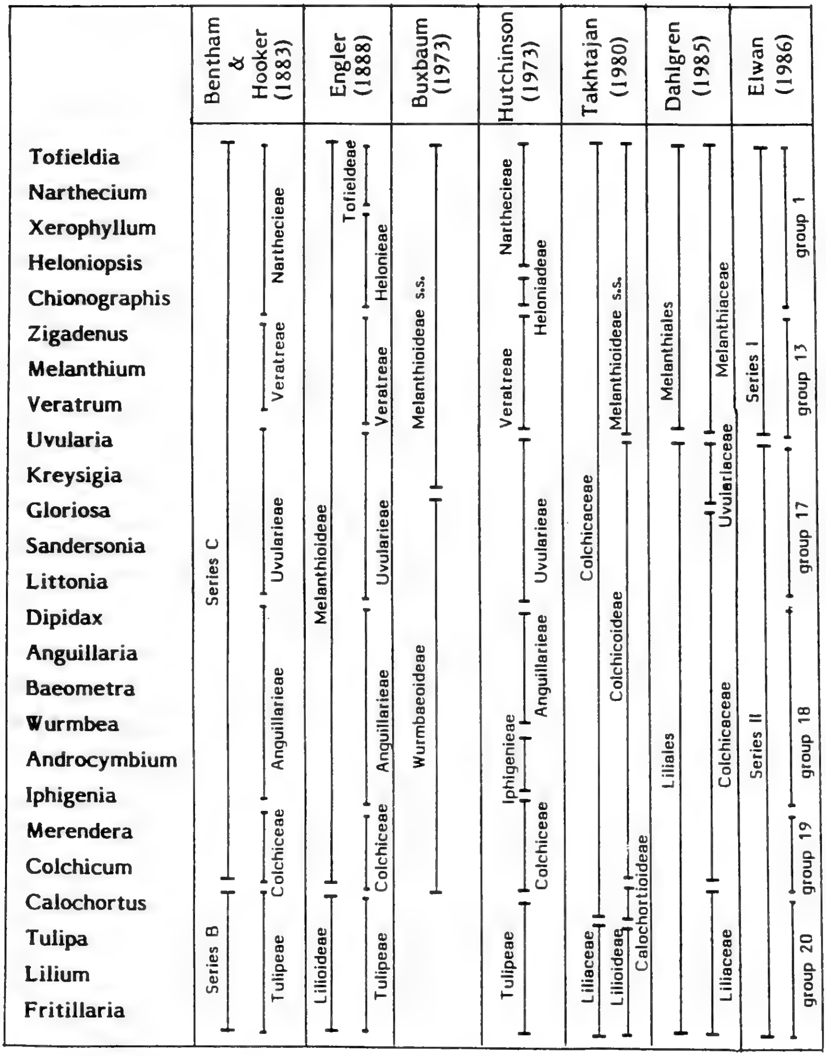
Melanthioideae is one of the largest subfamilies of Liliaceae in Engler (1888) system. It includes 6 tribes: Tofieleae, Helonieae, Veratreae, Uvularieae, Anguillarieae and Colchiceae. This subfamily is quite comparable to Bentham & Hooker (1883) series C. However, this series includes also Medeoleae (Asparagoideae-Parideae in Engler). Buxbaum (1937) separated the tuberous members of Melanthioideae in distinct subfamily (Wurmbaeoideae). This subfamily embodies Anguillarieae, Colchiceae, and Uvularieae p.p. (**Gloriosa, Littonia** and **Sandersonia**); whereas Melanthioideae **s.s.** includes the other 3 tribes in addition to **Uvularia**, **Kreysigia** and their relatives. Unlike Wurmbaeoideae, the rhizomatous Melanthioideae are mainly in Temp. N. hemisphere especially N. America and S.E. Asia. Within Uvularieae, **Uvularia** (rhizomatous) is N. am. while **Littonia, Gloriosa** and **Sandersonia** (tuberous) are trop. and S. Afr. (cf. Hutchinson, 1973). The distinction made by Buxbaum between the rhizomatous and the tuberous Melanthioideae had promoted a number of taxonomic arguments regarding the interrelationships within this subfamily. Hegnauer (1963), Wildmann & Pursey (1986) and Huber (1969) gave supports for the recognition of Wurmbaeoideae.

Within Liliaceae Hutchinson (1973) seemed not convinced with the subfamilial relationships, though he laid too much stress upon the nature of the rootstock; thus he recognised 28 consecutive tribes. In this system Medeoleae is transferred to Trilliaceae, while members of Melanthioideae **s.l.** are arranged in 8 tribes. However, the arrangement of these tribes reflects their vague relationships.

Takhtajan (1980) reflected also the heterogenity of Melanthioideae **s.l.** He recognised 2 subfamilies (Melanthioideae and Colchicoideae) under Colchicaceae (Liliineae). This family embraces also Calochortoideae (but not other Tulipeae). The Colchicoideae includes: Uvularieae, Glorioseae, Scoliopeae (= Medeoleae, = Parideae), Tricyrtideae, Anguillarieae and Colchiceae. Thus, Colchicoideae concept is wider than that of Wurmbaeoideae as to include in addition, **Uvularia, Medeola** and their allies.

Badawi & Elwan (1986) using a numerical analysis proposed a classification for Liliaceae **s.l.** In this classification Melanthioideae is seriously disrupted; Veratreae is separated not only from other Melanthioideae, but rather from other liliaceous taxa on the bases of a number of correlated characters. While Parideae (Medeoleae) is grouped

The classification of the cheif genera of Melanthioideae and Tulipeae in some systems



with Uvularieae. All the available information substantiates that Veratreae is a natural fairly distinct group, endemic to N. am., with related karyotype, marked capellary structure; and possessing related alkaloids (cf. Hegnauer, 1963; Sen, 1975; Sterling, 1982).

According to Takhtajan (1969) Melanthioideae s.s. with **Veratrum** comes nearest to the ancestral type of Liliales; while Hutchinson (1973) had claimed that Heloniadeae is the most ancient tribe of Liliaceae, being rhizomatous ebracteate. Cheadle & Kosaki (1971), Sen (1975) supported the primitiveness of Heloniadeae. Whether, Veratreae or Heloniadeae is the nearst to the ancestral origin of other liliaceous taxa, one can assume that the rhizomatous nature of the rootstock and the presence of raphides, which are generally present in Veratreae and Heloniadeae, are among the characters of the ancestral "Melanthioid" origin.

In view of many accumulated data Dahlgren **et al.** (1985) showed also that Melanthioideae s.s. and Colchicoideae can not, in any way, represent a natural assemblage, and the distinction between them has been raised to the order rank. Unlike Liliales (which embraces Colchicoideae), the Melanthiales endosperm formation is helobial, the tepals are less conspicous, rarely spotted or variegated and the raphides are generally present. Melanthiales includes: Melanthiaceae (incl. Petrosavieae) and Campynemaceae (Hypoxidaceae p.p. of the Haemodorales). Dahlgren **et al.** (1985) included members of Colchicoideae together with members of Iridaceae, Orchidaceae and some minor families in Order Liliales. They distinguished Colchicaceae, Uvulariaceae, Calochortaceae and Liliaceae (= Tulipeae including **Gagea** and **Medeola**) among the 10 families of the Liliales. This classification emphasizes the close relationship of not only **Calochortus** (as given by Takhtajan, 1980) but also of all other members of Tulipeae to members of Colchicoideae. Hereagain, although Dahlgren **et al.** (1985) did not suggest any ancestral origin of Liliales from Melanthiales, they stated that "within Liliales further differentiation may have gone towards the loss of raphides".

Elwan (1986) arranged Liliaceae as recognized by Hutchinson (1973), i.e. excluding Parideae, which is also Dioscoreales in Dahlgren **et al.** (1985), in two groups. One of them accomodates only Uvularieae s.l. (incl. **Uvularia** and **Gloriosa**), Tricyrtideae, Anguillarieae, Iphigenieae, Colchiceae and Tulipeae. In other words, one of the two main groups of Liliaceae (as recognized by Hutchinson) includes only Colchicoideae and Tulipeae (incl. **Calochortus**), while all other liliaceous taxa are in the other main group. The distinction between these two groups is based mainly on the presence or absence of raphides among high tendencies of some other characters such as the nature of the rootstock, and the venation type of tepals. Only **Walleria*** in the "Colchicoideae & Tulipeae" group contains oxalate raphides.

* **Walleria** is most probably Tecophilaeaceae (cf. Dahlgren et al., 1985, Elwan, 1986).

The absence of raphides in members of Colchicoideae and Tulipeae may distinguish them as one entity within Liliaceae (in the sense accepted by Hutchinson, 1973). Nevertheless, the distinction between members of Tulipeae at one hand and those of Colchicoideae on the other, was over looked by Elwan (1986). In this classification Uvularieae (incl. Tricyrtideae), Anguillarieae (incl. Iphegineae), Colchiceae and Tulipeae are arranged in four different groups of the same rank. However, the bulbous nature of the rootstock, the connate styles and the basifixed stamens in Tulipeae substantiate that this tribe is somewhat distinct from the other three tribes. An amendement should be considered in this classification to indicate such relationship.

Dahlgren **et al.** (1985) suspected that either or both **Medeola** and **Scoliopus** should be retained back from Trilliaceae, which contains raphides (cf. Dahlgren **et al.**, 1985), to Liliaceae **s.s.** or Uvulariaceae. Elwan (1979) recorded the presence of raphides in **Trillium ceruum** L., **T. govanianum** Wall. and **Paris quadrifolia** L. but not in **Medeola virginiana** L. Also Berg (1962) on embryological bases proved that **Medeola** and **Scoliopus** are not very much related to Trilliaceae. Sen (1975) on cytological bases, suggested the exclusion of **Scoliopus** in a tribe near Calochorteae. It seemed more acceptable, so far, to consider **Trillium** and **Paris** in Trilliaceae, while provisionally **Medeola** and **Scoliopus** are supplemented in Uvularieae or Tulipeae which represent the nearst devoid of raphides liliaceous relatives.

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BOOK REVIEWS

Alma L. Moldenke

"THE ORIGIN OF EUKARYOTIC CELLS" edited by Betsey Dexter Dyes & Robert Obar, xv & 345 pp., 77 b/w fig., 109 photo. & 54 tab. Van Nostrand Reinhold Company, New York, N. Y. 10003. 1986. $44.50 clothbound.

This fine collection of papers is volume 9 of the important Benchmark Papers in Systematic and Evolutionary Biology series in which the editors have chosen 35 classic comparative studies of living as well as fossil prokaryotes and eukaryotes for inclusion and have grouped these under 8 editor-commented topics such as: the origins of mitochondria, plastids, mobility organelles, meiosis and classification. Because of the recent advances in micropaleontology, electron microscopy and biochemistry what was first postulated, mainly by Lynn Margulies, as to the symbiotic relationship between prokaryotic cells and eukaryotic cells with their organelle inclusions can now be effectively documented. An important reference book!

"SEWALL WRIGHT AND EVOLUTIONARY BIOLOGY" by William B. Provine, xvi & 545 pp., 19 b/w photo., 19 fig. & 20 tab. University of Chicago Press, Chicago, Illinois 60637. 1986. $30.00.

What a wonderful service the author has performed for biologists — specialists in genetics and/or evolution, teaching professors, alert high school level teachers, graduate students, and course takers in this advanced field! From analyses of Wright's many writings, his carefully kept and studied correspondence and taped interviews Provine has not only documented the professional life of Sewall Wright and his times, but he has also broken down some of the barriers made by intricate mathematical formulae through which Wright did his advanced reasoning for his conclusions on the causes and processes of evolution, and he has shown Wright's ideas as compared with those of such earlier scientists and contemporaries as Beadle, Castle, Mayr, Goldschmidt, Morgan, Sturtevant, Kimura, Fisher and Dobzhansky.

It must be remembered and marveled at that this famous biologist upon entering elementary school at age 8 demonstrated self-taught cube root extraction and later in his publications produced such complicated formulae to follow!

The book's bibliography is particularly important since so many items are treated in the text -- and so is the list of Wright's 210 publications through 1984, including his masterpiece "Evolution and the Genetics of Populations" in 4 volumes.

"THE NATURALIST IN NICARAGUA" by Thomas Belt, 2nd Edition, with a Foreword by Daniel H. Janzen, xxvii & 403 pp., 1 b/w map, 17 fig., 10 photo. & 1 tab., University of Chicago Press, Chicago, Illinois 60637. 1985. $30.00 clothbound & $12.95 paperbound.

The author, Thomas Belt (1832--1878), was a widely traveled English mining engineer who was also an excellent naturalist. This account of his leisure time collecting trips was first published in 1874 and was described by Charles Darwin in that year as "the best of all natural history journals which have ever been published" in a letter to Sir J. D. Hooker. The preface to the English printed 2nd edition of 1888 gives a fine account of Belt's brief life, journeys and scientific papers. Today's ecologist Dan Janzen's added foreword emphasizes that this book is a wonderful 4-year record of these tropics of over 100 years ago and warns against our letting this excellent account "cease to be an introduction to the splendors of the tropics" and instead "become an obituary for them". Topics discussed in each chapter are listed at the beginnings, such as: description of San Antonio valley, pitcher-flowered Marcgravias, flowers fertilized by humming birds, stories about wasps, myriapods, tapirs, jaguars, summit of Pena Blanca. The text seems so real because it is usually rendered in the first person "I" or "we".

"A CONSCIOUS STILLNESS -- Two Naturalists on Thoreau's River" by Ann Zwinger & Edwin Way Teale, xxii & 243 pp., 2 end plates, 12 maps, 29 b/w draw. & 27 photo., Harper & Row Publishers, New York, N. Y. 10022. 1982. $18.95 clothbound & University of Massachusetts, P. O. Box 429, Amherst, Massachusetts 01002. 1984. $10.95 paperbound.

Reading this book in its entirety or in snatches is a sheer delight of the care- and problem-eradicating type as the two established nature-sensitive authors share their sights and thoughts while they canoe the Sudbury and Assabet Rivers of Massachusetts which together form the Concord. Previously and similarly Thoreau wrote of his trips on the Concord, as the title indicates. Teale's death prevented the completion of his writing, but Ann Zwinger and Mrs. Nellie Teale have managed to complete this beautiful task - and in splendid fashion. What a wonderful legacy Edwin Way Teale has left us in the remembrance of his lectures, field trips and conservation efforts and in the form of his many beautiful books still in wide circulation.

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NOVITATES ANTILLANAE. XII

Alain H. Liogier

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While studying several families for the floras both of Puerto Rico and the island of Hispaniola, I have come across several species new to science, mostly in the Myrtaceae; much field work needs to be done and I am sure that there are more species to be studied and named in the future. I am grateful to the staff of the New York Botanical Garden for letting me study the material in the Herbarium, for the use of the Library and also for sending specimens on loan and the xerox copies of plant descriptions as needed.

The second volume of the Flora of Puerto Rico is in press, and will probably be printed during this year; the same goes for the fourth volume of the Flora of Hispaniola. Further volumes are being prepared.

GUTTIFERAE

*Garcinia barkeriana* (Urb. & Ekm.) Alain, comb. nov.
*Rheedia barkeriana* Urb. & Ekm., Ark. Bot. 22,10: 18. 1929.

*Garcinia hessii* (Britt.) Alain, comb. nov.
*Rheedia hessii* Britt., Bull. Torrey Bot. Club 42: 390. 1915.

*Garcinia portoricensis* (Urb.) Alain, comb. nov.
*Rheedia portoricensis* Urb., Symb. Ant. 1: 369. 1899.

*Garcinia verticillata* (Urb.) Alain, comb. nov.
*Rheedia verticillata* Urb., Symb. Ant. 1: 369. 1899.

MYRTACEAE

*Calyptranthes acevedoi* Alain, sp. nov.

Frutex; rami juniores teretes glabri vel minutissime pilosuli, eglandulosi, dichotomi; hypophylla non visa; folia sessilia vel subsessilia, elliptica vel ovata, 1.7-4.5 cm longa, 1.5-3.5 cm lata, apice rotundata, basi subcordata, nervo medio supra ad basim impresso apice versus evanescente, nervis lateralibus utroque latere 8-10, utrinque leviter prominulis vel obsoletis, iis nullis, punctis glandulosis supra nullis, subtus crebris minutissimis, sub lente tantum visis, non pellucidis, glabra, chartacea; inflorescentiae ad apicem ramorum usque 4; prophylla ovata 3 mm longa 2 mm lata, dorso leviter carinata, ferrugineo-squamosa, squamis linearibus, apice obtusa; pedunculi primarii 1.5-1.8 cm longi, ramuli 3-flori, pedunculi secundarii nulli vel usque ad 1 mm longi; alabastra sessilia obovoidea 3 mm longa, 2.5 mm lata, apiculata glabra, glanduloso-punctata; calyptra 2.7 mm diam.; petala non visa; filamenta ad 3 mm longa, antherae subquadratae; baccae in paratypo (Acevedo & C. Laboy 349) globosae, 5 mm diam., dense glanduloso-granulatae, limbo calycino coronatae.

PUERTO RICO: Río Abajo Forest, Parcela 3A, March 16, 1983, Pedro Acevedo 36 (Type: UPR, Isotyle: NY); id., Los Puercos, 8 June 1983, Pedro Acevedo & C. Laboy 349 (UPR)

This species reminds of *C. nummularia* Berg, of Hispaniola; this last species differs by its young branches 2-lineate, glandular-punctate, glabrous; the leaves are reniform, the size variable in sterile and flowering branches, the midnerve plane above, the lateral nerves prominent on both surfaces, the inflorescences trichotomous, the flower buds globose, not or scarcely apiculate, 3 mm in diameter. Named after its collector, Pedro Acevedo.

*Calyptranthes banilejoana* Alain, sp. nov.

Frutex 3-4 m altus, rami cortice griseo, hornotini plus minus compressi lineolato-alati, glabri, eglandulosi; hypsophylla non visa; folia subsessilia, elliptica, rhomboidea vel obovata, 2-2.7 cm longa, 1-1.8 cm lata, apice obtusa vel breve cuspidata, apice ipso obtuso, basi cuneata, nervo medio supra inferne plus minus impresso, ad apicem versus applanato, superne prominente, lateralibus utroque 12-15, sub angulo 45° abeuntibus, utrinque aequaliter prominulis, ad marginem anastomosantibus, margine plana, punctis glandulosis minutis supra subimpressis, subtus prominulis pellucidis, lamina supra olivacea, subtus pallidiora, chartacea. Caetera non observata in specimina studiata; flores albi.

DOMINICAN REPUBLIC: Firme Banilejo, Piedra Blanca, alt. 800 m, 9 Aug. 1973, Alain H. Liogier 19941 (Typus: NY); id. Alain H. Liogier 19981 (NY).

This species differs from *C. grandis* Urb. & Ekm. by its leaves, which are lanceolate and acuminate and 3.5-5 cm long in *C. grandis*. Although the type specimen was collected with flowers, it has been impossible to study them.

*Calyptranthes guayabillo* Alain, sp. nov.

Frutex 3 m altus; rami dichotomi, hornotini teretes, pilis minutis aequaliter dibrachiis parcis et vix conspicuis brunneis obsiti, mox glabrescentes, glanduloso-granulati; folia elliptica, 3-7 cm longa, 2-5.5 cm lata, apice acuminata vel cuspidata, raro acuta, basi obtusa vel attenuata, nervo medio supra ad basin impresso, apice versus applanato, nervis lateralibus supra obsoletis subtus utroque latere 14-18, vix prominulis, supra non vel vix punctata, punctis glandulosis subtus sparsis non pellucidis, supra obscure viridia subtus pallidiora; petioli 2-3 mm longi; inflorescentiae pauciflorae 1-2 ad basin ramulorum hornotinorum; pedunculi 2.5-3 cm longi sparse pilosi, glanduloso-granulati, pedicelli 0-5 mm longi; alabastra ellipsoidea 2.5 mm longa, glanduloso-granulata; hypanthium campanulatum 2.5-3 mm longum; calyptra 2 mm diam.; caetera ignota.

DOMINICAN REPUBLIC: Cabezadas de Ciénaga de la Culata, Constanza, alt. 1,650 m, 16 Oct. 1968, Alain H. Liogier 13071 (Holotypus: NY, Isotypus: US); Loma Campanario, Ciénaga de la Culata, Constanza, alt. 1,650-1,950 m, in cloud forest, 24 sept. 1969, Alain H. Liogier 16060, 16065(NY).

Close to *C. grandis* Urb. & Ekm.; this last species has much narrower leaves, and many lateral nerves.

*Calyptranthes jimenoana* Alain, sp. nov.

Frutex 1.5 m altus; hornotini purpurascentes lineolati glabri eglandulosi; rami vetustiores teretes griseo-purpurei; folia subsessilia ovato-lanceolata 3-4 cm longa, 8-12 mm lata, apice longe caudato-acuminata, basi angustata inferne latissima, nervo medio supra impresso subtus prominente lateralibus utroque latere numerosis, utrinque tenuiter prominentibus in nervium 1 mm a margine anastomosantibus, supra punctis glandulosis minutis parcis impressis, subtus eglandulosa pallidiora, chartacea; inflorescentiae (juveniles tantum visae) ad apicem ramorum 2, 3-florae; pedunculi 4-5 mm longi, applanati, purpurei, glabri, eglandulosi; alabastra sessilia ellipsoidea, 1.5 mm longa, purpurea, glabra, apiculata; caetera non visa.

DOMINICAN REPUBLIC: In a ravine, Gorge of Arroyo de la Sal, above Jimenoa Dam, Jarabacoa, alto approx. 900 m,19 June 1968, A. Liogier 11764 (Holotypus: NY); in cloud forest, El Mogote, Jarabacoa, alt. 1,200-1,400 m, 19 June 1969, sterile, A. Liogier 15773 (NY, US).

Near *C. calophylla* Urb. & Ekm.; this last species differs by its much larger leaves (6-13 cm long), pilose when young; inflorescences 2-3 with a peduncle 2-3.5 cm long.

*Calyptranthes limoncillo* Alain, sp. nov.

Frutex 5 m altus; rami hornotini 2-lineati, pilis aequaliter dibrachiis ferrugineis puberula, eglandulosa; rami vetustiores teretes, griseo-rubri, glabri, eglandulosi; folia latissime ovata ad orbicularia, 3.5-5 cm longa, 3-4.5 cm lata, apice rotundata, obtusa vel breviter cuspidata, basi rotundata sessilia, nervo medio supra impresso subtus prominulo, lateralibus utroque latere valde numerosis sub angulo ca. 80° abeuntibus, utrinque tenuiter prominulis, ad nervium 2 mm e margine anastomosantibus, punctis glandulosis minutissimis supra impressis, subtus obsoletis, supra olivacea, subtus pallida, glabra chartacea; inflorescentiae (unica tantum visa) verisimiliter 1-3 axillares, pedunculo tereti glabro, 1 cm longo; flores 3, sessiles; fructus globosus, 5 mm longus, 5-6 mm latus, dense glanduloso-granulosus, limbo calycino coronatus.

DOMINICAN REPUBLIC: In forest, along Tablones river, Ciénaga de Manabao, Jarabacoa, alt. 1,000-1,100 m, 14 Aug. 1968, Alain H. Liogier 12098 (Holotypus: NY, Isotypus: US); id., 15 Jul. 1975, Alain & Perfa Liogier 23515, sterile (NY, SD); Constanza, Río Grande, 6-7 Jul. 1973, Alain & Perfa Liogier 19487 (NY, SD); Constanza, El Convento, 7 Apr. 1968, José J. Jiménez 5409 (NY).

In the vicinity of *C. myrcioides* Urb. & Ekm., which has elliptic-lanceolate, 1.5-3.8 cm broad leaves, acuminate to caudate-acuminate at apex.

*Calyptrogenia cuspidata* Alain, sp. nov.

Frutex vel arbor parva usque 6 m alta; rami hornotini teretes glabri grisei eglandulosi, striati, vetustiores nigrescentes cortice fisso; folia usque 3 mm longe petiolata, elliptica, 7-10 cm longa 4-5.5 cm lata, apice cuspidata, apice ipso anguste rotundato, raro obtusa vel rotundata, basi obtusa vel late cuneata in petiolum angustata, nervo medio supra impresso, subtus prominente, lateralibus utroque latere 8-10, utrinque prominentibus, nervis secundariis intermediis tenuioribus, omnibus in nervium 1 mm a margine remoto arcuato-conjunctis, venis laxe reticulatis subtus prominulis, punctis glandulosis supra obsoletis, subtus crebris pellucidis, lammina coriacea utrinque nitida glabra; flores sessiles vel subsessiles, 2-4 in glomerulos axillares vel terminales, pedicelli usque 2 mm longi; prophylla ovata 3-4 mm longa, 2-3 mm lata, apice rotundata glabra, glanduloso-punctata; alabastra ellipsoidea 1 cm longa, 4-5 mm lata, apice apiculata glanduloso-punctata glabra; caetera ignota.

DOMINICAN REPUBLIC: In rain forest, Monteada Nueva, Caña Brava, Barahona, alt. 1,300 m, June 15, 1968 (Holotypus: Alain H. Liogier 11636, US).

This genus contains to the present 7 species; this new one is near to *C. bracteosa*(Urb.) Burret, whose flower buds are pyriform, truncate at apex; the branchlets are glandular-punctate, the leaves obtuse.

*Eugenia cacuminis* Alain, sp. nov.

Frutex 2 m altus; rami hornotini compressi glabri glanduloso-punctati, gemmae adpresse-pilosae; rami vetustiores laeves cortice brunneo; folia 3-5 mm longe petiolata, oblongo-elliptica vel elliptica, 5-8 cm longa, 2-3.5 cm lata, apice acuminata, obtusa vel rotundata, basi cuneata, nervo medio supra impresso subtus prominente, nervis lateralibus numerosis sub angulo 60°-70° abeuntibus, utrinque prominulis, punctis glandulosis supra nullis vel obsolete impressis, subtus minutis vix prominulis, margine plana chartacea, supra in sicco griseo-nitida, subtus viridia; inflorescentiae racemosae axillares usque 2.5 cm longae vel in paniculam terminalis composita 14 cm longam; bracteae deltoideae acutae 1.5 mm longae ad medium pedunculi adnatae; pedunculi 5-8 mm longi striati glabri, glandulosi; bracteolae late deltoideae 0.5 mm longae, 1 mm latae, obtusae vel acutae ciliatae glandulosae; pedicelli usque 1 mm longi, strigosi; hypanthium campanulatus, 1 mm longus, glandulosus; sepala ovato-oblonga, inaequilonga, majores 2 mm longa, 1.5 mm lata, glandulosa, ciliata, minora late ovata, 1.5 mm longa et lata, utrinque dense pilosa, glandulosa, ciliata; petala oblonga 8 mm longa, glandulosa glabra, ciliata; fructus non visi.

PUERTO RICO: Summit of Cerro La Torrecilla, alt 600 m, Feb. 20 1986, Alain H. Liogier 35926 (Holotypus: UPR, Isotypus: NY).

A distinct species by its long defoliate inflorescences; the leaves remind those of *Psidium guajava;* the plant is nearly glabrous except for the flowering parts.

*Eugenia constanzae* Alain, sp. nov.

Frutex 2 m altus; ramuli spinescentes; rami hornotini teretes pulverulento-pilosi, brunnei eglandulosi; rami vetustiores grisei cortice fisso; folia sessilia subcoriacea, elliptica vel elliptico-oblonga, apice rotundata vel apice versus parce angustata, basi rotundata vel obtusa, 6-15 mm longa, 3-6 mm lata, nervo medio supra leviter impresso, subtus prominulo, lateralibus supra obsoletis subtus utroque latere 1-2, arcuatis non anastomosantibus, margine incrassato, supra nitida, obscure viridia et punctis glandulosis obsoletis, subtus pallidiora, punctis glandulosis minutis non pellucidis, glabra; flores sessiles solitarii in foliorum axillis vel ad nodos vetustos; bracteae semiorbiculares, 0.8 mm longae, 1.2 mm latae, ciliatae, bracteolae ovatae rotundatae 1 mm longae et latae, ciliatae; calycis tubus nullus; calycis lobi inaequales, ovati, majores 1.2 mm longi et lati, minores 1 mm longi et lati. Caetera ignota.

DOMINICAN REPUBLIC: Constanza, in thickets, near El Salto, alt. 1,000 m, Alain & Perfa Liogier 23852 (Holotypus: NY, Isotypus: SD).

I find no affinity for this plant; the spinescent branchlets, the small elliptic or elliptic-oblong glabrous leaves, the small sessile flowers distinguish it from all other known species.

*Eugenia higueyana* Alain, sp. nov.

Frutex; rami hornotini teretes brevissime pilis minutis adpressis sparsis pilosuli, eglandulosi, striati, vetustiores brunneo-grisei cortice fisso; folia elliptica vel lanceo-elliptica, 3-6.5 cm longa, 1-2.5 cm lata, apice acuminata, apice ipso anguste rotundata, basi acuta, in petiolum decurrente, nervo medio supra leviter impresso, subtus prominulo, lateralibus utroque latere 15-20, sub angulo 50°-60° abeuntibus, utrinque prominulis ad marginem anastomosantibus, venis laxe reticulatis utrinque prominulis, glandulis supra nullis, subtus tenuibus pellucidis; petiolus 2-3 mm longus, anguste sub-alatus; flores 1-2 in axillis foliorum, pedicelli filiformes 6-9 mm longi sparse et minutissime pilosuli; bracteolae oblongae 0.7 mm longae pilosulae; hypanthium subglobosum 2 mm longum 1.7 mm latum, lineis 8 albidis longitudinaliter munitum, glaber; lobi 4 subaequali, orbiculati concavi 2 mm longi et lati laxe reticulati glabri, margine ciliati; petala alba oblonga apice rotundata 3 mm longa, glabra epunctata; fructus ignotus.

DOMINICAN REPUBLIC: On limestone hill, from Higüey to Boca de Yuma, in woods, alt. 50 m, 26 Aug. 1968, Alain H. Liogier 12353 (Holotypus: US); id. July, 1978, Alain & Perfa Liogier 27785, sterile (NY, SD).

This plant reminds of E. boqueronensis Britt., from Puerto Rico; this last species has the leaves pubescent on the nerves beneath, the flowers in short racemes, the calyx lobes pubescent; the outstanding character in this species are the 8 whitish lines on the calyx.

Eugenia holdridgei Alain, sp. nov.

Arbor parva; rami hornotini tereti glabri eglandulosi spiniformes; cortice griseo fisso; folia elliptica, obovata vel orbicularia, 3-5 mm longa, 2-3 mm lata, apice plus minus emarginata vel truncata, basi obtusa vel rotundata, nervo medio utrinque prominulo, lateralibus utroque latere 2-3 sub angulo 30°-40° abeuntibus, utrinque prominulis ad marginem anastomosantibus, margine incrassato recurvo, venis subnullis, glandulis utrinque prominulis pellucidis, glabra, subcoriacea; petiolus 0-1 mm longus; pedunculi solitarii ad nodos vetustos, 2 mm longi; bracteolae oblongae, 0.6 mm longae ciliatae; flores non visi; fructus (juvenili) ellipsoidei 3 mm longi 2 2 mm lati, dense glanduloso-granulari, calycis lobi caduci; semina 1.

HAITI: Morne des Commissaires, Savane Jean Louis, 1,550 m alt., June 4, 1945, Holdridge 2080 (Holotypus: US).

A very striking species, with small, nearly all obcordate leaves with thickened margins the surface shiny; the calyx-lobes are early caducous in the young fruit.

Eugenia jimenezii Alain, sp. nov.

Arbor parva, 6-7 m alta; rami hornotini glabri, gemmae ferrugineo-pilosulae; rami vetustiores grisei cortice fisso; folia usque 5 mm longe petiolata, lamina chartacea oblongo-elliptica vel oblongo-lanceolata, 3-6 cm longa, 1-2.5 cm lata, apice versus sensim angustata, apice ipso acuta vel anguste obtuso, basi cuneata in petiolum protracta, nervo medio supra impresso, ad apicem evanescente, subtus per totam longitudinem prominente, lateralibus utroque latere 5-8, utrinque prominulis, ad marginem conjunctis, venis nullis, margine breviter recurvato, punctis glandulosis utrinque leviter prominulis, vix vel non pellucidis, in sicco supra obscure viridia, subtus pallidiora; inflorescentiae sericeo-ferrugineae, glabrae; flores in cymas abbreviatas in ramuli terminales vel axillares solitarii; pedunculi vix 1 mm longi, bracteae anguste deltoideae acutae 1.5 mm longae 0.8 mm latae, pedicelli usque 2 mm longi, bracteolae breviter lineares, 1 mm longae; hypanthium campanulatum 1 mm longum, sericeum; lobi 4, subaequilongi oblongi 2 mm longi 1.5 mm lati, sparse strigosi, glanduloso-punctati glandulis pellucidis, ciliati; petala elliptica 4 mm longa, glanduloso-punctata, ciliata; receptaculum glabrum; stamina numerosa, filamenta 3 mm longa, antherae quadrato-rotundatae; stylus 4 mm longus, stigma punctiforme; bacca non visa.

DOMINICAN REPUBLIC: Jaiquí Picao, 20 miles West of Santiago, on limestone hill, 300-400 m alt., 23 May 1969, Alain H. Liogier 15349 (Holotypus:NY; Isotypus: US).

This species might be considered as near to E. rhombea and E. axillaris; the former has rhombic-ovate leaves and glabrous calyx-lobes; the latter has glabrous branches, the flowers racemose, the calyx-lobes glabrous on the surface, the petals 1 mm long.

Named after the late José J. Jiménez, enthusiastic botanist in the Dominican Republic, who directed me to the type locality of this species.

Eugenia padronii Alain, sp. nov.

Arbor, circa 10 m alta, glabra; ramuli compressi viridi non glanduliferi, vetustiores cinerascentes cortice striato; petioli usque 5 mm longi supra leviter canaliculati; folia subcoriacea anguste elliptica vel oblongo-elliptica, 4.5-8.5 cm longa, 1.5-2.5 cm lata, apice rotundata, basi acuta in petiolum sensim protracta, nervo medio supra applanato vel basin versus prominulo interdum leviter impresso subtus prominente; nervis lateralibus supra vix obviis utroque latere usque 8, subtus plus minus obviis in nervo submarginali conjunctis, margine incrassato leviter recurva, punctis glandulosis supra obsoletis, subtus prominulis plus minus pellucidis, supra viridia, subtus pallidiora; flores ad ramos vetustiores sessiles 1-2, verisimiliter ad foliorum delapsorum axillas; bracteae nullae; calycis tubus campanulatus 1.5 mm longus, dense glanduloso-granulatus, lobi 4, semiorbiculares, subaequales, 2 mm longi, 2 mm lati, glandulis pellucidis sparsis obsiti; petala non visa; staminorum receptaculum annulus formans, 2.2 m diam., 0.7 mm latum, dense et minute ferrugineo-pilosum, e vestigiis stamina pluriseriata; ovarii apex glaber; baccae subglobosae (?immaturae) 7 mm longae 5 mm latae, nigrae, calycis lobis coronatae, 2-spermae.

PUERTO RICO: Maricao State Forest, about 800 m alt., Jan. 1986, collected by Rubén Padrón (Alain H. Liogier 35806, UPR, Holotypus; Isotypus: NY); id., June 10, 1970, R. O. Woodbury s.n.; id., June 20, 1970, R. O. Woodbury 20401 (NY); Río Abajo Forest, 400 m alt., Sept. 27, 1985, Alain H. Liogier 35679 (UPR).

This species might be considered near to E. sessiliflora Vahl, from the coastal forests in Puerto Rico and the Virgin Islands; this last species has the leaves coriaceous, oval, elliptic or suborbicular, the nerves and veins prominent; the flowers are larger (12 mm across), the calyx lobes 4-6 mm long, black-glandular; the berries are larger (2 cm in diam.).

Another species in the same group, E. sintenisii Kiaersk. has leaves ovate to obovate, membranous, the nerves prominulous beneath, the margin not thickened, the calyx-lobes oblong.

Named after Rubén Padrón, keeper of the Maricao State Forest, who for the first time collected the plant in flower and fruit.

Eugenia samanensis Alain, sp. nov.

Arbor parva vel statura media; ramuli plus minus compressi, glabri, sparse glanduloso-granulati, brunnei; rami vetustiores cortice griseo fisso; folia 2-4 mm longe petiolata, lamina coriacea, late elliptica, elliptica vel suborbiculata, 3.5-7 cm longa, 2.5-5 cm lata apice rotundata rarissime retusa, basi rotundata vel late obtusa, nervo medio supra impresso subtus prominente apicem versus evanescente, lateralibus utroque latere 8 10, utrinque parum prominulis, venis reticulato-anastomosantibus, supra grisea, glandulis minutis parce prominulis, subtus in sicco brunneo-pallidiora, punctis glandulosis sparsis non pellucidis; flores in alabastra tantum visi, in racemos 1-2 axillares glabri, 2.5 cm longi; pedunculo 1.5 cm longo, brunneo-glanduloso; pedicelli usque 4 mm longi, 1-2-flori; prophylla decidua non vidi; calycis lobi subaequilongi, orbiculares, 1.3 mm longi, apice rotundati, margine ciliati, glanduloso-punctati; petala et fructus non vidi.

DOMINICAN REPUBLIC: Slope of Pan de Azúcar, Samaná, c. 400 m alt., May 31, 1930, Ekman 15178 (Holotypus: US; Isotypus: S).

A distinct species by its rounded reticulate leaves, and its shortly racemose inflorescences. Near to *E. yumana* Alain, with terminal groups of flowers; the leaves have impressed glandular dots above.

ASCLEPIADACEAE

*Matelea borinquensis* Alain, sp. nov.

Volubilis; ramuli bifarian retrorso-pilosuli, viridi; folia 1-1.5 cm longe petiolata, petiolo supra sulcato, glabro vel sparse piloso; lamina elliptico-lanceolata 6-9 cm longa, 2.5-3 cm lata, apice sensim acuminata, basin versus angustata, basi ipsa subrotundata, nervo medio supra applanato subtus prominente, lateralibus utroque latere 5, utrinque applanatis vel subimpressis, ad marginem arcuatis et arcuato-conjunctis, glabra, supra viridia subtus pallidiora, membranacea, margine integra plana; cymas axillares, paucifloras, pedunculi bifarian pilosuli; sepala ovato-lanceolata, 3 mm longa, 1-1.5 mm lata, apice obtusa, nervo medio parce pilosa; corolla rotata, lobis elliptico-oblongis, 2 mm longis, 1.75 mm latis, rotundatis, imbricatis; corona 5-lobata, lobis triangularibus 1.5 mm longis, glabris; gynostegium depressum, 2 mm diam., 5-angulosum, pollinia obovata, horizontalia, compressa, glandula nigra, translatores subnulli; caetera ignota.

PUERTO RICO: Cerro Pelucho, San Lorenzo, alt. 400-500 m, March 8, 1984, Alain & Perfa Liogier, Luis F. Martorell 35111 (Holotypus: UPR).

This species seems to be near to *Matelea constanzana* Jiménez (=*Poicillopsis tuerckheimii* Schltr.), from Hispaniola; this last species has much smaller leaves (to 2.5 cm long, and 1.2 cm broad), these are puberulous; the calyx-lobes are smaller than the corolla-lobes.

NEW AND NOTEWORTHY SPECIES OF DAPHNOPSIS (THYMELAEACEAE) FROM MEXICO AND CENTRAL AMERICA

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*Daphnopsis* is a genus of about 55 species, native to tropical and subtropical regions of the New World. It is the largest neotropical genus of Thymelaeaceae, and is closely related to the neotropical *Schoenobiblus*. The genus has been revised and updated by Nevling (1959, 1960, 1961, 1963, 1967, 1978) and an additional species has been described by Laclette (1977).

Species of *Daphnopsis* are shrubs or small trees. Plants are dioecious and flowers are usually borne in terminal or axillary umbelliform racemes. They have a conspicuous hypanthium and petals are often absent or highly reduced. There is often a conspicuous disk at the base of the pistil or pistillode.

The following new species are published in preparation for various floristic treatments.

**Daphnopsis megacarpa** Nevling & Barringer, sp. nov. TYPE: MEXICO. Veracruz:. Cerro Vaxin al lado S de V6lcan San Martin Tuxtla, 1150 m, 15 June 1972, *Beaman 6181* (Holotype: F! Isotype: XAL).

Species *Daphnopsis radiata* affinis sed inflorescentiis feminae bracteatis, drupa solitaria 1.5-2.0 cm longa 8-12 mm lata.

Tree to 5 m tall; young stems sericeous, glabrescent, light brown, without conspicuous lenticels. Leaves alternate; petioles 5-10 mm long, slightly winged, glabrous; lamina elliptic, 10-20 cm long, 3-6 cm wide, membraneous, glabrous, the base attenuate, the apex acuminate, the venation pinnate, prominent below, with a well defined submarginal vein. Pistillate inflorescence compact, umbellate; primary peduncle 5-8 mm long, bracteate, the bract linear, 3 mm long, densely sericeous, caducous. Pistillate flowers not seen. Drupe ovoid, green turning white, 1.5-2.0 cm long, 8-12 mm wide, slightly 4-angled, only one per inflorescence.

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Additional specimens studied: MEXICO. Veracruz: San Andres Tuxtla, Lado N de Laguna Encantada Beaman 5325 (F, MEXU); Estacion Biológica Los Tuxtlas, Calzada 96 (F, MEXU); Estacion Biológica Los Tuxtlas, Rosas & Villapando 1405 (F, UNAM); Estacion Biológica Los Tuxtlas, Cerro Vigia, Gentry, Lott, et al. 32207 (A, MEXU, MO); Hidalgotitlan, 5 km SE de La Escuadra [17-16°N, 94-36 W], Vazquez et al. 1723 (F); San Andres Tuxtla, Estacion Biológica Los Tuxtlas [18-35 N, 95-01 W], Villegas 27 (F, MEXU).

Daphnopsis megacarpa is a distinctive species known from fruiting specimens collected between 450 and 1250 m in the Tuxtla range of southern Veracruz, Mexico. The pistillate inflorescences are unique because of the small, caducous bracts. The fruits are among the largest recorded for the genus and are borne one to an inflorescence. This species might be confused with some forms of D. americana, but it differs from that species by the pedicels less than 3.5 mm long. Vegetatively, it resembles D. radiata Donn.-Sm. but the large fruits distinguish it from that species. Daphnopsis costaricensis also has large fruits, but it can be distinguished from D. megacarpa by its very large, obovate leaves. We have not been able to locate flowering material of this species.

A specimen from Tlapacoyan, Nee & Hansen 18561, has staminate flowers and cannot be easily compared to the fruiting specimens from the Tuxtlas. It has similar vegetative features and comes from wet forest but it may represent a distinct, undescribed species. More collections are needed to clarify this problem.

Daphnopsis witsbergeri Nevling, Matekaitis & Barringer, sp. nov.

TYPE: EL SALVADOR. Achuachapan: Finca San Benito, Cerro La Piedra, del Filo, 13°54′ N, 89°55′ W, 980 m., 28 Aug. 1979, Witsberger 721 (Holotype: F!).

Species D. americana affinis, sed hypanthio infundibuliformi, antheris alternisepalo sessilis, pistillo glabro.

Shrubby tree to 6 m tall; young stems sparsely sericeous, glabrescent; older stems with reddish-brown cortex, the lenticels prominent, white. Leaves alternate; petioles 4-5 mm long, terete, glabrous; lamina narrowly elliptic, 3.5-6.7 cm long, 1.0-1.7 cm wide, subcoriaceous, glabrous, the base cuneate, the margin slightly revolute when dry, the apex obtuse to rounded, the venation prominent above and below. Staminate inflorescences terminal or lateral capitula, the lateral capitula often opposite a leaf; primary peduncles 4-8 mm long, sericeous; rhachis 1-2 mm long; secondary peduncles minute. Staminate flowers 7-12 per inflorescence, green; pedicels 1-2 mm long, sericeous; hypanthium, 3.5 mm long, campanulate-funnelform, sericeous outside, glabrous within, strongly veined; calyx lobes reflexed, 2-2.5 mm long, very obscurely papillate within; stamens 8, obdiplostemonous, the antisepalous whorl inserted on the calyx lobes, exserted, the alternisepalous whorl inserted about 1 mm below the mouth of the hypanthium, included, the filaments 1-2 mm long, glabrous, the anthers ovoid, 0.5-0.7 mm long; disk tubular, free, undulate, to 0.5 mm long; pistillode, 1 mm long, glabrous, on a gynophore 0.5 mm long. Pistillate inflorescences in capitula; primary peduncles 6-8 mm long, sericeous; rhachis 1-2 mm long; secondary peduncles minute. Pistillate flowers 5-8 per inflorescence; pedicels 1 mm long, sericeous; hypanthium barrel-shaped, 2 mm long, sericeous outside, glabrous within; calyx lobes spreading, 1 mm long, obscurely papillate within; staminodia 8, papilliform; disk annular, free, less than 1 mm long; pistil 1-1.5 mm long, slightly sericeous above, the gynophore 0.1-0.2 mm long, the style slightly eccentric, about 1 mm long, the stigma capitate, exserted. Drupe globose, 6 mm diam., green, the style persistent.

Additional specimens studied: EL SALVADOR. Achuachapan: Finca San Benito, Cerro La Piedra del Filo, 13°54′ N, 89°55′ W, 28 Aug. 1979, _Witsberger 722_ (F); same locality, 23 Oct 1978, _Davila s.n._ (F).

Common name: "Chilindrón de tierra fría."

_Daphnopsis witsbergeri_ is a member of subgenus _Daphnopsis_. It is known from a single locality in the province of Achuachapan, El Salvador. It appears to be most closely related to _D. americana_ but is distinguished from that species by its funnelform hypanthium, subsessile anthers, and glabrous pistillode on a short gynophore.

**_Daphnopsis costaricensis_** Barringer & Grayum, sp. nov. TYPE: COSTA RICA. Puntarenas, Osa Peninsula, ridge between Quebrada Banegas and Rio Riyito, ca. 7 km W of Rincón de Osa, 100-300 m, 8° 41′N, 83° 33′W, 8 Oct 1984. _Grayum_, _Schatz_, _Herrera_, _Valerin_, & _Chavarria 4094_ (holotype: MO!).

Species insignis foliis grandis obovatis 15-27 cm longis, floris 1.0-1.3 cm longis albos tubulato-infundibuliformis, drupis 2.4 cm longis.

Few branched shrub to 2 m tall; young growth glabrous, older growth with a light brown cortex, lenticels not prominent. Leaves alternate; petiole 3-7 mm long, glabrous, very slightly winged; lamina oblanceolate to ovate, 15-27 cm long, 5.5-9.0 cm wide, glabrous, dark green above, silvery green below, subcoriaceous, the base cuneate, the apex obtuse to acuminate, the venation prominent below, without a well-developed marginal vein. Staminate inflorescence umbelliform, the umbellules capitate; primary peduncle 0-0.5 mm long; rhachis 3-5 mm long; secondary peduncle 10-12 mm long, finely sericeous, glabrescent, bracts sericeous, lanceolate. Staminate flowers 8-14 per head, white; pedicel 1.0-1.5 mm long; hypanthium tubular-funnelform, 10-13 mm long, striate, sparsely sericeous outside, glabrous within, 1 mm wide at base, 3-3.5 mm wide at the mouth, with a thickened faucal annulus within; lobes reflexed, the apex rounded, apiculate, the mucra densely sericeous; stamens yellow, 8, the antisepalous whorl sessile, borne on the lobes, the alternisepalous whorl borne at the mouth of the hypanthium; disk 4-lobed, 0.5 mm long; pistillode bottle-shaped, 1.5-2.0 mm long, the stigma clavate. Pistillate flowers not seen. Drupe ovoid, white, 2.4 cm long, 1.6 cm wide.

Additional specimen studied: COSTA RICA. Puntarenas: Osa Peninsula, NW of airfield, about 5 km W of Rincon de Osa, 50-200 m, moist forest with open understory, 9-12 Jan 1970, Burger & Liesner 7314 (F).

*Daphnopsis costaricensis* is known only from the Osa peninsula of Costa Rica. It is distinctive because of its large, obovate leaves, white, tubular flowers, and large fruits. It is easily distinguished from *D. americana* ssp. *caribaea*, the only other Costa Rican species, by these characters. It is best classified in subgenus *Daphnopsis*, but it is not closely related to any other Central American species. Like many other species found on the Osa Peninsula, its affinities seem to be with species from the lowland forests of western Colombia and Ecuador.

*Daphnopsis correae* Barringer & Nevling, sp. nov.
TYPE: PANAMA. Panama, region of Cerro Jefe, 1000 m, edge of forest, 3 Oct. 1969, Correa, Dressler, Escobar, & Lewis 1612 (Holotype: MO!).

Species insignis foliis obovatis obtusis subtus glaucis, floris bicoloribus, staminodiis 8, disco cupulato.

Shrub to 2 m tall; young growth glabrous, older growth with reddish-brown cortex, lenticels white. Leaves alternate; petioles 5-7 mm long, glabrous, dark brown, flattened above; lamina ovate to obovate, 9-13 cm long, 4.5-6.0 cm wide, glabrous, glaucous below, coriaceous, the base cuneate, the margin recurved when dry, the apex obtuse to rounded, the venation prominent below. Pistillate inflorescence umbelliform; primary peduncle 1-4 mm long, glabrous; rhachis 1-2 mm long; secondary peduncles 4-5 mm long, glabrous; flowers 15-20 per head, the pedicel 1-2 mm long; hypanthium green, 2-3 mm long, 1 mm wide at the base, 1.5-2.5 mm wide at the mouth, sericeous outside, glabrous within, the lobes 1-2 mm long, rounded, brown, sericeous outside, thick, with a longitudinal ridge above the stamens; staminodes 8, the upper whorl subsessile, less than 1 mm long, the alternisepalous whorl attached at the mouth, sessile, the anthers less than 1 mm long; disk cupuliform, 0.7 mm long, glabrous, lobulate; ovary subglobose, the style 1 mm long, the stigma clavate. Drupes pinkish-red.

Additional specimen studied: PANAMA. Panama: Cerro Jefe, cloud forest, 850-900 m, Sytsma 1422 (MO). Canal Zone: between Fort San Lorenzo and Fort Sherman near Pavon road junction with road 82. 22 Oct. 1974. Mori & Kallunki 2733 (F, MO).

Daphnopsis correae is distinctive because of its bicolored flowers, pinkish-red fruits, and leaves with glaucous undersides. It is classified in subgenus Daphnopsis, but does not appear to be closely related to any of the other Central American species in that subgenus. It can be distinguished from all other Panamanian Daphnopsis by its umbelliform inflorescence, green and brown flowers, glaucous leaves, and shrubby habit. It is currently known from specimens collected near Cerro Jefe and in the Canal Zone, but material recently collected in Chiriqui Province may also represent this species.

Acknowledgements

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# A NEW SPECIES OF RUDBECKIA (ASTERACEAE-HELIANTHEAE) FROM HILLSIDE BOGS IN EAST TEXAS

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The section Macroline of the genus Rudbeckia is distinguished from the section Rudbeckia by the presence of lemon-yellow or pale yellow rays, somewhat compressed and basilaterally attached achenes that are slightly (if at all) shorter than the chaff, large often elongating flower heads, and a basic chromosome number of X = 18 (Cronquist 1980). Recent field work and a study of herbarium specimens has revealed the following new species in section Macroline from acid hillside bogs in Angelina, Jasper, and Newton Counties, Texas.

RUDBECKIA SCABRIFOLIA Larry E. Brown, sp. nov. Fig. 1.

A R. maxima Nutt. similis sed differt capitulis parvioribus non elongescentibus et ligulis parvioribus et inflorescentia ramificatione et laminis foliorum scabris non glaucis nitentibusque.

Erect perennial herbs to 2 meters tall. Roots fibrous, arising from a 0.8-2.0 cm thick rootstock. Fresh stems somewhat glaucous. Stems terete, striate, and glabrous; upper peduncles often with a few scattered hairs. Basal leaves large; petioles to 28 cm long; blades oval, or ovate, 7.3-16.7 cm wide and 9.4-23.5 cm long. Leaf margins entire to undulate. Blade base subtruncate to broadly cuneate, blade tissue decurrent 1-3 cm down petiole as a narrow wing. Principal lateral veins numerous and arcuate, arising from a prominent midrib vein. Lower cauline blades similar but smaller. Blades of mid-cauline leaves elliptic, to 13 cm long, often winged to base by blade tissue. Upper leaves sessile, auriculate, elliptic to oblong, often contracted above middle to a more narrow apex. Extreme upper leaves more or less bract-like. Blade surfaces not glaucous as in R. maxima but lustrous and scabrous-pubescent with erect, reclining, or sometimes appressed 0.1-1.2 mm long hairs. Flower heads 3-11 in a branched inflorescence, rarely (if ever) a single monocephalous head as found in R. maxima. Discs hemispherical to ovate, not elongating, 1.5-2 cm wide and 1.1-2.5 cm long. Receptacle columnar to 1 cm long. Ligules pale yellow, reflexed, 1-3.3 cm long and 3.5-9 mm wide, abaxial surface hirsute with glandular and non-glandular hairs, adaxial surface glabrous. Phyllaries spreading to reflexed, ciliate and pubescent abaxially. Chaff to 6 mm long, partially enfolding ovary and achene, pale or yellowish hairs on the flat

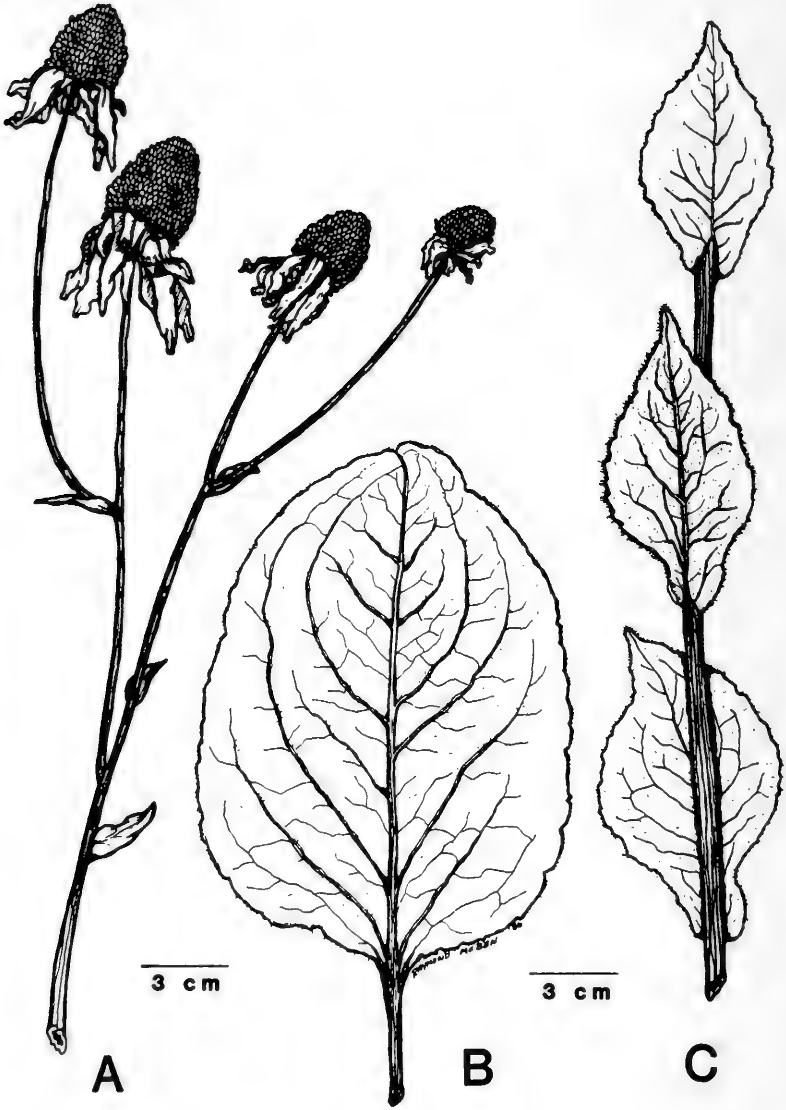


Fig. 1. Rudbeckia scabrifolia (from holotype).
A, inflorescence; B, basal leaf; C, upper culm leaves.

apex with hairs extending a short distance down the abaxial keel, a purple line on the margins with the purple line of the abaxial keel somewhat expanded at the acute chaff apex. Corolla tube of disk flowers to 4.9 mm long, brown with 5 purple lines terminating at the sinuses of the 5 erect corolla lobes. Corolla lobes to 0.9 mm long, purple at tips. Achenes purple, glabrous, 3-4 mm long, 4-angled, somewhat compressed, acute at base and basilaterally attached to receptacle. Pappus an irregularly toothed or lacerate crown, 1.1-2 mm long. On mature flower heads the pappus extends to, or almost to, the apex of chaff. Flowering mostly in June but perhaps again in the fall as Brown 4646 (ASTC) collected on 22 September 1979 has a number of immature flower heads.

TYPE: UNITED STATES. TEXAS. ANGELINA COUNTY: ca 1 mi S of junction FR 339 and Fr 330 on 330, SW facing seepage slope with some pitcher plants present, 17 Jul 1980, John R. Ward 352 (holotype, ASTC, two sheets). This site is now in the Upland Island Wilderness of the Angelina National Forest.

Additional Collections Examined: ANGELINA CO: bog SE of Zavalla on U.S. highway 63, 0.5 mile NW of the Angelina-Jasper Co. line, 27 June 1978, K. L. Marietta 321 (ASTC); proposed Graham Creek Wilderness area, 8.8 mi S of Zavalla on U.S. 69 left on FR 314, 22 Sept 1979, Nixon & Ward 9790 (ASTC); hillside bog with pitcher plants below highway 63 at first guardrail S of intersection with FR 327, 16 Aug 1986, Brown 10656 (SBSC); same site, 19 Aug 1985, Brown 9405 (SMU). JASPER CO.: pitcher plant bog area associated with creek, 3 mi S of Letney, 6 Aug 1976, Nixon et al. 7296 (ASTC); Boykin Springs, Angelina National Forest, July 1964, D. J. Banks s.n. (ASTC); on seepage slope, Boykin Springs, Angelina National Forest, 6 June 1963, Correll & Wasshausen 27533 (LL); proposed Graham Creek Wilderness area, ca 0.3 mi N of intersection FR 314 & 330 on 330, seepage slope with pitcher plants, 17 June 1980, Ward 539 (ASTC); same site, 16 Aug 1986, Brown 10652 (SBSC, SMU, VDB); same site, 2 Aug 1986, Brown 10594 (TAES, NY). NEWTON CO.: pitcher plant bog 9 mi N of Wiergate on Hwy 87, then 2.5 mi E of Walker Cemetery in vicinity of Mill & Copperas Creeks, 24 July 1973, Nixon & Cox 6103 (ASTC).

Rudbeckia scabrifolia most closely resembles R. maxima Nutt.; however, the author has observed no plants intermediate between R. scabrifolia and R. maxima. Plants referable to R. maxima have not been observed by the author in those counties where R. scabrifolia is found. Table 1 is a list of some of the major differences between these two species. R. scabrifolia is a distinct species that is adapted to a unique environment which is present as scattered small patches on some east Texas hillsides.

Table I. A Comparison of R. scabrifolia and R. maxima

| FEATURE | R. scabrifolia | R. maxima |
|---|---|---|
| Fresh stems | glaucous | glaucous |
| Blade surface | non-glaucous, shining, and scabrous-pubescent | glaucous, dull, and glabrous |
| Basal blade shape | mostly oval to 16 cm broad | mostly elliptic to 13 cm broad |
| Basal blade base | more or less truncate or abruptly contracted | gradually narrowed |
| Inflorescence | branched with 3-11 heads | often monocephalous |
| Discs of flower heads | to 2.5 cm long | to 8 cm long |
| Habitat | acid hillside bogs | dry to moist sites, often roadsides |

At present, herbarium specimens of R. scabrifolia are available from two sites in Angelina Co., three sites in Jasper Co., and one site in Newton Co. Most, if not all, of these sites are pitcher plant bogs present on hillside seepage areas. A recent study (Nixon & Ward 1986) indicates these bogs develop on sandy uplands that are underlain by impermeable layers of clay materials. Water percolates downward through the sandy soils to the clay region and then moves laterally to emerge on the lower hill slope. In two bogs examined by the author, flowering stems of R. scabrifolia are common and conspicuous in the wet and mucky soils of the open center of the bog. Around the bog edge, where the soils are drier, flowering stems are absent or rare but plants with basal leaves only are common.

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Raymond McBen of the Staff and Instructional Development Department of Houston Community College made the drawing and Paul A. Fryxell of Texas A&M University provided the Latin diagnosis. The curators and staff of Southern Methodist University (SMU), Stephen F. Austin State University (ASTC), University of Texas (LL), and Texas A&M University (TAES) kindly allowed me to visit and study herbarium sheets of Rudbeckia. A special thanks is extended to Elray Nixon of ASTC for the loan of 13 sheets of R. scabrifolia which largely formed the basis of the species description.

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# STREPTOPOGON JUAREZII N. SP.
# and
# TREMATODON NORRISII N. SP.*

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## Streptopogon juarezii sp. nov.

Distinguitur ex ovatis, levibus aristatis foliis quae leves margines habent et quae gemmis carent et quae cellulas marginis quadratis inconspicuas habent.

This new species is distinguished by having elliptically ovate, smooth, entire, aristate leaves without gemmae. The sporophyte with an oblong tubular immersed capsule with a short (±1 mm) seta and a peristome of a high, ±hyaline basal membrane and 16 slender, perforate, papillose teeth. Autoicous.

TYPE: Sobre un tronco humedo. 21 km al oeste de Xalapa, Veracruz, Mexico. 1700 m elevacion. Coll. L. Gil Juárez G., No. 627, 20 VII 1976 (type, TENN; isotype, INIREB).

## Trematodon norrisii sp. nov.

Distinguitur ex parvitate, ex foliis anguste lanceolatis, ex costa percurrente, et ex perfragilibut angustis dentibus peristomatos.

Distinguished from other small species of Trematodon by the narrowly lanceolate (1-2 mm) leaves with percurrent costae; capsules 2 mm in length, abruptly narrowed to slender hypophyses, and with thin, ±diaphanous walls; teeth slender, very fragile, 200-250 µ; spores 25-30 µ, prominently papillose.

TYPE: Moist, diffusely lit soil bank in dense tropical sub-deciduous forest along road to Puerto Vallarta about 4 miles north of San Juan Caxstle, Municipio Compostela, Nayarit, Mexico. Coll. D. H. Norris & D. J. Taranto, No. 13641, 24 July 1970 (type, TENN; isotype, HSC).

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ESTUDIOS QUIMICOS PRELIMINARES EN ALGAS MARINAS CLOROFITAS DEL GOLFO DE MEXICO.

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Entre los alimentos de valor económico, figuran los de origen marino incluyendo las algas, cuyos pigmentos, de reconocida importancia por su participación en el proceso biosintético, hacen posible la nutrición de los seres vivos.
Los reportes publicados en relación a U. lactuca son escasos, no obstante el atractivo que ofrece su contenido proteico, el cual parece ser un magnífico potencial para el uso alimentario con miras a una explotación futura, razones que motivaron nuestro interés por compilar informacion concerniente a esta alga de amplia distribución en las costas mexicanas. En el área de estudio fueron muy comunes E. lingulata y C. mexicana, por lo que se les eligió para comparar las variaciones con especial atención hacia los pigmentos fotosintéticos y sustancias orgánicas de reserva de dichas plantas.
El material biológico fué recolectado en forma manual en mayo de 1981, en las escolleras de Ciudad Madero y Soto La Marina, Tamaulipas, México, sobre rocas calizas en la desembocadura de los ríos Pánuco y Soto La Marina respectivamente, ambos portadores de descargas industriales. Las algas libres de epífitas y otras impurezas, fueron separadas en lotes de cincuenta especímenes para los procesos de extracción y análisis. Todos los reactivos y solventes utilizados fueron de grado analítico libres de peróxidos. Los extractos de las plantas fueron procesados en ausencia de luz.
El material se dividió en dos fracciones. Una parte se secó a temperatura ambiente y posteriormente en estufa a 40°C y se molió hasta obtener una harina algal. Sobre ésta se determinó humedad y cenizas por el método de Larsen (1978), proteínas, grasa y fibra cruda por el procedimiento de Larsen y Kobech (1979) y carbohidratos totales por la técnica colorimétrica de Dubois y Col (1956). Los resultados obtenidos pueden observarse en la Tabla I, siendo especialmente alto y de interés para nosotros el contenido proteico en U. lactuca.
La segunda fracción permaneció en refrigeración a -20°C

y en ausencia de luz. Para la extracción de los pigmentos se utilizó acetona 90% según la metodología de Jeffrey (1968) y Garside y Riley (1969). Se utilizó baño ultrasónico para la extracción exhaustiva. Una parte de este extracto se saponificó según recomienda Jensen (1978), para la determinación de carotenos. Las xantófilas se reconocieron luego de una partición del extracto con éter de petróleo y metanol acuoso al 85%, siguiendo la metodología de Davis (1965). La naturaleza de los pigmentos se comprobó por cromatografía en capa delgada comparando el Rf de los pigmentos presentes en las plantas en varios sistemas cromatográficos, con los obtenidos a partir de standards (Sigma Chem. Co) o con los Rf reportados en la literatura (Foppen, 1971). Los resultados se observan en la Tabla II. La identificación se complementó eluyendo de las placas cada uno de los pigmentos con dimetilformamida y posterior análisis por espectrofotometría visible. Los espectros se realizaron en un Beckman DU.

Las tres plantas contienen clorofilas a b, $\alpha$-caroteno y luteína, U. lactuca tiene también violaxantina y C. mexicana violaxantina y neoxantina.

La cuantificación de las clorofilas se llevó a cabo por dos métodos distintos. El primero aplicó las ecuaciones matemáticas de Jeffrey y HumPhrey (Holden, 1975), midiendo la absorción de cada extracto a 664, 647 y 630 nm. El segundo método consistió en realizar una cromatografía en capa fina (sistema D) de los extractos y posterior lectura de la reflectancia en un espectrofotómetro de capa fina Zeiss MQIII. Se había determinado previamente la longitud de onda de respuesta máxima para clorofilas a y b que resultó ser 670 y 650 nm respectivamente, así como el rango de linealidad.

El $\alpha$-caroteno y luteína se cuantificaron por este último método, utilizando el sistema F de cromatografía para el caroteno y E para luteína. Ambos se midieron a 440 nm, utilizando $\alpha$-caroteno como standard, debido a que el coeficiente de extinción de ambos es similar a la longitud de onda utilizada (Jeffrey, 1968). No se cuantificaron violaxantina y neoxantina, pues aparecen como trazas. Los resultados se observan en la Tabla III y son promedio de por lo menos cinco determinaciones.

CONCLUSIONES.

De las algas verdes estudiadas, fué C. mexicana la que ofreció más variedad de pigmentos y en la mayor concentración. Por el análisis químico proximal, se advierte la riqueza proteica de U. lactuca. Será objeto de un -

estudio posterior su composición en aminoácidos.
Se advierte la ventaja, en cuanto a precisión y rapidez del análisis, del uso de espectrofotometría en capa fina para el análisis cuantitativo de pigmentos, tal y como recomiendan Garside y Riley (1969).

TABLA I

* ANALISIS QUIMICO PROXIMAL DE ALGAS MARINAS CLOROFITAS

| | Humedad % | Cenizas % | Nitrógeno % | Proteínas % | Grasa % | Fibra Cruda % | Carbohidratos % |
|---|---|---|---|---|---|---|---|
| *U.lactuca* | 3.4 | 11.6 | 3.5 | 23.0 | 1.8 | 6.3 | 40.0 |
| *E.lingulata* | 9.8 | 12.8 | 3.1 | 13.1 | 2.4 | 14.8 | 46.5 |
| *C.mexicana* | 15.0 | 18.5 | 2.5 | 16.4 | 2.3 | 16.2 | 37.0 |

* Valores expresados como porcentaje sobre peso seco.

TABLA III

VALORES PORCENTUALES DE PIGMENTOS AISLADOS DE ALGAS MARINAS CLOROFITAS EXPRESADOS EN mg/100 gr. de PESO SECO.

| | A L G A S | | | | | |
|---|---|---|---|---|---|---|
| PIGMENTOS | *U. lactuca* | | *E. lingulata* | | *C. mexicana* | |
| | * | ** | * | ** | * | ** |
| Clorofila *a* | 44,20 | 55 | 23,60 | 29 | 87,00 | 90 |
| Clorofila *b* | 34,90 | 38 | 8,50 | 13 | 52,30 | 58 |
| Alfa Caroteno | | 1.40 | | 1.70 | | 9.10 |
| Luteína | | 4.10 | | 2.20 | | 4.10 |

* Cuantificado según ecuaciones Jeffrey - Humphrey
** Cuantificado por espectrofotometría en capa delgada (c.c.d)

## TABLA II

Rf DE PIGMENTOS FOTOSINTETICOS EN 3 ALGAS MEXICANAS

| | SISTEMAS | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | a | b | c | d | e | f | Color | Identidad |
| U. lactuca | 0.52 | 0.66 | 0.95 | 0.37 | 0.24 | - | Verde | Clorof a |
| | 0.45 | 0.51 | 0.91 | 0.38 | 0.26 | - | Verde claro | Clorof b |
| | - | - | - | - | - | 0.82 | Amarillo | $\alpha$ -caroteno |
| | 0.54 | 0.52 | 0.40 | 0.63 | 0.82 | - | Amarillo fuerte | Luteina |
| E. lingulata | 0.34 | - | 0.35 | 0.47 | 0.67 | - | Amarillo claro | Violaxantina |
| | 0.67 | 0.64 | 0.93 | 0.47 | 0.37 | - | Verde | Clor a |
| | 0.45 | 0.45 | 0.91 | 0.35 | 0.28 | - | Verde claro | Clor. b |
| | - | - | - | - | - | 0.82 | Amarillo | $\alpha$ -caroteno |
| | - | 0.54 | 0.72 | 0.78 | 0.84 | - | Amarillo fuerte | Luteina |
| C. Mexicana | 0.45 | 0.64 | 0.92 | 0.44 | 0.17 | - | Verde | Clorof. a |
| | 0.46 | 0.41 | 0.91 | 0.38 | 0.28 | - | Verde claro | Clorof b |
| | - | - | - | - | - | 0.82 | Amarillo | $\alpha$ -caroteno |
| | 0.52 | 0.53 | 0.72 | 0.75 | 0.80 | - | Amarillo fuerte | Luteina |
| | 0.36 | 0.48 | 0.55 | 0.55 | 0.67 | - | Amarillo claro | Violaxantina |
| | 0.20 | 0.18 | 0.21 | 0.20 | 0.35 | - | Naranja | Neoxantina |

a. Celulosa 1% n-propanol en éter de petróleo
b. Celulosa 25% cloroformo en éter de petróleo
c. Celulosa éter de petróleo: acetona: n-propanol (90:10:0.45)
d. Celulosa impregnada con triglicéridos. acetona: metanol: agua (20:76:4)
e. Kieselgur impregnada con triglicéridos, acetona: metanol: agua (20:76:4)
f. Silica-Gel G. éter de petróleo: éter etílico (99:1)

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# NOTES ON THE GENUS *CLERODENDRUM* (*VERBENACEAE*). XXIX

Harold N. Moldenke

*CLERODENDRUM* Burm.

Additional bibliography: Mold., Phytologia 61: 316--338. 1986; Takhtajan [transl. Crovello], Florist. Regions 67. 1986.

Additional excluded taxa: *Clerodendrum leandrii* Mold., Lloydia 13: 207--208. 1950 = *Radamaea* sp., *Scrophulariaceae*. *Clerodendrum brevicalyx* Mold. ex Holmgren & al., Ind. Vasc. Pl. Type Microf. 441 nom. nud. 1985 = ?

*CLERODENDRUM KAEMPFERI* (Jacq.) Sieb.

Additional synonymy: *Clerodendron coccineum* D. Dietr., Syn. Pl. 3: 616. 1843. *Volkameria coccinea* Herb. ex D. Dietr., Syn. Pl. 3: 616 in syn. 1843. *Clerodendrum kaempferi* Sieb. ex Hassk., Cat. Pl. Hort. Bogor. Cult. 136. 1844; Mold., Résumé Suppl. 15: 19 in syn. 1967; Alexander, Hong Kong Shrubs 28. 1971 [not *C. kaempferi* Fisch., 1821]. *Clerodendron dentatum* Wall. apud Voigt, Hort. Suburb. Calc. 466. 1845. *Volkameria kämpferiana* Jacq. apud Voigt, Hort. Suburb. Calc. 466. 1845. *Volkameria kämpferi* Jacq. apud Sieb. & Zucc., Abhandl. Akad. Wiss. Muench. Math.-Phys. 4 (3): 153 in syn. 1846. *Clerodendron speciosissimum* Hort. Angl. ex Schau. in A. DC., Prodr. 11: 672 in syn. 1847 [not *C. speciosissimum* Paxt., 1837, nor Van Geert, 1836]. *Clerodendron squamatum* β *indicum* Hassk., Retzia 1: 62--63. 1855. *Clerodendron squamatum* var. *indicum* Hassk., Retzia 1: 63. 1855. *Volkameria koempferi* Jacq. apud Franch. & Savat., Enum. Pl. Jap. 1: 359 in syn. 1875. *Clerodendron illustre* N. E. Br., Gard. Chron. 56 [ser. 2, 22]: 424. 1884. *Clerodendron squamatum* Wahl ex Bachman, Flora 69 [ser. 2, 44]: 414. 1886. *Clerodendron squamatum* Cham. ex Briq. in Engl. & Prantl, Nat. Pflanzenfam., ed. 1, 4 (3a): 175. 1895. *Clerodendron coccineum* Hort. Morr. ex Voss in Vilm., Blumengärt. 1: 832 in syn. 1895. *Clerodendron speciosissimum* "Hort. ex p[arte]" ex Voss in Vilm., Blumengärt. 1: 832 in syn. 1895. *Clerodendron kaempferi* Sieb. apud Jacks. in Hook. f. & Jacks., Ind. Kew., imp. 1, 2: 1276. 1895 [not *C. kaempferi* Fisch. ex Morr., 1845, nor "Sieb. herb. ex Miq.", 1903, nor Steud., 1948]. *Clerodendron squammatum* Vahl apud Pynaert, Rev. Hort. Belg. 22: 284 & 287 sphalm. 1896. *Clerodendron squamutum* Vahl apud Bretschn., Hist. Europ. Bot. Discov. China 136 in syn. 1898. *Clerodendron coccineum* D. Dietz. apud H. J. Lam, Verbenac. Malay. Arch. 363 in syn. 1919. *Clerodendron squamatum* var. *typicum* H. J. Lam, Verbenac. Malay. Arch. 363. 1919. *Clerodendron dentatum* "Wall. ex Steud." apud Bakh. in Lam & Bakh., Bull. Jard. Bot. Buitenz., ser. 3, 3: 93 & 108 in syn. 1921. *Clerodendron coccineum* H. K. ex Bakh. in Lam & Bakh., Bull. Jard. Bot. Buitenz., ser. 3, 3: viii in syn. 1921. *Clerodendron squamatum* var. *typica* Bakh. in Lam & Bakh., Bull. Jard. Bot. Buitenz., ser. 3, 3: 93. 1921. *Clerodendrum infortunatum* Lour [in part] apud E. D. Merr., Trans. Amer. Philos. Soc. 24 (2): 337 in syn. 1935 [not *C. infortunata* L., 1753, nor *C. infortunatum* Auct., 1955, nor Blume, 1967, nor Dennst., 1959, nor Gaertn., 1965, nor Miq., 1968, nor Vent., 1821, nor Willd., 1976]. *Clerodendron infortunatum* "Lour., in part" ex Mold., Prelim. Alph. List Inv. Names 20 in syn. 1940 [not *C. infortunatum* Auct., 1963, nor Blume, 1947, nor Gaertn., 1788, nor Lam., 1947, nor Lindl., 1918, nor Schau., 1918, nor F.-Vill., 1882, nor Walp., 1843, nor Wight, 1850, nor Willd., 1976]. *Clerodendron kaempferi* (Jacq.) Sieb. ex Mold., Suppl. List Inv. Names 2 in syn. 1941. *Clerodendron* "(or *Volkameria*?) *dentate* Roxb." apud Fang, Icon. Pl. Omeiens. 1: pl. 69. 1944. *Clerodendron dentata* Roxb. ex Pételot, Pl. Méd. Camb. Laos Vietn. 2: 255 in syn. 1953. *Clerodendron kaempferi* (Jack) Sieb. ex Tingle, Check List Hong Kong Pl. 38 sphalm. 1967. *Clerodendron speciosissimum* Hort. ex Mold., Phytologia 31: 396 in syn. 1975. *Clerodendron dentatum* (Roxb.) Wall. ex Mold., Phytol. Mem. 2: 384 in syn. 1980. *Clerodendrum kaempferi* (Jack.) Sieb. ex Hu, Enum. Chin. Mat. Med. 6. 1981.

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Illustrations: Jacq., Icon. Pl. Rar. 3: pl. 500 (in color). 1792; Kerner, Hort. Semperviv. pl. 112 (in color). 1803; Edwards, Bot. Reg. 8: pl. 649 (in color). 1822; Lodd., Bot. Cab. 8: pl. 796 (in color). 1823; Loisel.-Deslong. in Mordant de Launay, Herb. Amat. 8: pl. 519 (in color). 1827; Reider, Ann. Blumist. 8: pl. [6] (in color). 1832; Drapiez, Herb. Amat. Fl. 6: pl. 408 (in color). 1833; Berge, Pflanzenphysiogn. 94. 1880; Bachman, Flora 69 [ser. 2, 44]: 414, pl. 9, fig. 17 & 18. 1886; Pynaert, Rev. Hort. Belg. 22: 253 (in color). 1896; Solereder, Syst. Anat. Dicot. 713, fig. 151 C & D [anat.]. 1899; D. H. Scott in Solereder, Syst. Anat. Dicot. [transl. Boodle & Fritsch] 1: 632, fig. 151 C & D [anat.]. 1908; Neal, In Honolulu Gard. 271, fig. 59e. 1928; Fang, Icon. Pl. Omeien. 1: pl. 69. 1944; Bowden, Amer. Journ. Bot. 32: 198, fig. 202 [anat.]. 1945; Metcalfe & Chalk, Anat. Dicot. 2: [1028], fig. C & D [anat.]. 1950; Bor & Raizada, Some Beaut. Indian Climb. 148, fig. 93. 1954; Sharma & Mukhopadhyay, Journ. Genet. 58: 381, pl. 9, fig. 7 & 8 [anat.]. 1963.

A small, erect, gregarious, semi-woody or only basally woody shrub or subshrub, 0.5--3 m. tall. ramose or often single-stemmed, spreading rapidly by underground stems; branches rather stoutish, medullose or hollow, very obtusely tetragonal, often deeply sulcate between the angles in drying, minutely and obscurely strigillose-puberulent or glabrate (except for the nodes); nodes annulate with a narrow band of long, interpetiolar, multicellular, white hairs; principal internodes 1.8--4.5 cm. long; leaves decussate-opposite, large; petioles cylindric, stout (especially at the base), 1.6--24.5 cm. long, pulverulent-puberulent, the lowest 1 cm. on the largest ones usually collapsing quickly in wilting; leaf-blades thin-membranous or chartaceous, dark- or deep-green and dull or shiny above, much paler beneath, ovate or broadly ovate to obcordate, 5.9--30 [--35] cm. (or more) in length, 5--20 [--35] (or more) sm. wide, apically abruptly acute or very shortly acuminate, marginally subentire or repand to denticulate, basally deeply cordate with the lobes often overlapping, very sparsely strigillose or glabrous above, minutely pulverulent and densely squamulose with glistening, golden, peltate scales beneath; midrib stoutish, flat or subprominulent above, prominent beneath; secondaries slender, 6--9 per side, the 2 or 4 lowermost issuing palmately from the lamina-base, the lowest with numerous conspicuous tertiaries extending into the basal lobes, flat or subprominulent above, prominulent beneath; vein and veinlet reticulation rather abundant, the larger parts somewhat conspicuous (but not prominulent) above, flat or the larger parts subprominulous beneath; inflorescence terminal or a pair of cymes also axillary in the uppermost leaf-axils, the terminal panicle large, dense, and showy, 27--34 cm. long, 15--18 cm. wide, composed of 9--14 pairs of ascending, many-flowered, spreading, rather short-stipitate cymes, with short sympodia, all parts deep bright scarlet or red; peduncles stoutish, 4.5--6 cm. long, minutely puberulent or glabrate, often deeply sulcate (along with the sympodia) in drying; pedicels slender, 5--15 mm. long, puberulent; bracts foliaceous, ovate or spatulate, long-stipitate, to 2.5 cm. long and 2 cm. wide; bractlets linear or oblong, 5--15 mm. long, to 2 mm. wide, puberulent; prophylla linear or oblong, 5--11 mm. long, puberulent; flowers fragrant, relatively small; calyx campanulate, red, 5--10 mm. long, rather widely spreading and loose, deeply 5-lobed or -parted to ½ or 2/3 its length, the tube about 2 mm. long, glandular-hairy on both surfaces, the lobes ovate or lanceolate to triangular, about 3.5 mm. long, apically acute or short-acuminate, externally puberulent; corolla hypocrateriform, red or scarlet to vermillion, to 3.8 cm. long overall, the tube very slender, 1.5--2 cm. long, about twice as long as the calyx, externally obscurely puberulent, the limb 5-lobed and about 15 mm. wide, the lobes spatulate or obovate, 3--8 mm. long, about 3 mm. wide, subequal or unequal, apically rounded, dorsally puberulent; stamens 4, inserted in the upper part of the corolla-tube, long-exserted, ascending, extending 3 cm. beyong the mouth of the corolla-tube, circinately curved in bud; filaments slender, 4--5 cm. long, slightly villous; anthers oblong, versatile, yellow; style slender, 6--8 cm. long, usually extending about 2 cm. beyond the corolla-mouth, glabrous; stigma minute, shortly bifid, the branches apically acute; ovary superior, 4-celled, externally glabrous; ovules 1 per cell, pendulous; fruiting-calyx patelliform, coriaceous, rather fleshy, greenish-white dorsally, bright-red ventrally, accrescent, glabrous, enclosing the fruit, 4 cm. in diameter, the lobes lanceolate, 10--14 mm. long, 3--5 mm. wide, strongly reflexed in age; fruit drupaceous, at first green, later red, finally blue or bluish-black to black, globular, 6--13 mm. long and wide, shorter than the mature calyx, succulent, the weight of the mature infructescence often bending the branches to the ground; seeds black; chromosome number: 2n = 52, 60, or 92.

This is the type species of the Section *Squamata* Schau. in Subgenus *Euclerodendron* (Schau.) Thomas. The type of the species was collected by Jacquin in the Schönbrunn gardens in Vienna from cultivated material originally from Mauritius (according to his assertion). He named it in honor of Engelbert Kämpfer (1651--1716), a German physician and traveler, apparently in the belief that the plant represented Kämpfer's pl. 58, published by Banks in 1791, which, however, we believe represents the very closely related C. *japonicum* (Thunb.) Sweet instead.

The type of C. *squamatum* was collected by Pierre Sonnerat (1748--1814) in the East Indies, sent by him to Lamarck and forwarded by Lamarck to Vahl. The type of C. *illustre* is a plant collected in the Veitch Nurseries on September 4, 1884, and deposited in the Kew herbarium.

*Clerodendrum kaempferi* has been encountered by collectors in forests and bamboo jungles, in open places, in hammock clearings, and at the margins of woods, along roadsides and streamsides, in moist fields and yards, in sandy soil on dry level land, on dry gentle slopes and hillsides, in thickets and light woods, along grassy trailsides, among limestone rocks near the sea, in damp or wet places at the edges of ponds, and on village commons, at 10--2300 m. altitude, in flower from April to January, in fruit in July and September. Dee and Bunpheng report it common in open pine forests and along the edges of evergreen forests in Thailand. It is said often to be abundant in secondary vegetation and near human habitations. It has been introduced along roadsides at Antonina in Paraná, Brazil. On Hainan island Lei reports it "fairly common in sandy soil of thickets on dry level land" and as "scattered shrubs abundant on village commons". In India it is said by Sharma (1982) to flower from December to March and by both Patel (1968) and Bor & Raizada (1954) in March and April. Bojer (1837) says that in Mauritius it normally flowers in May and June.

*Clerodendrum kaempferi* is a very handsome species, apparently found wild from India and the Andaman Islands to southern China, Hainan, and Taiwan, southward and eastward into Malaya and Indonesia. It is widely cultivated in many tropical and subtropical countries in both hemispheres and there tends to escape and become naturalized. It is grown in greenhouses and as a specimen plant in more temperate regions.

Authors differ greatly in their opinions about the actual origin of this species. A chronologic review of its history illustrates this situation. Jacquin (1793) asserts that the type specimen came from cultivated plants in Austria which originated in Mauritius. Raeuschel (1797) asserts that what he called C. *kaempferi* is originally from India, while what he called C. *squamatum* is from the East Indies ["Ind. orient."]; Lamarck (1808) considered its native land to be China and Japan; Bojer (1837) found it cultivated in Mauritius, but introduced there from China and Japan; Voigt (1845) found it growing in gardens near Calcutta.

Siebold & Zuccarini (1846) and Miquel (1865) assert definitely that the species was introduced into Japan from Korea. Franchet & Savatier (1875) say; "Hab[itat] in Japoniâ, e remotiore tempore introductum. Kiou-siou, circa Nangasaki e Corea allatum, teste Thunberg." Mason (1885) comments that "The Burmese gardens are ornamented with this species, which bears a large cone of superb scarlet flowers. Although said to be originally from China, it appears to be naturalized in Burma". Maximowicz (1886) gives its distribution as "China australi (Hooker et Arnott): ins. Hainan (Hancock), in boreali et in Japonia cultum. India, Mauritius. Ex Kaempfero in Japoniam intriductum ex ins. Luzon et ex Korea, inde et ab indigenis Rjuke giri et Korei giri appellatur". Diels (1902) found it at Chunking in central China; Brandis (1906) lists it from 3000 feet altitude in Sikkim, as well as from Assam, Silhet, Singapore, and China and adds "Often cultivated"; Cooke (1906) claims that it is a "native of China and Sumatra". Dunn & Tutcher (1912) found it naturalized in Hong Kong, where it flowers in May.

Hallier (1918) gives the distribution of the species, as known to him, as Japan, China, Hainan, Sikkim, East Bengal, Bhutan, Assam, Burma, the Andaman Islands, Singapore, Sumatra, Java, Celebes, and the Philippine Islands; Bakhuizen (1921) lists it from Japan, China, India, the Philippines, and the Malay Archipelago; Neal (1928) describes it sa cultivated in Hawaii, with its native home given as "India and China". Grey & Hubbard (1933) found it cultivated in Cuba, where it was collected by Atkins in 1906. Hu (1938) lists the species from Fukien, Kwangsi, Kwangtung, Szechuan, and Yünnan provinces, China. Kanjilal and his associates (1939) found it in Assam, wild and "also widely cultivated in the gardens", flowering there in the "cold season". Lam & Meeuse (1942) give its natural distribution as "India and China to Japan, Philippines, and Moluccas".

Fang (1944) tells us that "This plant has been cultivated commonly in various gardens in western Szechuan. It is highly appreciated for its beautiful scarlet flowers and ample inflorescences as well as for its long flower-season from May to July". Pételot (1953) claims that it occurs throughout Indochina, as well as in "trop[ical] Asia and China". Bor & Raizada (1954) claim it to be a "Native of China, extending to the Himalayas, Japan and Sumatra, cultivated throughout the tropical and subtropical parts of the globe".

Masamune (1955) reports the species "introduced (?)" in Okinawa; Nath (1960) reports it from the Southern Shan States of Burma; Deb (1961) found it "generally under cultivation in homestead compounds" in Manipur. Hundley & Ko (1961) assert that it is a "Native of India and China. Naturalized in Ceylon", listing it also from Burma; Rolla (1963) claims that it is "common" in Sikkim, while Banerji (1965) reports it only "occasional" in Nepal. Burkill (1965) informs us that it is "found from the Himalayas and Japan to Sumatra and Celebes; in the [Malay] Peninsula it occurs about Singapore and Malacca. Since 1790 it has been in cultivation in European gardens, and probably came into the Peninsula through this". Ohwi (1965) refers to it, on the other hand, as a "Malayan shrub often cultivated in the warmer parts of our area [Japan] as an ornamental". Sen & Naskar (1965), as well as Maheshwari & Singh (1965), report it cultivated in India; Matthew (1966) lists it from West Bengal. Yamazaki (1966) asserts that it is a "Native of tropical Asia"; Rose (1968) found it cultivated in France; the Baileys (1976) list it as cultivated in the United States, but native to "China & India"; Sharma (1982) lists it from East Punjab. My wife and I observed it in outdoor cultivation at 7000 feet altitude in Sri Lanka. According to Synge (1956) and Bor & Raizada (1954) it has been in cultivation in England since 1790. It is probable that the "C. *japonicum*" recorded from Karakelong, in the Talaud Islands, is really C. *kaempferi*. The *Herb. Hort. Bot. Bogor. XV.J.A.XXXII.8a*, cited below, cultivated in Java, is said to have come originally from Borneo.

The color of the corollas of C. *kaempferi* has been described as "scarlet" by Roxburgh (1832), Mason (1885), Cooke (1906), Dunn & Tutcher (1912), Neal (1928), Fang (1944), Bor & Raizada (1954), Deb (1961), Banerji (1965), and Patel (1968), as well as on *How 70751* and *Moldenke & al. 28161*, as "brilliant scarlet" by Woodrow (1884), "deep-scarlet" by Pal & Krishnamurthi (1967), "bright-scarlet" by the Baileys (1976), "scarlet-red" on *Liang 61985*, "crimson" by Burkill (1965), "coral-crimson" by Firminger (1918), "vermillion" on *Araujo & Angeli 1328, Hatschbach 34848, Mello Barreto 4386*, and *Reitz 6874*, "red" on *Bunpheng 857, Dee 578, Eberhardt 4911, Gressitt 45* & *826, Larsen & Larsen 34222, Lei 196, Pickles 2952, Tak 98, Tsiang 2123, Tsui 306*, and *Yates 2525*, "bright-red" on *Chun & Tso 43442, Liang 61548*, and *Sumithraarachchi & al. DBS.509*, "orange-red" on *Lam 2775*, "orange" on *Congdon 734*, "strong reddish-orange" on *Avery 1289*, and "red or orange" by Pételot (1953).

Common and vernacular names recorded for the species include "ba-lantana", "ban dó", "bantaná", "ban trăng", "bhandariphul", "bugyini". "bugy-ni", "bu-gynee-nee", "bu jī nee", "ch'au shi mut li", "ch'êng-t'ung", "ch'êng-t'ung-hua", "clerodendre ecailleux", "dhopat-tita", "dok pung ping dong", "fi giri", "flor de părîdá", "fung mi chu", "fung mĩ chũ", "fun nam", "giri", "higiri", "hi guiri", "hpetnan", "Kämpfers Losbaum", "kaukgyi-pan", "kom ping", "korei giri", "lapung ping", "leo dó", "orokdang", "pagoda flower", "pak yat hung", "pangil pangil", "patrang", "peragu écailleux", "petka", "pet pint", "phingphee daeng", "phumphi daeng", "scaled clerodendrum", "scarlet clerodendron", "scarlet clerodendrum", "sepanggil hutan" [=forest summoner of spirits], "sorot geni", "taû giri", "tau-gisi", "tei too", "tigiri", "to kiri", tookiri", "tooth-leaved clerodendrum", "too guiri", "tou giri", "toû-giri", "volkamier de Koempfer"; and "volkamier écarlate". Tingle (1967) provides additional names in Chinese characters and Kurz (1875) provides one in Burmese characters. Miquel (1865) points out that the Japanese vernacular name, "tigiri", with its various orthographic variants, signifies "the Chinese giri".

Harler (1962) reports that the inflorescences of *Clerodendrum kaempferi* are used as cut flowers in India. Hu (1938, 1981) reports that the species is a "medicinal plant for the native T'ai people in Yünnan" and that the roots and leaves are offered in Chinese materia medica as "Radix et folium clerodendri kaempferi". In Vietnam an infusion is drunk as a tea in the treatment of consumption -- Pételot (1953) says "Dans la province de Quảng-Tri au Centre-Vietnam, les racines bouillies donnent une tisane contra les maladies de poitrine". In Indonesia an infusion in vinegar is used to treat gonorrhea. Bor & Raizada (1954) report that the foliage is chewed to treat passing of blood in the stool and the juice of the leaves is used as a lotion in India. In Malaya the plant is used in native magic for "summoning the forest spirits". Briquet (1895), remarkably, under the name "C. *infortunatum* Lindl.", asserts that the plant "ist angeblich giftig".

The pollen is described by Serbanescu-Jitariu & Mitroiu (1973) on the basis of a Herb. Lugd.-Batav. specimen in the herbarium of the University of Cluj (as no. 89965), as: "prolat; 3-colporat, mai rar 4-colporat; văzut apical 39--72,8 mu in diam., din profil înalt 46,8--72,8 mu, lat 36,4--52 mu. Polenul scuturat din antere si văzut cu ochiul liber este galben-portocaliu, în apă la microscop portocaliu-brun, în chloralhidrat galben-pal. În general sporoderma prezintă aceleasi caracteristici că la polenul de *Cl. infortunatum*, cu deosebirea ca spinulii de pe suprafata acesteia sînt relativ mai mari."

Bowden (1945) and Darlington & Wylie (1956, 1961) give the chromosome count for this species as 2n = 60, based on a specimen *no. 2830-39* from the Royal Palm Nursery at Oneco, Florida. Sharma & Mukhopadhyay (1963), however, as well as Cave (1964) and Bolkhovekikh and his associates (1969) give it as 2n = 52.

The Baileys (1935) list only the Royal Palm Nursery, mentioned above, as a commercial source of seeds or plants of this species for the American horticultural trade; Mattoon (1958) lists two sources.

Sweet (1827) informs us that, as "C. *squamatum*", it was introduced [by Sir Joseph Banks] to English gardens in 1790 from China, but as "C. *dentatum*" in 1826 from the East Indies.

As to methods of cultivation, Baines (1877) states that this plant can "be raised from seeds sown as soon as ripe in autumn, but in order to obtain them the first flower-stems must not be removed, but allowed to remain on the plant until the seed is matured. Sow the seeds singly in small pots, covering them with ¼ in. of soil, they will soon vegetate and will require treating in every way similar to young plants raised from cuttings."

An anonymous "Grower" in The Garden [London] (1893) gives very elaborate and detailed instructions about the cultivation of this and related species in England. He notes that "There must be a reason for the absence of these fine flowering subjects from our collections of stove plants now-a-days. I think this is largely to be attributed to their susceptibility to the attacks of the mealy bug. If this be so, more is the pity, for they are truly grand plants when well grown, taking up a little more room than the average run of plants when cultivated as specimens, but not so when confined to small pots. Within the fog radius there is always the risk of injury after about the middle of September, but not so in the country, where I have had them good to the end of October. The fogs cause the flowers and the buds, too, to drop in large numbers, so much so as to spoil the look of the panicles. During the summer months I have grown them most successfully for conservatory decoration. From the time of the plants opening their first flowers onwards to the end of August (and even into September in the country) I have found them to stand well, making a splendid as well as a continuous display."

Pynaert (1896) says: "Le *Clerodendron squamatum* est un des plus jolis arbustes florifières de serre chaude tempérés. Il est connu depuis longtemps dans les cultures, mais beaucoup de jardiniers ne s'en souviendront guère, car malgré ses rares merites, il a disparu de la plupart des collections. Sa culture est pourtant des plus faciles: un rempotement annuel suffit à la plante. En lui donnant un compost fertile, les panicules floraux offriront les plus vifs coloris. La floraison a lieu en juillet-août. Les arbustes sont taillés après la floraison. On provoque leur entrée dans le stade de repos en les plaçant dans un endroit un peu moins chaud de la serre.....Le *Clerodendron squamatum* est originaire de China; il peut acquerir 3 metres de hauteur. C'est une des espèces les plus brillantes par le floraison de grands panicules du plus beau rouge écarlate."

Firminger (1918) says that "The stems of this shrub rise naked from the ground about three feet, and then bear a parasol-like expansion of handsome, rich green, heart-shaped leaves, in a very stately way....When in full flower, in April and May, no plant can surpass this in beauty."

Bor & Raizada (1954) aver that "This is one of the most showy of shrubs, having great clusters of scarlet flowers which appear during March-April. It should be cut back after flowering, otherwise it becomes bare and scraggy. The plant prefers partial shade and is often attacked by insects, especially mealy bugs and scales."

Alexander (1971) comments that "The plants thrive in semi-shade, but become straggly with age and should be cut nearly to the ground after the fruits mature. Once established, it spreads by root, travelling horizontally underground for yards, with fresh stems popping up all over the place: for this reason, it is best not planted in a formal bed but rather in a border where the soil is not likely to be regularly dug up. Propagated by seeds or cuttings."

The nomenclatural and taxonomic history of *Clerodendrum kaempferi* is quite involved and there are many differences of opinion among botanical and horticultural writers about it. Some of the more important and relevant discussions are quoted, in part, hereinafter:

Loureiro (1790) describes his controversial C. *infortunatum* thus: "Sp. 1. *Clerodendrum infortunatum*. ℘ Fung mi chu. Differ. spec. *Cler.* foliis cordatis tomentosis. Lin. sp. 1. Hab., & notae. Caulis fruticosus, erectus. 7-pedalis: ramis 4-gonis, 4-sulcatis. Folia magna, cordata, lato-ovata, acuminata, sub-crenata, pilosa, rugosa, opposita, petiolis longis. Flos terminalis Corymbo racemoso, vasto. Calyx, corolla, stamina, stylus, pedunculi omnia coloris coccinei rutili. Calyx 5-fidus, campanulatus. Corolla tubo longo, tenui: limbo 5-fido, subaequali, rotundato: stamina longissima, per fissuram supremum Corollae ascendentia: antheris nutantibus, basi emarginatis. Stylus longus: stigmate acuto, bifido. Bacca 1-sperma. Habitat Cantone. Sinarum." This appears to describe mostly C. *kaempferi* and partly C. *viscosum* Vent. according to Merrill (1935).

Poiret (1808) provides a lengthy description of his interpretation of C. *squamatum*: "Cette plante, assez semblable par son port au *Clerodendrum infortunatum*, en differe en ce que ses feuilles sont glabres, plus profondément échancrées à leur base, & que les panicules, les calices & les corolles sont également glabres: elle est d'ailleurs remarquable par la beauté de son port & ses belles panicules de fleurs.

"Ses tiges sont droites, frutescentes; elles se divisent en rameaux glabres, tétragones, marqués à chaque fâce d'un fillon assez profond. Les feuilles sont opposées, petiolées, très-grandes, ovales, longues de trois à cinq pouces, larges de deux à quatre, en coeur, & profondément échancrées à leur base, aiguës à leur sommet, entières à leur bords ou quelquefois obscurément denticulées; marquées de nervures, dont la principale est divisée en d'autres, simples pour la plupart, si l'on en excepte celles qui occupent la base de la feuille: elles se terminent à une ou deux lignes avant le bord des feuilles. La fâce inférieure de ces feuilles est glabre, d'un vert pâle, couverte d'un assez grand nombre de petits corps écailleux, arrondis ou oblongs, ombiliqués dans leur milieu, que je soupçonne être, ou quelque kermès, ou quelques plantes cryptogames parasites, voisines des ecidium. La fâce supérieure est d'un vert plus foncé, chargée de très-petits poils fort courts, rares, à peine sensibles. Les pétioles sont glabres, striés, au moins aussi longs, & même plus longs que les feuilles. Dans les dernières & jeunes feuilles ils sont pubescens, même velus à leur base, & les feuilles ciliées à leurs bords.

"Les fleurs forment une très-belle & grande panicule terminale, étalée, glabre, & dont les pédoncules communs sont profondément fillonnés, d'abord dichotomes, puis souvent trichotomes à leur seconde division; munis, à chacune de leur bifurcation, de deux folioles opposées, pétiolées, ovales, aiguës, un peu velues en dessous. Celles des ramifications supérieures se rétrécissent insensiblement, & enfin les dernières sont sessiles, étroites & subulées: chaque fleur est supportée par un pédicule filiforme, assez long. Le calice est profondément divisé en cinq découpures très-glabres, un peu colorées, ovales, aiguës, persistentes. La corolle a un tube grêle, trois fois plus long que le calice, qui se partage à son orifice en cinq divisions lanceolées, aiguës. Les étamines sont remarquables par leurs filamens, qui me paroissent de couleur purpurine, & d'une longueur bien plus considerable que dans les autres espèces: ils saillent d'environ deux pouces hors de la corolle. Les pistils sont de la même longueur.

"Cette belle espèce a été rapportée par Sonnerat des Indes orientales, qui en a communiqué des exemplaires au citoyen Lamarck. C'est d'après un de ces exemplaires que M. Vahl a établi cette espèce." Note the idea that on first glance the scales on the lower leafblade-surface might be parasitic fungi; also that the corolla-tube is described as three (not two) times as long as the calyx.

Thunberg (1830), in transferring *Volkameria kaempferi* Jacq. to *Clerodendron,* describes the plant as an "Arbor formosissima ad ambulacra culta", but this description applies to *Sterculia platanifolia* L. f., not to our plant!

Roxburgh (1832, 1874) separates his *Volkameria dentata* by its leaf-blades being marginally acutely dentate, with the two basal lobes so large that they overlap each other, whereas in what he regards as *V. kaempferi* the leaf-blades are marginally entire and the basal lobes are smaller and not overlapping. He asserts that *V. kaempferi* is "A large, ramous, erect, shrub, now common in gardens about Calcutta; it was originally introduced from China. Is in flower during the hot and rainy season." Of *V. dentata* he says: "An erect, very elegant shrub, of three or four feet in height, a native of the Silhet district; flowering time the hot and rainy season; it has not yet ripened seed in the Botanic garden, where it grows luxuriantly, and is very ornamental when in flower. It differs from *V. Kaempferi* and *Buchanani* in the leaves being dentate, and from *urticifolia* in being a permanent shrub; besides in that species the leaves are much deeper cut around the margin, and the lobes never so large as even to meet. In all the four, the flowers are nearly alike in size, structure and colour, viz. a very bright deep scarlet."

Morren (1845) gives a detailed history of the species as interpreted by him: "Cette belle plante de serre-chaude, s'élevant en arbre branchu et richement florifière, a été introduit par la société hollandaise qui exploite en ce moment les richesses horticulturales du Japon; c'est en 1843 qu'elle a passé de Hollande en Belgique où les horticulteurs la connaissent sous le nom de *Clerodendron Kaempferi*. En Angleterre où elle est à peine introduit et où elle n'existe que dans les collections les plus riches, comme celle de duc de Northumberland, elle est connue sous le nom de *Clerodendron coccineum*. M. Lindley qui dans le Botanical register de 1844, a revu les différentes espèces du genre *Clerodendron*, l'a classée sous le véritable nom que Martin Vahl, professeur de Copenhagen, lui a donné dans le deuxième volume.....de ses Symbolae botanicae, publié en 1791. M. Lindley a démontré également que cette plante est le *Volkameria Kaempferiana* de Jacquin, dénomination fausse pour le genre, mais d'où est venue l'appellation sous laquelle les horticulteurs hollandais ont envoyé cette espece en Belgique.

"C'est encore cette même espèce que M. Paxton a donnée dans son Magazine of Botany.....pour le *Clerodendron speciosissimum*. Au reste, ce végétal avait déjà paru en Europe dès 1790, mais il y a été perdu depuis, et c'est grâce aux travaux de la compagnie hollandaise de l'exploration du Japon, que cette réintroduction a eu lieu. Le *Clerodendron squamatum* est originaire de la Chine, et si son nom générique, *Clerodendron*, rappelle son étymologie, κληρος, fortune, et δενδρον, arbre, arbre de fortune, c'est, en effet, pour nos serres une bonne fortune que son acquisition.

"Les clerodendron intitulés *Clerodendron squamatum* et *Clerodendrom squamatum verum* dans les catalogues des horticulteurs de Belgique, ne sont pas des *Clerodendron* de ce nom. Nous les avons examinés et sur aucune de ces deux espèces, l'une bien différent de l'autre, n'existe le caractère spécifique du *squamatum*, à savoir les lépides écailleuses du dessous de la feuille. Sur le *Clerodendron squamatum verum*, nous avons trouvé des poils forts et gros; sur le *Clerodendron squamatum* reputé la vieille plante, les poils sont plus petits, maigres et épars.

"Il suit de là des rectifications importantes à faire. Les *Clerodendron* vendus et à ventre en Belgique, sous le nom de *squamatum* et de *squamatum verum* ne sont pas des *Clerodendron squamatum*. Seulement, le *Clerodendron Kaempferi* des horticulteurs belges et hollandais est le vrai *Clerodendron squamatum* des auteurs. Troisiemement, les *Clerodendron speciosissimum* et *coccineum* ne sont autres choses que le *Clerodendron squamatum*. Voilà ce qui reste de clair et de positif su milieu de cette tour de Babel, où avec la confusion des langues, l'horticulture des catalogues entraine encore la confusion de l'esprit. Notre premier devoir est de ramener par tous nos moyens les intelligences à ce qui est juste et honnête; et si nous blessons ici quelques intérêts, notre droit est dans la raison, la science et la vérité." It would appear that the C. *squamatum* and C. *squamatum verum* to which he refers, being without scales on the leafblades, but being, instead, pubescent there, probably are forms of C. *speciosissimum* Van Geert, or the less hairy one perhaps C. *buchanani* (Roxb.) Walp.

Siebold & Zuccarini (1846) note that "Schon Willdenow bemerkt.... mit Recht, dass die Thunbergsche *Volk. japonica* nicht mit der in Gärten unter diesem Namen kultivierten Pflanzen zusammengezogen derden könne, und nennt in der Enumeratio.....letztere *Cler. fragrans*. Persoon führt ebenfalls *V. japonica* und *fragrans* gesondert auf. Erst die neueren Schriftsteller ziehen beide wieder zusammen, lassen dagegen aber *Cl. squamatum* oder *Kämpferi* als eigne Art bestehen. Allerdings scheinen zwar zwischen dieser und *Volk. japonica* Thunb. nach des Letzteren Beschreibung seiner Pflanze einige Verschiedenheiten obzuwalten, aber da Thunberg, Kämpfer a. a. O. zu seiner Pflanze citirt, dessen Beschreibung offenbar auf *Volk. Kämpferi* hinweist (Fi kiri, i.e. ignea kiri. a colore igneo stylos floridos, perianthia ac flosculos tingente), so dürfte dieses die Abweichungen in der Beschreibung ausgleichen und demnach *Cl. squamatum* Vahl als identisch mit *Volk. japonica* Thunb. zu betrachten seyn, *Cler. fragrans* dagegen als eigne Art bestehen, deren Stammform mit einfachen Blüthen jetzt auch schon in Gärten vorkommt. C. *squamatum* ist nach Thunberg aus Korea nach Japan verpflanzt, ob C. *fragrans* auch in Japan sich finde, scheint noch zweifelhaft. Im Sieboldtschen Herbarium wenigstens fehlt sie."

Hasskarl (1855) divides C. *squamatum* Vahl into two Greek-letter varieties: alpha *japonicum* -- with the "tubo corollae calycis duplam longitud. vix aequante" and beta *indicum* -- with the "tubo corollae calyce plus duplo longiore". It seems to me than the former applies to C. *japonicum* (Thunb.) Sweet and the latter to C. *koempferi* (Jacq.) Sieb., although he seems to have regarded his *japonicum* as representing the typical "C. *squamatum* Vahl". He further observes that his *indicum* "differunt: C. *intermedium* Cham....foliis acuminatis opacis calyce patulo semi-5-fido, laciniis oblongis acutis, corollae tubo calyce sub-4-plo longiore; -- C. *urticifolium* Wll..... pube ramorum et nervorum foliorum, foliis grosse dentatis, panicula amplissima subnuda, calyce semi-5-fido campanulato patente, corollae tubo calyce subtrilobo longiore; -- C. *Blumeanum* Schauer.....foliis cordato-ovatis, opacis, acute dentatis, glandulis raris conspersis, panicula subnuda, calyce campanulato 5-dentato, dentibus recurvis, corollae tubo calycem 6-duplo excedente.......De varieteit *indicum*, is van Singapoer verkregen en in habitus zeer gelijkvormig, doch in alles, van kleinere dimensiën, dan de var. *japonicum*."

According to Makino (1903) the "*Clerodendron Kaempferi* Sieb. Syn. Pl. Oecon. Jap. in Vern. Batav. Gen. XII (1830) p. 41, is *Sterculia platanifolia* Linn. fil. (Jap. Ao-giri)." Even if this is so as to the plant described, his transfer of Jacquin's binomial from *Volkameria* to *Clerodendron* is not invalidated by any misidentification of the plant involved.

Backer (1916), in his description of C. *squamatum* Vahl, says: "Veranderlijk wat betreft de lengte van kelk en kroonbuis. De javaansche exemplaren behooren alle tot de varieteit *japónicum* Hasskarl, waarbij de kelk 10--17 mM hoog is en de kroonbuis 15--20 mM lang. Op Sumatra en ook elders vindt men den typischen vorm, waarbij de kelk 8--10 mM, de kroonbuis 18--25 mM lang is. Op de Philippijnen treft men, behalve deze beide vormen, nog een tusschenvorm aan." The var. *japonicum* he refers to is C. *japonicum* (Thunb.) Sweet and the third Philippine form is C. *bethunianum* Low.

Merrill (1935) has investigated Loureiro's C. *infortunatum* and comments that "Loureiro's description applies unmistakably to the widely distributed species currently known as *Clerodendrum squamatum* Vahl, for which H. Lam cites about twenty synonyms. *Clerodendrum japonicum* (Thunb.) Sweet......is the oldest binomial, if Doctor Lam be followed in treating this as a collective species, as it was based on *Volkameria japonica* Thunb. which dates from 1784. Doctor Carl G. Alm kindly supplied me with excellent photographs of Thunberg's type with critical notes. Thunberg's statement: 'Arbor vasta, excelsa' is an error; the species is a small shrub. The plant is not 'tota glabra', the branches of the inflorescence being densely hairy and with numerous intermixed glandular hairs but the pilosity is not visible to the naked eye. The leaves are glabrous. This form differs from C. *squamatum* Vahl, among other characters, by its much larger calyces. The form with smaller calyces, which is not uncommon near Canton, is C. *kaempferi* (Jacq.) Sieb. (C. *squamatum* Vahl), and this I believe to be specifically distinct from C. *japonicum* (Thunb.) Sweet."

The Baileys (1976) correctly separated C. *kaempferi* (with C. *squamatum* as a synonym) from C. *japonicum* (Thunb.) Sweet.

In summary, it may be pointed out that C. *squamatum* Vahl is regarded as the correct appellation for the species here under discussion by Bojer (1837), Siebold & Zuccarini (1846), Hasskarl (1855), Mueller (1860), Seemann (1862), Miquel (1865), Kurz (1870, 1875), Franchet & Savatier (1875), Fernandez-Villar (1880), Clarke (1885), Mason (1885), Maximowicz (1886), Woodrow (1889), Dietrich (1842), Morren (1845), Voigt (1845), Jackson (1895), Pynaert (1896), Diels (1900, 1902), Dunn & Tutcher (1912), Backer (1916), Rodger (1922), Neal (1928), Kanjilal & al. (1939), Biswas (1941), Pételot (1953), Bor & Raizada (1954), Hundley & Ko (1961), Burkill (1965), Corner & Watanabe (1969), Rao & Verma (1969), Serbanesco-Jitariu & Mitroiu (1973), and Sharma (1982).

On the other hand, C. *kaempferi* and/or C. *squamatum* is regarded as a synonym of C. *japonicum* by Makino (1903), the Baileys (1941, 1974), Lam & Meeuse (1942), Fang (1944), Hara (1948, 1972), Masamune (1955), Mattoon (1958), Backer & Bakhuizen (1965), Banerji (1965), Ohwi (1965), Yamazaki (1966), and Pande (1967). It is regarded as a synonym of C. *speciosissimum* Van Geert by Morton (1974).

Other binomials sometimes included in the synonymy of C. *kaempferi* are: *Clerodendron* (or *Clerodendrum*) *darranii* Lévl. [by Pételot, 1953, actually a synonym of C. *japonicum* (Thunb.) Sweet], C. *fulgens* Firminger [a name that probably belongs in the synonymy of C. *speciosissimum* Van Geert], C. *japonicum* Sweet [by Alexander, 1971], C. *kaempferi* Fisch. [apparently really a synonym of C. *japonicum*], C. *leveillei* Fedde [by Pételot, 1953, a distinct species, which see], C. *scopiferum* Miq. [a distinct species, which see], C. *speciosissimum* Hort. Angl. [a synonym of C. *glandulosum* Lindl.], C. *speciosissimum* Paxt. [a synonym of C. *speciosissimum* Van Geert], and *Volkameria japonica* Thunb. [by Maximowicz, 1886, and Pételot, 1953, a synonym of C. *japonicum* (Thunb.) Sweet].

In the synonymy of *Clerodendrum kaempferi* given by me on previous pages of the present series of notes there are numerous homonyms to which reference is made. These, and how they are disposed of by me in the present series of notes, are as follows:

*Clerodendron infortunatum* Auct., 1963, C. *infortunatum* Schau., 1918, and C. *infortunatum* Willd., 1976, are synonyms of *Clerodendrum viscosum* Vent.; *Clerodendron infortunatum* Blume, 1947, is *Clerodendrum buchanani* (Roxb.) Walp.; *Clerodendron infortunatum* Bot. Reg. is *Clerodendrum speciosissimum* Van Geert; *Clerodendron infortunatum* Dennst.,C. *infortunatum* Lam., 1947, C. *infortunatum* Walp., 1843, and C. *infortunatum* Wight, 1850, are synonyms of *Clerodendrum villosum* Blume; *Clerodendron infortunatum* Gaertn., 1885, is *Clerodendrum infortunatum* L.; and *Clerodendron infortunatum* F.-Vill., 1882,is *Clerodendrum minahassae* Teijsm. & Binn.

*Clerodendrum infortunata* L., 1753, C. *infortunatum* Gaertn., 1788, C. *infortunatum* P.S., and C. *infortunatum* Vent., 1821, are all C. *infortunatum* L.; *Clerodendrum infortunatum* Auct., 1955, C. *infortunatum* Blume, 1967, C. *infortunatum* Lour. (in part), and C. *infortunatum* Willd., 1976, are all synonyms of C. *viscosum* Vent.; C. *infortunatum* Dennst., 1959, C. *infortunatum* Hassk., and C. *infortunatum* Wight are synonyms of C. *villosum* Blume; C. *infortunatum* Lindl. is C. *speciosissimum* Van Geert, and C. *infortunatum* Miq., 1968, is C. *confusum* H. Hallier.

*Clerodendrum kaempferi* Fisch., 1821, *Clerodendron kaempferi* Fisch. ex Morr., 1845, C. *kaempferi* Steud., 1948, and C. *kaempferi* "Sieb. herb. ex Miq.", 1903, are all synonyms of *Clerodendrum japon-*

*icum* (Thunb.) Sweet.

*Clerodendron speciosissimum* Paxt., 1837, and C. *speciosissimum* Van Geert, 1836, are in the synonymy of *Clerodendrum speciosissimum* Van Geert.

*Clerodendron squamatum* Hallier f. is a synonym of C. *bethunianum* Low; C. *squamatum* Hort. ex Morr., C. *squamatum* Neal & Metzger, 1934, and C. *squamatum* Rock, 1934, are *Clerodendrum speciosissimum* Van Geert; and C. *squamatum* H. J. Lam, 1923, is *Clerodendrum intermedium* Cham.

Numerous infraspecific taxa have been proposed. My disposal of these is as follows: *Clerodendron squamatum* var. *bethuniana* (Lowe) Bakh. is *Clerodendrum bethunianum* Low; *Clerodendron squamatum* var. *esquamatum* Backer is *Clerodendrum scopiferum* Miq.; *Clerodendron squamatum* var. *japonicum* Hassk. is *Clerodendrum japonicum* (Thunb.) Sweet; *Clerodendron squamatum* var. *javanicum* Teijsm. is *Clerodendrum japonicum* (Thunb.) Sweet; *Clerodendron squamatum* var. *rumphianum* (DeVriese) Bakh. is *Clerodendrum rumphianum* DeVriese & Teijsm.; *Clerodendron squamatum* var. *scopiferum* H. J. Lam and var. *scopiferum* (Miq.) H. J. Lam are *Clerodendrum scopiferum* Miq.; *Clerodendron squamatum* var. *typica* Bakh. is *Clerodendrum japonicum* (Thunb.) Sweet; *Clerodendron squamatum* var. *urticifolia* C. B. Clarke and var. *urticifolium* Hook. f. are *Clerodendrum urticifolium* (Roxb.) Wall.; *Clerodendron squamatum* ♀ *indicum* Hassk. is *Clerodendrum speciosissimum* Van Geert; and *Clerodendron squamatum verum* Hort. ex Morr. is *Clerodendrum speciosissimum* Van Geert.

*Clerodendrum japonicum* (Thunb.) Sweet and C. *kaempferi* (Jacq.) Sieb. are the two red-flowered squamulose-leaved species most often confused. They may usually be distinguished as follows:

1. Calyx in anthesis 10--15 mm. long; corollas 2--3 cm. long........ C. *japonicum*.

1a. Calyx in anthesis less than 10 mm.long; corollas over 3 cm. long C. *kaempferi*.

It should be noted that populations of *Clerodendrum kaempferi* in the New World usually have the terminal panicles much denser, with shorter sympodia and more shortly stipitate cymes, and the axillary cymes much shorter-pedunculate than in C. *japonicum*.

Keys to help distinguish C. *kaempferi* from other cultivated taxa in this genus will be found under C. *bethunianum* Low in the present series of notes [58: 195--198], from other Madagascar taxa under C. *baronianum* Oliv. [58: 184--194], from Indian and Hawaiian taxa under C. *indicum* (L.) Kuntze [61: 23--25], from other Assam species under C. *griffithianum* C. B. Clarke [60: 134--136], from other Chinese taxa under C. *canescens* Wall. [58: 416], from other Indochinese species under C. *hahnianum* Dop [60: 141--143], and from other Indonesian taxa under C. *klemmei* Elm.

Among the inaccuracies and errors in the literature of C. *kaempferi* may be noted the following: the Angely (1971) work is often mis-cited as "1970", the titlepage date. Similarly, the Hooker & Arnott (1836) work is often mis-cited as "1841", but pages 193--288 were actually issued in 1836. The Jacquin (1792) work is dated "1793" by Bretschneider (1898) and by Makino (1903) and as "1789", "1791", or "1797" by other authors.

The Dietrich (1842) reference is very often cited as "1843" -- including by myself in previous installments of the present series - but actually all of the volume here involved was published between December 29 and 31, 1842.

Hallier (1918) dates the Miquel (1858) reference as "1856", but pages 705--960 were actually not issued until 1858. Yamazaki (1966) cites the Hara (1918) reference as "1949".

The Siebold (1830) reference occurs on a page with the printed number "51", but this is a typographic error (often used by authors) -- it should read "31", as can be seen plainly from the numbers of the next succeeding correctly numbered pages. Siebold & Zuccarini (1846) mistakenly cite the Willdenow (1800) reference as "p. 358", instead of page 385.

In 1892 a writer, who signed himself merely as "W. W.", provided a description and two illustrations of what he called *C. kaempferi* -- the line drawing appears to represent *C. japonicum* (Thunb.) Sweet while the splendid full-color plate seems to represent *C. paniculatum* L.

Pal & Krishnamurthi (1967) describe the leaves of the species here being discussed as "incised"; Pételot (1953) refers to them as "hastées" and as "hispides" on the upper surface; How refers to them as "rough" -- none of these statements is applicable. Baines (1877) refers to the species as a "South American species", but, actually, it is surely an Asiatic species. Lam & Meeuse (1942) describe it as "a small straight tree, 3.5 m high, trunk 3 m", and in a few other places in the literature it is spoken of as a "tree" -- certainly by error. Pickles describes it as a "shrub 9 ft. x 6 in., bole with many stems arising from the ground, bark pockmarked, gray-green, outer bark soft, inner fibrous, patchy green and yellow; sapwood cream" -- again implying that the plant is arborescent. Levine refers to "pale blue-purple flowers" -- certainly incorrect: perhaps he is referring to the fruit.

Miquel (1865) cites an unnumbered Pierot collection from "nangasaki", Japan; Hallier (1918) cites *Zollinger 2557* from Java, *Elbert 2933* & *2994* and *DeVriese & Teijsmann s.n.* from Celebes, *Hallier 4257b* from Basilan, *Hallier 4257a* from Luzon, *Prain's Collector 46* from the Andaman Islands, and *Daalen 487* from Sumatra.

Lam (1919) cites *Buijsmann 74* from Java, *Herb. Bogor. 1163* and *Daalen 487* from Sumatra, and *Herb. Bogor. 2567* & *5301* from Celebes; Hu (1938) cites *Wang 78755* & *79782* from Yünnan, China; Pételot (1953) cites *Poilane 1132* from Vietnam; and Deb (1961) cites his *no. 299* from Manipur, India.

Material of *Clerodendrum kaempferi* has been misidentified and distributed in some herbaria as *C. bethuneanum* Hook. f., *C. bethunianum* Low, *C. cordatum* Don, *C. cordifolium* (Hochst.) A. Rich., *C. cordifolium* Roxb., *C. fallax* Lindl., *C. fragrans* Vent., *C. infortunatum* Gaertn., *C. intermedium* Cham., *C. kaempferi* Fisch., *C. paniculatum* L., *C. splendens* G. Don, and even as *Acanthaceae*.

On the other hand, the *Elmer 9763* & *14504*, *Foxworthy Philip. Bur. Sci. 786*, *Ramos & Edaño Philip. Bur. Sci. 39076*, and *Teijsmann 8502*, distributed as *C. kaempferi*, actually are *C. bethunianum* Low, while *Boden-Kloss 1464a* and *Yates 848* are *C. buchanani* (Roxb.) Walp.; *Donggala 70, Elmer 17610, Tsang & al. 7674*, and *Usteri s.n.* [23/XII/02] are *C. intermedium* Cham.; *Chang 4134, Chiao 1495, Ching 1900* & *5193, Chung 2351* & *2893, Franck 150, Henry 12060, Herb. Canton Chr. Coll. 12540, Herb. Hort. Bot. Calcutt. s.n.* [23/XII/1937], *Herb. Univ. Nanking 14694, Kreuzpointner s.n.* [Herb. Hort. Monac. 12 Oct. 1886], *Peng & al. 541, Pi 6133, Pradham & Ihapa 6437*, and *Savatier s.n.* [Yedo] are *C. japonicum* (Thunb.) Sweet; *Stevens 453* is *C. paniculatum* L.; *Koorders 20647b, Meebold s.n.* [Oahu, 8.1941], and *Vaupel 13* are *C. speciosissimum* Van Geert; *Ching 5193, Chun 104, Dee 578, Franck 173, Herb. Roy. For. Dept. 7775, McClure 8854*, and *Tsui 306* are *C. urticifolium* (Roxb.) Wall.; and *Kazmi s.n.* [19.1.52] is not verbenaceous. *Chun 5007* is a mixture of *C. kaempferi* and *C. fortunatum* L.; *Lam 2775* consists only of leaves and so its identification with this species is tentative and problematic.

It may be worth mentioning here that the "*C. japonicum*" of Holthuis & Lam (1942) and of Lam (1945) probably is a misidentification for *C. kaempferi*. On the other hand, the "*C. kaempferi*" or "*C. squamatum*" of Kwa-wi (1759), Banks (1791), Regel (1856, 1880), Baines (1881), Lubbock (1892), Wilson (1912), and Corner & Watanabe (1969) probably is *C. japonicum*, while that of Lindley (1844) and Hargreaves (1958) probably is *C. speciosissimum* Van Geert; and that of "W. W." in Garden [Lond.] (1892) is probably *C. paniculatum* L.

Citations: FLORIDA: Dade Co.: *Avery 1238* (Ac, Lc, Ld, Tu). *1289* (Ac, Ld, Ws). BRAZIL: Amazonas: *Lafroy s.n.* [Environs de Manaos] (P). Paraná: *Dusén 8870* (B, Ld--photo, N--photo, S, S, W--148182, W--1481822). Rio de Janeiro: *Carauta 58* [Herb. FEEMA 18413] (Fe); *Luetzelburg 6900* (B, Mu, V); *Patschke 201* (B). RÉUNION ISLAND: *Bernier s.n.* (P). NEPAL: *Shrestha & Bista 1784* (W--2581502); *Stainton, Sykes, & Williams 6887* (Bm). INDIA: Sikkim: *J. D. Hooker s.n.* [2-5000 ped., Sikkim] (L, Pd); *T. Thomson s.n.* [Sikkim] (L, Pd); *Treutler 289* (L); *Wallich s.n.* (S). West Bengal: *C. B. Clarke 9102* (L), *35350F* (L), *35350G* (X); *Herb. Swartz s.n.* (S). State undetermined: *Griffith 6051/1* [East Himalayas] (L, Mu--865); *Roxburgh s.n.* (Br). SRI LANKA: *Sumithraarachchi DBS.509* (Ac, Gz, Lc, Ld, N, N, Tu, W--2807771, Ws). BURMA: Tenasserim: *Wallich 1789/1* (L, L). ANDAMAN ISLANDS: South: *Kurz s.n.* (K); *Prain's Collector 46* (Br). CHINA: Fukien: *DeGrijs 396* (S). Kwangtung: *Bladh s.n.* (S); *Chun & Ting 445* (Ac); *C. C. Levine Herb. Canton Chr. Coll. 735* (Ph, W--779008); *Tsiang 2123* (N); *Tsui 306* (W--1754589); *Ying 853* (Ca--358913). CHINESE OFFSHORE ISLANDS: Hainan: *Chun & Tso 43442* (N, W--1669521); *C. Ford s.n.* [15-6-93] (W--456057); *Gressitt 826* (I); *Hancock 20* (L); *How 70751* (N); *Lei 196* (B, Ba), *805* (B, Ba, Bz--19735, Mi, N, W--1754349); *Liang 61548* (N), *61983* (N); *Tak [Tsang] 25* [Herb. Lingnan Univ. 15524] (Ca--315764, W--1248870), *98* [Herb. Lingnan Univ. 16847] (Ca--356630, W--1659518); *C. Wang 32835* (N); *Wu 1089* (Ca--358996). HONG KONG: *Chun 5007* in part (Du--200923). THAILAND: *Bunpheng 857* (Ld); *Congdon 734* (Ac); *Dee 578* [Herb. Roy. For. Dept. 7775] (Ld); *Larsen & Larsen 34222* (Ac, Ld). VIETNAM: Annam: *F. A. McClure 771* [Herb. Canton Chr. Coll. 7284] (S). Tonkin: *Eberhardt*

*4911* (B). MALAYA: Malacca: *Herb. Harvey s.n.* [Malacca, 1816] (Du--166594). Singapore: *N. J. Andersson s.n.* [28 Jan. 1853] (S). TAIWAN: *Gressitt 45* (N); *Katsumada 21952* (Ca--322498); *Ream 543* (Ws); *Tanaka & Shimada 10974* (Go). PHILIPPINE ISLANDS: Luzon: *Mendoza 1518* [Philip. Nat. Herb. 18525] (W--2214791). Negros: *Elmer 9763* (Bz--20625); *Herb. Usteri s.n.* [23/XII/02] (N). GREATER SUNDA ISLANDS: Bawean: *Buwalda 3342* (Bz--72911). Celebes: *Kaudern 47* (N, N, S), *193* (N, S); *Kjellberg 342* (S); *Posthumus 2474* (Bz--20638); *Rachmat s.n.* [Vuuren 562] (Bz--20643, Bz--20644); *Smith 650* (Bz--20651), *651* (Bz--20652). Kava: *Osbeck s.n.* (S). Sabah: *Yates 16* (W--129147). Sarawak: *Pickles 2952* (W--2376942). Sumatra: *Bünnemeijer 485* (Bz--20694), *571* (Bz--20673, Bz--20674), *3388* (Bz--20690), *3756* (Bz--20697), *4147* (Bz--20691); *Daalen 487* (Bz--20677, Bz--20678); *Lörzing 3536* (Bz--20693); *Teijsmann 2217 H.B.* (Bz--20679); *Van Steenis 3237* (Bz--20685); *Voogd 1314* (Bz--20682, Bz--20683); *Yates 2525* (Ca--318346, Du--200922). TALAUD ISLANDS: Karakalang: *Lam 2775* (Bz--20668, Bz--20669). CULTIVATED: Austria: *Herb. Jacquin s.n.* [Macbride photos 34295] (F--976305--photo of type, Kr--photo of type, N--photo of type, V--type, V--isotype, V--isotype, V--isotype); *Herb. Portenschlag s.n.* (V). Brazil: *Araujo & Angely 1328* [Herb. FEEMA 12338] (Fe); *Bailey & Bailey 238* (Ba, Ld--photo, N--photo); *Carauta 480* [Herb. Cent. Pesq. Florest. 5474] (Fe); *Dierberger s.n.* [Herb. Inst. Bot. S. Paulo 34718] (N, Sp); *Hatschbach 34848* (Ba--371331); *A. Lutz 588* (Lz); *Mello Barreto 4386* [Herb. Jard. Bot. Belo Horiz. 13060] (F--909819); *Pickel 1836* (Sf); *Reitz 6874* (W--2534996). England: *Herb. Hort. Anglic. s.n.*[1816] (B); *Herb. Sprengel s.n.* [Hort. Kew.] (B); *Herb. Veitch's Nursery s.n.* [Sept. 4, 1884; type of C. *illustre*] (K). France: *Herb. Martius s.n.* [H. B. Paris 1842] (Br). Hong Kong: *Woo & Woo 287* (Mi); *C. Wright s.n.* (W--44912). India: *Herb. Hort. Bot. Calcutt. s.n.* (Le, Mu--864, Mu--1153, T); *Herb. Martius s.n.* [H.B.C.] (Br); *Voigt s.n.* [H. B. Seramp.] (Cp, Cp, Cp); *Wallich 1798* (B, K, K), *1798/A* (V), *1798/1* (B, B, B), *6050/1* (B), *s.n.* (Cp). Java: *Herb. Hort. Bot. Bogor. XV.J.A.XXXII.8* (Bz--26384, Bz--26385), *XV.J.A.XXXII.8a* (Bz--26397). Kulungsu Island: *Chung 1672* (Ca--224957). Mauritius: *Bojer s.n.* (K, K); *Herb. Hooker s.n.* (K). Sri Lanka: *Collector undetermined s.n.* [Roy. Bot. Gard. 1887] (Pd); *Moldenke, Moldenke, & Jayasuriya 28161* (Ld, Pd, W-2764402); *Moldenke, Moldenke, Jayasuriya, & Sumithraarachchi 28172* (W--2764559), LOCALITY OF COLLECTION UNDETERMINED: *Collector undetermined s.n.* [24th June 1802] (Pd), *s.n.*(L); *Herb. Petit-Thouars s.n.* (P). MOUNTED ILLUSTRATIONS: Edwards, Bot. Reg. 8: pl. 649. 1822 (B); Fang, Icon. Pl. Omeien. 1: pl. 69. 1944 (Ld); Neal, In Homolulu Gard. 271, fig. 59e. 1928 (Ld); Lodd., Bot. Cab. 8: pl. 796. 1823 (N); Pynaert, Rev. Hort. Belg. 22: 253. 1896 (Ld); unidentified color plate (Ba).

*CLERODENDRUM KAEMPFERI* f. *ALBUM* (P'ei) Mold., Phytologia 58: 196. 1985; stat. nov.

Synonymy: *Clerodendron japonicum* var. *album* P'ei, Mem. Sci. Soc. China 1 (3): 144. 1932. *Clerodendrum kaempferi* var. *album* (P'ei) Mold., Phytologia 1: 167. 1935.

Bibliography: P'ei, Mem. Sci. Soc. China 1 (3): 144. 1932; Mold., Phytologia 1: 167. 1935; Mold., Known Geogr. Distrib. Verbenac., ed. 1, 57 & 90 (1942) and ed. 2, 131 & 182. 1949; Mold., Alph. List Cit. 4: 1011. 1949; Mold., Résumé 169, 193, & 450. 1959; Patel, Fl. Melghat 269. 1968; Mold., Fifth Summ. 1: 288 & 322 (1971) and 2: 867. 1971; Mold., Phytol. Mem. 2: 277, 313, & 538. 1980; Mold., Phytologia 58: 196. 1985.

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

The form is based on *Tsiang 2506* from North Gate, Kochow, Kwangtung, China, collected in May, 1929. The collector describes it as an undershrub, the leaf-blades deep-green above, light-green beneath and the corollas white. Slooten found what appears to be the same form in Borneo.

A key to distinguish this taxon from cultivated taxa, assuming that it will eventually appear in cultivation, will be found under *C. bethunianum* Low in the present series of notes [58: 195--198].

Citations: GREATER SUNDA ISLANDS: Kalimantan: *Slooten 2165* (Bz--20598).

*CLERODENDRUM KAEMPFERI* f. *SALMONEUM* Mold., Phytologia 34: 18. 1976.

Bibliography: Patel, Fl. Malghat 269. 1968; Mold., Phytologia 34: 18 & 264. 1976; Hocking, Excerpt. Bot. A.30: 419. 1978; Mold., Phytol. Mem. 2: 284 & 538. 1980; Mold., Phytologia 58: 196. 1985.

This form differs from the typical form of the species in having the corollas salmon-pink or rose in color.

The form is based on *Larsen & Larsen 34181* from Khun Yuam, Maehongson, in northern Thailand, at 600--700 m. altitude, collected on September 5, 1974, and deposited in the Herbarium Jutlandicum at Aarhus University.

Patel (1968) mentions what is probably this same color form as growing in Melghat, India, where he implies that it is cultivated in gardens "for its flowers". A key to help distinguish it from other cultivated taxa in this genus will be found under *C. bethunianum* Low in the present series of notes [58: 195--198].

Citations: THAILAND: *Larsen & Larsen 34181* (Ac--type).

*CLERODENDRUM KALAOTOENSE* H. J. Lam, Verbenac. Malay. Arch. 307--308 [as "*Clerodendron*"]. 1919; Mold., Known Geogr. Distrib. Verbenac., ed. 1, 66 & 90 [as "*kalaotoënse*"]. 1942.

Synonymy: *Clerodendron kalaotoense* H. J. Lam, Verbenac. Malay. Arch. 307. 1919. *Clerodendron kalaotoënse* H. J. Lam apud A. W. Hill, Ind. Kew. Suppl. 6: 49. 1926. *Clerodendron kalaotense* H. J. Lam apud Fedde & Schust., Justs Bot. Jahresber. 47 (2): 245. 1927. *Clerodendrum kalaotoënse* H. J. Lam ex Mold., Known Geogr. Distrib. Verbenac., ed. 1, 66 & 90. 1942

Bibliography: H. J. Lam, Verbenac. Malay. Arch. 307--308 & 364. 1919; Bakh. in Lam & Bakh., Bull. Jard. Bot. Buitenz., ser. 3, 3: 95, 109, & IX. 1921; A. W. Hill, Ind. Kew. Suppl. 6: 49. 1926; Fedde & Schust., Justs Bot. Jahresber. 47 (2): 245. 1927; Mold., Known Geogr. Distrib. Verbenac., ed. 1, 66 & 90 (1942) and ed. 2, 146, 147,

& 182. 1946; Mold., Résumé 194, 196, & 450. 1959; Mold., Fifth Summ. 1: 322 (1971) and 2: 867. 1971; Mold., Phytol. Mem. 2: 313 & 533. 1980; Mold., Phytologia 61: 270. 1986.

A shrub, about 2 m. tall; branches subtetragonal, appressed-puberulent; leaves decussate-opposite; petioles 2--6.5 cm. long, appressed-puberulent; leaf-blades subchartaceous, ovate, 10.5--18 cm. long, 5.5--9.5 cm. wide, apically acute, marginally entire, basally attenuate, pubescent on both surfaces but especially beneath and on the venation; secondaries 6 or 7 per side; panicle terminal, foliose, 16--17 cm. long, 12--20 cm. wide, appressed-puberulent or pubescent; peduncles absent or to 2.5 cm. long and appressed-puberulent; bractlets minute, linear, about 2 mm. long; pedicels 7--12 mm. long, slender, appressed-puberulent; calyx about 7 mm. long, externally densely appressed-pubescent, internally sparsely so, 5-lobed, the lobes lanceolate, 4 mm. long; corolla white, its tube 4 cm. long, slender, glabrous, the lobes elliptic, 7 mm. long, 3.5 mm. wide, dorsally puberulent; stamens and style exserted about 2.5 cm. from the corolla-mouth; stigma shortly bifid; ovary externally glabrous; fruit not known.

This species is based on *Docters van Leeuwen-Reijnvaan 1373* from 150 m. altitude on Kalao-Toa Island, southwest of Celebes, Indonesia, collected in anthesis on May 6, 1913. Lam (1919) remarks that "This species is closely allied to *C. ingratum*. It has, however, much larger leaves and its calyx and corolla-lobes are smaller, whilst the corolla-tube is glabrous without".

Nothing is known to me of this species beyond what is stated in its meager bibliography (above).

*CLERODENDRUM KALBREYERI* J. G. Baker in Thiselt.-Dyer, Fl. Trop. Afr. 5: 295 & 311 [as "*Clerodendron*"]. 1900.

This binomial, previously regarded as valid for a distinct species in many of my previous publications, now proves to be nothing more than a synonym of *C. violaceum* Gürke, which see.

*CLERODENDRUM KAMPOTENSE* Dop in Lecomte, Notul. Syst. 4: 8 [as "*Clerodendron*"]. 1920; Mold., Known Geogr. Distrib. Verbenac., ed. 1, 59 & 90. 1942.

Synonymy: *Clerodendron kampotense* Dop in Lecomte, Notul. Syst. 4: 8. 1920.

Bibliography: Dop in Lecomte, Notul. Syst. 4: 8. 1920; A. W. Hill, Ind. Kew. Suppl. 6: 49. 1926; Fedde & Schust., Justs Bot. Jahresber. 48 (1): 497. 1927; Dop in Lecomte, Fl. Gén. Indo-chine 4: 853 & 879--880. 1935; Mold., Known Geogr. Distrib. Verbenac., ed. 1, 59 & 90 (1942) and ed. 2, 136 & 182. 1949; Mold., Résumé 175 & 450. 1959; Mold., Fifth Summ. 1: 300 (1971) and 2: 867. 1971; Mold., Phytologia 31: 395. 1975; Mold., Phytol. Mem. 2: 288, 387, & 538. 1980; Mold., Phytologia 60: 143. 1986.

A branching shrub; branches pendent, brown, striate, finely pubescent; leaves decussate-opposite; petioles slender, 6 cm. long, pubescent; leaf-blades elliptic or elliptic-oblong to oval, membranous or subchartaceous, 14 cm. long, 6 cm. wide, apically short-acuminate and apiculate, marginally subentire, basally obtuse or rounded to truncate, glabrous above, slightly pubescent on the venation beneath; midrib rounded, prominent; secondaries 10--12, thin, arcuate; tertiaries irregular; veinlet reticulation very delicate; inflorescence terminal, paniculate, large, foliose, pyramidal, to 30 cm. long and 18 cm. wide, the ramifications rebranched, 5 cm. long, terminally trichotomous, the cymes 5--7-flowered; bracts foliaceous, elliptic or lanceolate, stipitate, persistent; bractlets linear, small; pedicels 6--10 mm. long; calyx campanulate, red, 8--9 mm. long, glabrous, the tube 4 mm. long, the lobes oval, 4 mm. long, basally 2 mm. wide, apically acute, nervate; corolla white, 2.4--2.5 cm. long, glabrous, the tube 1.5 cm. long, apically dilated, the lobes spatulate, 1 cm. long, apically obtuse; stamens long-exserted; filaments glabrous; anthers oblong; style slender; stigma shortly bifid; ovary externally glabrous; fruiting-calyx accrescent, 1.5 cm. wide, the lobes reflexed; fruit drupaceous, black, shiny, 1 cm. long.

This species is based on *Geoffray 284* and *284bis* from woods at the foot of Mt. Kamchay, Kampot, Cambodia, and is known only from the original collections. A key to help distinguish it from other Indochinese species will be found under C. *hahnianum* Dop in the present series of notes [60: 141--143]. Nothing is known to me of it beyond what is stated in its bibliography (above).

**CLERODENDRUM KANICHI** DeWild., Ann. Mus. Congo Bot., ser. 4, 1: 119 [as "*Clerodendron*"]. 1903; B. Thomas, Engl. Bot. Jahrb. 68: [Gatt. Clerod.] 80 & 94. 1936.

Synonymy: *Clerodendron kanichi* DeWild., Ann. Mus. Congo Bot., ser. 4, 1: 119. 1903. *Clerodendrum canichi* Thomas, Engl. Bot. Jahrb. 68: [Gatt. Clerod.] 25 sphalm. 1936.

Bibliography: DeWild., Ann. Mus. Congo Bot., ser. 4, 1: [Étude Pl. Katang.] 119, pl. 37. 1903; Prain, Ind. Kew. Suppl. 3, imp. 1, 44. 1908; DeWild., Syll. Fl. Congol. 439. 1909; Stapf, Ind. Lond. 2: 238. 1930; B. Thomas, Engl. Bot. Jahrb. 68: [Gatt. Clerod.] 25, 80, & 94. 1936; Mold., Known Geogr. Distrib. Verbenac., ed. 1, 48 & 90 (1942) and ed. 2, 115 & 182. 1949; Prain, Ind. Kew. Suppl. 3, imp. 2, 44. 1958; Mold., Résumé 141 & 450. 1959; Mold., Fifth Summ. 1: 229 (1971) and 2: 867. 1971; Mold., Phytol. Mem. 2: 219 & 538. 1980.

Illustrations: DeWild., Ann. Mus. Congo Bot., ser. 4, 1: [Étud. Pl. Katang.] pl. 37. 1903.

This species is based on *Verdick 323* from Lukafu, Katanga, Zaire, collected in December, 1899, deposited in the Brussels herbarium. Thomas (1936) cites only the original collection and makes this species the type species of his Section *Oligocymosa* Thomas in Subgenus *Cyclonema* (Hochst.) Gürke.

Collectors have encountered this plant on savannas, referring to it as a bush, and have found it in anthesis in October and December. "Kanichi" is said to be the vernacular name for the plant in Zaire.

Citations: ZAIRE: *Beurief 753* (Br, Br, N); *Lynes 140* (Br); *Verdick 323* (Br--type, Ld--photo of type, N--photo of type). MOUNTED ILLUSTRATIONS: DeWild., Ann. Mus. Congo Bot., ser. 4, 1: pl. 37. 1903 (N).

*CLERODENDRUM KATANGENSE* DeWild., Ann. Mus. Congo Bot., ser. 4, 1: [Etude Fl. Katang.] 120, pl. 38 [as "*Clerodendron katangensis*"]. 1903; B. Thomas, Engl. Bot. Jahrb. 68: [Gatt. Clerod.] 48, 88, & 94. 1936.

Synonymy: *Clerodendron katangensis* DeWild., Ann. Mus. Congo Bot., ser. 4, 1: [Étude Fl. Katang.] 120. 1903.

Bibliography: DeWild., Ann. Mus. Congo Bot., ser. 4, 1: [Étude Fl Katang.] 120, pl. 38. 1903; Prain, Ind. Kew. Suppl. 3, imp. 1, 44. 1908; Stapf, Ind. Lond. 2: 238. 1930; B. Thomas, Engl. Bot. Jahrb. 68: [Gatt. Clerod.] 48, 88, & 94. 1936; Mold., Known Geogr. Distrib. Verbenac., ed. 1, 48 & 90 (1942) and ed. 2, 115 & 182. 1949; Prain, Ind. Kew. Suppl. 3, imp. 2, 44. 1952; Mold., Résumé 141 & 450. 1959; Mold., Résumé Suppl. 12: 5 & 6. 1965; Mold., Fifth Summ. 1: 229 & 242 (1971) and 2: 867. 1971; Mold., Phytol. Mem. 2: 219, 232, & 538. 1980.

Illustrations: DeWild., Ann. Mus. Congo Bot., ser. 4, 1: [Étude Fl. Katang.] pl. 38. 1903.

This species is based on *Verdick 400* from the borders of the Mwena, Katanga, Zaire, collected in March, 1900, and deposited in the Brussels herbarium.

Collectors have found this plant in anthesis in January and March and report the vernacular name, "kakope", for it. It is a member of the Section *Chaunocymosa* Thomas in Subgenus *Cyclonema* (Hochst.) Gürke. Thomas (1936) cites only the type collection.

Citations: ZAIRE: *Verdick 400* (Br--type, Ld--photo of type, N--photo of type). ANGOLA: Moxico: *Barros Machado 125* (Ul). MOUNTED ILLUSTRATIONS: DeWild., Ann. Mus. Congo Bot., ser. 4, 1: [Etude Fl. Katang.] pl. 38. 1903 (N).

*CLERODENDRUM KAUDERNI* Mold., Amer. Journ. Bot. 38: 326. 1951.

Bibliography: Mold., Amer. Journ. Bot. 38: 326. 1951; Mold., Biol. Abstr. 26: 185. 1952; Mold. in Humbert, Fl. Madag. 174: 154, 229, 230, & 268, fig. 37 (3). 1956; Mold., Résumé 155 & 450. 1959; G. Taylor, Ind. Kew. Suppl. 12: 36. 1959; Mold., Fifth Summ. 1: 260 (1971) and 2: 867. 1971; Mold., Phytol. Mem. 2: 249 & 538. 1980; Mold., Phytologia 57: 469 (1985) and 58: 189. 1985.

Illustrations: Mold. in Humbert, Fl. Madag. 174: 229, fig. 37 (3). 1956.

A shrub or small forest tree, to 6.5 m. tall; branchlets and twigs rather irregular, slender, glabrous; nodes not annulate; principal internodes rather regular, 2--5 cm. long; leaves decussate-opposite, borne only on the twigs; petioles slender, 5--9 mm. long, ampliate in disciform fashion at the base (in drying), canaliculate above and pilosulous in the channel, otherwise glabrous; leaf-blades rather uniformly green on both surfaces or slightly lighter beneath, submembranous or very thin-chartaceous, brunnescent in drying, lanceolate-elliptic or elliptic, 3--5 cm. long, 1--2.3 cm. wide, apically varying from acute or obtuse to rounded or subacuminate, marginally entire or with a single pair of rounded teeth near the apex, glabrous on both surfaces or pilosulous on the midrib above; midrib slender, flat above, prominulent beneath; secondaries filiform, 5--7 per side, arcuate-ascending, mostly flat or even obscure on both surfaces, arcuately joined in loops several mm. from the margins; vein and veinlet reticulation obscure or indiscernible on both surfaces; inflorescence axillary, cymose, the cymes usually 2- or 3-flowered, at the tips of the twigs only; peduncles none; pedicels very slender, about 5 mm. long, puberulent; calyx obconic-campanulate, 3--4.5 mm. long, very minutely puberulent or glabrescent, its rim very shortly 4-denticulate; corolla hypocrateriform, the tube very narrowly cylindric, 2.5--2.8 cm. long, externally glabrous, apically slightly ampliate, the limb less than 1 cm. wide; stamens and pistil exserted less than 1 cm. from the corolla-mouth; fruit drupaceous, crimson-red.

This endemic species is based on an unnumbered W. Kaudern collection from Majunga in western Madagascar, collected in July, 1912, and deposited in the Stockholm herbarium.

A key to help distinguish this species from other Madagascar taxa will be found under C. *baronianum* Oliv. in the present series of notes [58: 184--190].

Citations: MADAGASCAR: *Kaudern s.n.* [Catrèpe, May 1912] (N, S), *s.n.* [Majunga, July 1912] (F--photo of type, Ld--photo of type, N--photo of type, S--type, Sg--photo of type); *G. W. Parker s.n.* (K).

*CLERODENDRUM KIANGSIENSE* Merr. ex Li, Journ. Arnold Arb. 25: 426--427 [as "*Clerodendron*"]. 1944; Mold., Alph. List Inv. Names Suppl. 1: 6. 1947.

Synonymy: *Clerodendron kiangsiense* Merr. ex Li, Journ. Arnold Arb. 25: 426. 1944. *Clerodendron kwangsiense* Merr. ex Mold., Resume Suppl. 3: 30 in syn. 1962.

Bibliography: P'ei, Mem. Sci. Soc. China 1 (3): 152. 1932; Li, Journ. Arnold Arb. 25: 426--427 & 507. 1944; Mold., Alph. List Inv. Names Suppl. 1: 6. 1947; Mold., Known Geogr. Distrib. Verbenac., ed. 2, 131 & 182. 1949; E. J. Salisb., Ind. Kew. Suppl. 11: 56. 1953; Mold., Résumé 169, 265, & 450. 1959; Mold., Résumé Suppl. 3: 30. 1962; Mold., Fifth Summ. 1: 288 & 448 (1971) and 2: 867. 1971; Mold., Phytol. Mem. 2: 277 & 538. 1980.

A shrub, sometimes arborescent, 2.5--3 m. tall; branchlets densely brown-puberulent, not lenticellate; leaves decussate-opposite; petioles 2--4.5 cm. long, puberulent; leaf-blades chartaceous, ovate-oblong, 9.5--12 cm. long, 5.5--7 cm. wide, apically acuminate, marginally entire, basally subtruncate, sparsely puberulent on both surfaces; secondaries 4--6 per side, slight conspicuous above, prominent beneath; veinlet reticulation inconspicuous above, prominulent beneath; inflorescence cymose-paniculate, to 10 cm. long; peduncles 5.5--6 cm. long, puberulent; bracts foliaceous, oblong, 8--9 mm. long, 3--4 mm. wide, apically acuminate, puberulent, scattered-glandulose; flowers more or less crowded; pedicels 1--2 mm. long; bractlets linear, 2--3 mm. long; calyx campanulate, 5--6 mm. long, puberulent, inconspicuously scattered-glandulose, the rim 5-dentate; corolla hypocrateriform, white or pinkish, its tube slender, 1.2--1.5 cm. long, scarcely 1 mm. wide, apically scattered-puberulent, basally glabrous, the lobes mostly oblong, 5--7 mm. long, 1.5--3 mm.

wide, dorsally more or less puberulent; stamens exserted about 1 cm. from the corolla-mouth; style exserted about 1 cm.; stigma 2-lobed, the lobes apically acute.

This species is based on *J. L. Gressitt 1554* from 400 m. altitude between Kit-than and Sungwu in southern Kiangsi, China, collected on July 1, 1936, and deposited in the Arnold Arboretum herbarium at Jamaica Plain, Massachusetts.

Li (1944) comments that "This species is near *Clerodendron kwangtungense* Hand.-Mazz., differing in the more compactly arranged flowers, in the puberulent and glandular calyces and bracts, and in the absence of lenticels. *Chung 2021* of Pangyung, Chekiang, referred by P'ei....to *Clerodendron kwangtungense* Hand.-Mazz. undoubtedly represents the same species."

Collectors have found *C. kiangsiense* growing in light woods, at 115--400 m. altitude, in flower in June and July. The corollas on the type collection are said to have been "white", while those on the Tsiang collection, cited below, were "pinkish" when fresh.

Material of *C. kiangsiense* has been misidentified and distributed in some herbaria as *C. kwangtungense* Hand.-Mazz. and as *C. trichotomum* Thunb.

Citations: CHINA: Chekiang: *Ching 2021* (Ca--281764). Kiangsi: *Tsiang 9816* (N).

*CLERODENDRUM KIBWESENSE* Mold., Phytologia 4: 48--49. 1952.

Bibliography: Mold., Biol. Abstr. 26: 1471. 1952; ,old., Phytologia 4: 48--49. 1952; Mold., Résumé 144, 150, & 450. 1959; G. Taylor, Ind. Kew. Suppl. 12: 36. 1959; Mold., Fifth Summ. 1: 235 & 251 (1971) and 2: 867. 1971; Mold., Phytol. Mem. 2: 225, 240, & 538. 1980; Holmgren & al., Ind. Vasc. Pl. Type Microf. 441. 1985.

A shrub, to 3 m. tall; branchlets slender, very obscurely tetragonal, very lightly pulverulent-puberulent, more densely so on the youngest parts; principal internodes 2--6 cm. long; nodes only faintly annulate or not annulate; leaves decussate-opposite; petioles very slender, 1--1.5 cm. long, pilose-pubescent with brownish hairs; leaf-blades membranous, somewhat lighter beneath, brunnescent in drying, elliptic, 4--6 cm. long, 1.5--3 cm. wide, apically rounded to a very slight apiculation, marginally entire or subentire, basally acute, rather densely short-pubescent on both surfaces; midrib slender, prominent beneath; secondaries few, filiform, mostly about 4 per side, distant, arcuate-ascending, flat above, very slightly subprominulous beneath; veinlet reticulation abundant but rather obscure on both surfaces; inflorescence terminal, paniculate, consisting of 1 or 2 pairs of lateral and a terminal cyme; peduncles slender, obscurely tetragonal, 2.5--4 cm. long, very finely puberulent; sympodia and inflorescence-branches very slender, often stramineous, sulcate or compressed, microscopically puberulent or glabrescent; pedicels filiform, about 1 mm. long, microscopically puberulent; calyx campanulate, about 2 mm. long, microscopically puberulent or glabrate, its rim deeply 5-lobed, the lobes about as long as the tube; corolla very small, about 4 mm. long; fruiting-calyx broadly campanulate, about 3 mm. long and 4 mm. wide, externally minutely puberulent, its lobes ovate, erect-spreading, apically acute; fruit drupaceous, small.

This species is based on *Scheffler 62* from a sunny thick-bush steppe, on red laterite soil, at Kibwesi, Ukambani, at about 1000 m. altitude, Tanganyika (Tanzania), collected on January 28, 1906, and deposited in the Brussels herbarium. The plant has much the same aspect as a *Premna*, but was placed by Berthold Thomas in "*Clerodendrum* cfr. Sektio *Microcalyx*". Hornby describes it as a "large shrub in rocky kopje", in fruit in January.

Citations: TANZANIA: Tanganyika: *Scheffler 62* (Br--type, Ld--photo of type, N--fragment of type, N--photo of type, S--isotype). MOZAMBIQUE: Moçambique: *Hornby 2499* (Af).

*CLERODENDRUM KINABALUENSE* Stapf, Trans. Linn. Soc. Lond., ser. 2, 4: 216 [as "*Clerodendron*"]. 1894; Mold., Known Geogr. Distrib. Verbenac., ed. 1, 64 & 90. 1942.

Synonymy: *Clerodendron kinabaluense* Stapf, Trans. Linn. Soc. Lond., ser. 2, 4: 216. 1894. *Clerodendron disparifolium* var. *kinabaluense* (Stapf) Bakh. ex Mold., Résumé 272 in syn. 1959. *Clerodendron disparifolium* var. *kinabaluense* f. *clementium* Bakh., in herb.

Bibliography: Stapf, Trans. Linn. Soc. Lond., ser. 2, 4: 121 & 216 (1894) and 4: 522. 1896; Durand & Jacks., Ind. Kew. Suppl. 1, imp. 1, 101. 1901; H. J. Lam, Verbenac. Malay. Arch. 279 & 364. 1919; Bakh. in La, & Bakh., Bull. Jard. Bot. Buitenz., ser. 3, 3: 83, 109, & IX. 1921; E. D. Merr., Bibl. Enum. Born. Pl. 517. 1921; Durand & Jacks., Ind. Kew. Suppl. 1, imp. 2, 101. 1941; Mold., Known Geogr. Distrib. Verbenac., ed 1, 64 & 90 (1942) and ed. 2, 145 & 182. 1949; Mold., Alph. List Cit. 4: 1204. 1949; Durand & Jacks., Ind. Kew., imp. 3, 101. 1959; Mold., Résume 192, 262, 265, & 450. 1959; Mold., Fifth Summ. 1: 322, 443, & 448 (1971) and 2: 867. 1971; Mold., Phytol. Mem. 2: 313 & 538. 1980; Mold., Phytologia 59: 330 (1986) and 60: 180. 1986.

A slender shrub or undershrub, 1.5 m. tall; young branches densely spreading-hirtellous or hirsute, later glabrescent, with pale bark; leaves decussate-opposite, equal; petioles slender, 2.5--4 cm. long, sparsely puberulent sometimes constricted above the base and below the apex; leaf-blades oblanceolate or lanceolate-oblong, 15--25 cm. long, 5--6.5 cm. wide, apically acuminate, marginally repand-serrulate, at first scattered-setulose with minute setae above which are finally deciduous except for their bases, tawny-pubescent or fuscous-puberulent on the venation beneath; secondaries 11--13 per side; inflorescence terminal, paniculate, to 20 cm. long, 10--13 cm. wide, erect, spreading-pubescent or puberulent, the ramifications subtended by lanceolate to filiform bracts, the cymes lax, 2--5-flowered; pedicels 8--18 mm. long; calyx 5-parted, the segments lanceolate, 8--13 mm. long during anthesis, apically acute or attenuate-acute, pubescent, finally accrescent; corolla hypocrateriform, white, the tube slender, 1.2--2 cm. long, pilosulous or pubescent, the lobes subequal, subspatulate, apically apiculate; stamens and style exserted 1.8--2 cm. from the corolla-mouth; fruiting-calyx red and showy; fruit drupaceous, dark-blue.

This species is based on *Haviland 1307* from 3200 feet altitude at

Penokok, Mount Kinabalu, Sabah, Indonesia. Stapf (1894) says of it: "Allied to C. *disparifolium*, Blume, C. *Griffithianum*, C. B. Clarke, and C. *calamitosum*, but distinct by the long leaves; from the first also by the much larger calyx, and from the second by the shorter corolla-tube. C. *obtusidens*, Miq., of which I do not know the type, has the calyx only half as long, according to the description. There are in the Herbarium several closely-allied species from North Borneo, but all undescribed."

Lam (1919) notes that "As Stapf mentions that this species is allied to C. *disparifolium*, C. *calamitosum* and C. *Griffithianum*, it may be that it had better be brought to the subsection *Axilliflora*. But as Stapf speaks only of a 'terminal panicle' we provisorily placed it among the *Paniculata*." He cites only the type collection, although without definite collector or number.

Collectors have encountered *Clerodendrum kinabaluense* in rainforests on mountains with steep slopes, at 1400--2300 m. altitude, in flower in February and May, and in fruit in November. Clemens reports it "not infrequent locally".

The corollas are said to have been "white" on *Nooteboom 920*.

Material of this species has been identified and distributed in some herbaria as "aff. C. *penduliflorum* Wall." On the other hand, the *Clemens 10087* & *31262* and *Hallier 2934*, distributed as C. *kinabaluense*, actually are C. *haematolasium* H. Hallier, the latter being the type collection.

Citations: GREATER SUNDA ISLANDS: Sabah: *M. K. Clemens 50525* (N); *Clemens & Clemens 4967b* (Bz--19206), *s.n.* [May 20, '32] (Bz--19207, Ld--photo, N--photo), *s.n.* [Marai Parai, March 27, '33] (N); *Nooteboom 920* (Sn--1228509).

*CLERODENDRUM KIRKII* J. G. Baker in Thiselt.-Dyer, Fl. Trop. Afr. 5: 299 [as "*Clerodendron*"]. 1900; B. Thomas, Engl. Bot. Jahrb. 68: [Gatt. Clerod.] 73 & 94. 1936.

Synonymy: *Clerodendron kirkii* J. G. Baker in Thiselt.-Dyer, Fl. Trop. Afr. 5: 299. 1900.

Bibliography: J. G. Baker in Thiselt.-Dyer, Fl. Trop. Afr. 5: 293 & 299. 1900; K. Schum., Justs Bot. Jahresber. 28 (1): 495. 1902; Thiselt.-Dyer, Ind. Kew. Suppl. 2: 43. 1904; B. Thomas, Engl. Bot. Jahrb. 68: [Gatt. Clerod.] 41, 73, & 94. 1936; Mold., Known Geogr. Distrib. Verbenac., ed. 1, 51 & 90. 1942; H. N. & A. L. Mold., Pl. Life 2: 66. 1948; Mold., Known Geogr. Distrib. Verbenac., ed. 2, 120 & 182. 1949; Mold., Résumé 149 & 450. 1959; Mold., Résumé Suppl. 9: 3. 1964; Mold., Fifth Summ. 1: 249 & 448 (1971) and 2: 867. 1971; Mold., Phytol. Mem. 2: 238 & 538. 1980; Mold., Phytologia 59: 335. 1986.

Baker's original (1900) description of this taxon is: "A shrub 4 ft. high, with pubescent branchlets. Leaves mostly ternate, shortly petioled, oblong, 2--3 in. long, acute or cuspidate, rounded at the base, deeply and irregularly crenate, moderately firm, thinly pubescent above, densely pubescent beneath. Cymes forming a lax small terminal panicle; pedicels short, pubescent. Calyx pubescent, 1/6 in. long; tube campanulate; teeth ovate, shorter than the tube.

Corolla white; tube cylindrical, ½ in. long; segments of the limb obovate, 1/8 in. long. Stamens three times the length of the corolla-lobes."

The species is based on an unnumbered Kirk collection from the upper Shire Valley, Malawi, collected in July of 1861, and deposited in the Kew herbarium. Baker (1900) and Thomas (1936) each cite only the original collection, the latter author placing the species in Section *Microcalyx* Thomas, Subsection *Paniculata* Thomas, of Subgenus *Euclerodendrum* (Schau.) Thomas.

A key to help distinguish this species from other African species will be found under C. *dusenii* Gürke in the present series of notes [59: 335].

Nothing is known to me of this species beyond what is stated in its rather brief bibliography (above).

*CLERODENDRUM KISSAKENSE* Gürke, Engl. Bot. Jahrb. 28: 304 [as "*Clerodendron*"]. 1900; B. Thomas, Engl. Bot. Jahrb. 68: [Gatt. Clerod.] 48 & 94. 1936.

Synonymy: *Clerodendron kissakense* Gürke, Engl. Bot. Jahrb. 28: 304. 1900. *Clerodendron kissakiense* Gürke apud K. Schum., Justs Bot. Jahresber. 28 (1): 496 sphalm. 1902.

Bibliography: J. G. Baker in Thiselt.-Dyer, Fl. Trop. Afr. 5: 520. 1900; Engl., Bot. Jahrb, 28: 466. 1900; Gürke, Engl. Bot. Jahrb. 28: 304. 1900; K. Schum., Justs Bot. Jahresber. 28 (1): 496. 1902; Thiselt.-Dyer, Ind. Kew. Suppl. 2: 44. 1904; B. Thomas, Engl. Bot. Jahrb. 68: [Gatt. Clerod.] 13, 17, 48, 89, & 94. 1936; Mold., Known Geogr. Distrib. Verbenac., ed. 1, 49 & 90 (1942) and ed. 2, 116 & 182. 1949; Mold., Résumé 144 & 450. 1959; Gillett, Kew Bull. 14: 342--344. 1960; Townsend, Excerpt. Bot. A.3: 127. 1961; Mold., Résumé Suppl. 9: 3. 1964; Mold., Fifth Summ. 1: 235 & 448 (1971) and 2: 867. 1971; Mold., Phytol. Mem. 2: 225 & 538. 1980.

A small shrub, about 50 cm. tall; stems erect, completely glabrous, basally woody; internodes unusually elongate, 6--10 cm. long; leaves clustered on short branches, somewhat fleshy, nigrescent in drying, lanceolate, 4--6 cm. long, 10--15 mm. wide, apically short-acuminate, marginally mostly indistinctly and irregularly serrate, basally gradually narrowed, completely glabrous on both surfaces; inflorescence terminal, subspicate, dense, 8--12 cm. long, composed of few-flowered verticillate cymes resembling a menthaceous inflorescence; bracts lanceolate, sessile, 5--10 mm. long, mostly only 1 mm. wide, apically acute, glabrous; pedicels 6--10 mm. long; calyx broadly campanulate, 5--6 mm. long, glabrous, 5-lobed almost to the middle, the limb oblique, the lobes semiorbicular, wider than long, about as long as the tube, with their margins overlapping; corolla hypocrateriform, greenish-yellow, the upper lip bluish, the tube slightly longer than the calyx, the lower lip cymbiform, bearing on its inner basal portion a flat spoonlike projection; filaments 12--15 mm. long, basally tomentose.

This species is based on *Goetze 42* from on laterite on a light tree-steppe at Kissaki [Kisiki], at 250 m. altitude, Usagara, Tanganyika [Tanzania], collected in anthesis on October 28, 1898, and deposited in the Berlin herbarium, now destroyed. Gürke (1900) notes that "Diese eigentümliche Art gehört der Section *Cyclonema* an, weicht aber von allen bisher bekannten Arten durch den zusammengesetzt ährenförmigen Blütenstand ab, der ihr einen mehr Labiatenähnlichen Habitus verleiht."

Gürke (1900), Baker (1900), and Engler (1900) each cite only the original collection, but Thomas (1936) adds *Stuhlmann 713*, also from Tanganyika. Gillett (1960) comments that it is possibly conspecific with C. *wildii* Mold. [now known as C. *makanjanum* H. Winkler] , "but best left sub judice pending further collection".

Nothing is known to me of *Clerodendrum kissakense* beyond what is stated in its rather meager bibliography (above).

*CLERODENDRUM KISSAKENSE* var. *ROVUMENSE* Gürke, Engl. Bot. Jahrb. 28: 304 & 466 [as "*Clerodendron*"]. 1900; B. Thomas, Engl. Bot. Jahrb. 68: [Gatt. Clerod.] 89. 1936.

Synonymy: *Clerodendron kissakense* var. *rovumense* Gürke, Engl. Bot. Jahrb. 28: 304 & 466. 1900.

Bibliography: Gürke, Engl. Bot. Jahrb. 28: 304 & 466. 1900; B. Thomas. Engl. Bot. Jahrb. 68: [Gatt. Clerod.] 89. 1936; Mold., Known Geogr. Distrib. Verbenac., ed. 1, 49 & 90 (1942) and ed. 2, 116 & 182. 1949; Mold., Résumé 144 & 450. 1959; Mold., Fifth Summ. 1: 235 (1971) and 2: 867. 1971; Mold., Phytol. Mem. 2: 225 & 538. 1980.

This variety differs from the typical form of the species in its larger leaves and red-violet corollas.

The variety is based on *Busse 1007* from Kwa Mitra on the Rovuma river, Tanganyika [Tanzania], collected on February 9, 1901, and deposited in the Berlin herbarium, now destroyed. Thomas (1936) cites the original collection and *Schlieben 6050*, also from Tanganyika.

This plant has been found growing in grassland, at 260 m. altitude, flowering in February.

It seems very doubtful if the Schlieben collection, cited below, really represent the present taxon, since the collector asserts that its corollas were "white" and it was cited by Thomas (1936) as what he called C. *lanceolatum* Gürke [now called C. *ternatum* var. *lanceolatum* (Gürke) Mold., which see].

Citations: TANZANIA: Tanganyika: ?*Schlieben 5997* (Br, Ld--photo, Mu, N, N--photo).

*CLERODENDRUM KLEMMEI* Elm., Leafl. Philip. Bot. 2: 514--515 [as "*Clerodendron*"]. 1908; Mold., Alph. List Comm. Vern. Names 19. 1939.

Synonymy: *Clerodendron klemmei* Elm., Leafl. Philip. Bot. 2: 514. 1908.

Bibliography: Elm. Leafl. Philip. Bot. 2: 514--515. 1908; E. D. Merr., Philip. Journ. Sci. Bot. 7: 342. 1912; Prain, Ind. Kew. Suppl. 4, imp. 1, 50. 1913; H. Hallier, Meded. Rijks Herb. Leid. 37: 75. 1918; H. J. Lam, Verbenac. Malay. Arch. 309 & 364. 1919; Bakh. in Lam & Bakh., Bull. Jard. Bot. Buitenz., ser. 3, 3: 73, 78, 109, & IX. 1921; E. D. Merr., Enum. Philip. Flow. Pl. 3: 402. 1923; Mold., Alph. List Comm. Vern. Names 19. 1939; Mold., Known Geogr. Distrib.

Verbenac., ed. 1, 62 & 90. 1942; Mold., Phytologia 2: 100. 1945; Mold., Alph. List Cit. 1: 191. 1946; H. N. & A. L. Mold., Pl. Life 2: 66. 1948; Mold., Alph. List Cit. 2: 457 (1948) and 4: 1085, 1158, & 1205. 1949; Mold., Known Geogr. Distrib. Verbenac., ed. 2, 141 & 182. 1949; Prain, Ind. Kew. Suppl. 4, imp. 2, 50. 1958; Mold., Résumé 183 & 450. 1959; Mold., Fifth Summ. 1: 315 (1971) and 2: 868. 1971; Anon., Biol. Abstr. 54 (7): B.A.S.I.C..S.53. 1972; Mold., Phytologia 23: 315. 1972; Hocking, Excerpt. Bot. A.23: 291. 1974; Mold., Phytol. Mem. 2: 306 & 538. 1980; Brenan, Ind. Kew. Suppl. 16: 71. 1981; Holmgren & al., Ind. Vasc. Pl. Type Microf. 442. 1985; Mold., Phytologia 58: 404 (1985), 59: 343 & 409 (1986), and 61: 164-166, 270, & 330. 1986.

A small slender tree; old bark brownish, young bark smooth and yellowish, covered with elongate lenticels; leaves numerous, decussate-opposite; petioles 1--3 cm. long, rather slender, glabrous, completely deciduous; leaf-blades submembranous, lanceolate to oblong or obovate, the medium-sized ones 12 cm. long and 4 cm. wide, apically mostly acuminate, variable, basally attenuate or simply acute, flat, glabrous; secondaries 5--7 per side, ascendingly curvate, prominent beneath; veinlet reticulation coarse, prominent beneath; inflorescence terminal or subterminal, paniculate or subcorymbose, the cymes much branched; peduncles smooth, glabrous, yellowish, ascending, 4--7 cm. long, more or less flattened distally; secondary peduncles less than half that length, rather numerous and fastigiate, subtended by filiform bracts 5 mm. long; pedicels 5--8 mm. long, puberulent, usually bibracteate at the middle; calyx campanulate, 4 mm. long, glabrous, its 5 segments 1.5 mm. long and apically acute; corolla tubular, 6 cm. long, apically gradually widened, glabrous, deciduous, the limb 5-lobed, the lobes oblong, regular, 5--7 mm. long, 3 mm. wide, apically obtuse, spreading; stamens 4, surpassing the corolla by 1 cm., glabrous, inserted some distance below the corolla-mouth; anthers versatile, oblong, 2.5 mm. long; style slender, equaling the stamens, glabrous; stigma subclavate, with a pronounced point; ovary dome-shaped, glabrous; fruiting-calyx with the portion containing the fruit much expanded and with a thin apiculate rim; fruit drupaceous, obovoid, 13 mm. long, 10 mm. wide, olive-green, shiny, widest above the middle.

This species is based on *A. D. E. Elmer 8679* from Baguio, in Banguet Province, Luzon, Philippine Islands, collected in March of 1907. It is named after Mr. W. Klemme of the Philippine Forestry Bureau, who first discovered it in Lepanto Province. Merrill (1908) comments that "Its much smaller leaves, much larger and more numerously branched paniculate cymes, and the double length of its corolla-tube serve to segregate it from C. *simile* Merr."

Collectors describe *Clerodendrum klemmei* as a low shrub or small slender tree, 0.5--3.5 m. tall, with a stem diameter to 5 cm., the old bark brownish, the young bark smooth and yellowish, covered with elongated lenticels, the buds white, the calyx at first light-green, reddish on the sun-exposed sides, or completely red, the corolla white or creamy-white, about 6 cm. long, and the fruit ornamental, very dark dull-green, later purplish. The corolla is said to have been "white" on *Herb. Philip. Bur. Sci. 48506, Herb. Philip. For. Bur. 30178, Loher 5042, Weiss 4248,* and *Williams 2051* and "white with bright pink" on *Clemens 16256.*

Collectors have encountered this plant in secondary forests, on pine ridges with *Adinandra*, along roadsides and streams, and on damp forested slopes and mossy summits, at 600--1600 m. altitude, in anthesis from October to March, as well as in May, and in fruit from December to April, as well as in October. Merrill (1923) asserts that it is endemic to Luzon, where it occurs "In thickets and forests at medium altitudes, ascending to 1,600 m." and is known to the natives as "luag". He cites *Curran PFB 11618, 16603, & 16618, Curran & Merritt PFB 15834, Elmer 8679, Klemme PFB 5684, McGregor PBS 20191, Ramos PBS 7712. 7251, & 27024,* and *Wood PFB 13059.*

Elmer mistakenly refers to the drupaceous fruit as a "capsule".

Bakhuizen (1921) has provided a key to distinguish the Indonesian species of *Clerodendrum*, as delimited by him. It is reproduced here in modified form, with the nomenclature somewhat updated.

1. Calyx very shortly toothed or subtruncate, cupuliform, in fruit never reflexed, and when mature always smaller than the fruit.
  2. Leaf-blades ovate or oblong, basally obtuse or abruptly and shortly acute-acuminate.
    3. Cymes borne in the axils of normal leaves, forming a leafy inflorescence; straggling or climbing shrubs......*C. inerme.*
    3a. Cymes borne in the axils of bracts, forming a leafless terminal panicle; erect shrubs or small trees.
      4. Panicles dense, umbelliform, many-flowered; corolla-tube 1--1.7 cm. long; calyx 2--3.5 mm. long......*C. sahelangii.*
      4a. Panicles lax; corolla-tube more than 2.5 cm. long; calyx more than 3.5 mm. long.
        5. Calyx and corolla externally pilose; corolla about 3 cm. long......................................*C. mindorense.*
        5a. Calyx and corolla externally glabrous; corolla about 6 cm. long....................................*C. klemmei.*
  2a. Leaf-blades obovate, basally acutely attenuate.
    6. Corolla light-blue, zygomorphic, the tube wide-cylindric, 1½ to 2 times as long as the calyx; panicles elongate; leaf-blades glabrous on both surfaces except for the larger venation.........................................*C. serratum.*
    6a. Corolla white or pale-yellow, actinomorphic, the tube slender, many times as long as the calyx; panicles short, umbelliform; leaf-blades densely pilose on both surfaces......... *C. incisum.*

1a. Calyx distinctly lobed, usually to the middle or beyond, when stellately spreading or reflexed during the fruiting stage often torn, mostly as large or larger than the fruit.
  7. Well-developed leaf-blades widest at or above the middle, the basal secondaries not stronger than the rest; leaf-blades basally acuminate or cuneate (rarely cordate).
    8. Corolla dark-red or crimson; climbing shrubs.
      9. Corolla-tube 3 or more times as long as the calyx, externally subglabrous; calyx small, red, 5 mm. long or less...

*C. splendens.*

9a. Corolla-tube less than twice as long as the calyx, externally softly pubescent; calyx large, white (during anthesis) or purple (in fruit), 1.5--2.5 cm. long...........*C. thomsonae.*

8a. Corolla white or light-yellow, rarely flesh-color or orange; erect shrubs or small trees.

10. Corolla-tube not over 5 cm. long, usually less than 4.5 cm.

11. Corolla externally glabrous................*C. laevifolium.*

11a. Corolla externally densely glandular-pilose.

12. Leaf-blades glabrous on both surfaces; corolla-lobes unequal, obliquely spreading.

13. Inflorescence pendulous, racemose; calyx large, ininflated, externally glabrous; corolla-tube 1--1.5 cm. long, less than twice as long as the calyx............ *C. wallichii.*

13a. Inflorescence erect, wide-paniculate; calyx small, externally hairy; corolla-tube 2--3 cm. long, 2--4 times as long as the calyx.............*C. phyllomega.*

12a. Leaf-blades pubescent on both surfaces or at least beneath; corolla-lobes equal and similar, spreading subradially when mature.

14. Inflorescence pendulous, umbelliform or subcapitate, densely many-flowered; corolla flesh-color.*C. deflexum.*

14a. Inflorescence erect, loosely paniculate, often leafy.

15. Calyx-segments narrow, linear or subulate, extending almost to the base.

16. Leaf-blades irregularly subcrenate-serrate, apically obtuse, basally abruptly and shortly acute-attenuate, the surface rugose; corolla-tube internally glabrous.....................*C. calamitosum.*

16a, Leaf-blades marginally entire or irregularly and distantly dentate above the middle, apically short acuminate, basally cuneate, rounded, or cordate.

17. Small shrubs, usually less than 1 m. tall; stem fistular and inhabited by ants; leaf-blades elliptic or elliptic-obovate, basally broadly rounded or cordate, marginally entire or undulate-denticulate; panicle thyrsoid; corollas bright-yellow, tinged with red...*C. breviflorum.*

17a. Shrubs 1--3 m. tall; stems not fistular; leaf-blades oblong or obovate, basally cuneate and obtuse to rounded,marginally irregularly and distantly serrate above the middle, rarely subentire; corolla white or pale-yellow............ *C. disparifolium.*

15a. Calyx-segments broadly ovate or oblong, apically acute or obtuse, extending only ½ to 2/3 the length [rarely, in *C. fortunatum*, almost to the base].

18. Calyx inflated campanulate, externally glabrous or sparsely pilose; leaf-blades marginally irregularly dentate or rarely subentire.

19. Panicles terminal, leafy below; calyx externally glabrous, 5-cleft to ½ its length; corolla-tube 2-3 times as long as the calyx; leaf-blades ovate or ovate-rhomboid, marginally irregularly and bluntly serrate except at the apex and base..C. *phlomidis*.

19a. Panicles composed of axillary cymes, leafy; calyx externally sparsely pilose, cleft almost to the base; corolla-tube about as long as the calyx; leaf-blades oblong-lanceolate, elliptic or subobovate, marginally irregularly dentate or subentire C. *fortunatum*.

18a. Calyx infundibular, externally densely puberulent; leaf-blades marginally entire, rarely dentate.

20. Inflorescence terminal, sometimes leafless except at the base; corolla-tube 1.5--2.5 cm. long; leaf-blades basally obtuse to rounded or sometimes subcordate.........................C. *porphyrocalyx*.

20a. Inflorescence composed of cymes in the axils of normal leaves; corolla-tube 4--5 cm. long; leaf-blades basally acute-attenuate........C. *ingratum*.

10a. Corolla-tube more than 5 cm. long, rarely less than 6 cm.

21. Cymes in the axils of normal leaves, 1--5-flowered; leaves in whorls of 3--5, rarely opposite, 10 or more times as long as wide.........................................C. *indicum*.

21a. Inflorescence terminal, leafless; leaves always opposite, the blades less than 7 times as long as wide.

22. Calyx cleft to the base, the lobes narrowly lanceolate.

23. Calyx and corolla externally glabrous; leaf-blades densely glandular-punctulate beneath; undershrubs about 1 m. tall, with hollow club-shaped internodes which have 2 opposite holes apically................C. *fistulosum*.

23a. Calyx and corolla externally pubescent; leaf-blades not or only scarcely glandular-punctulate beneath; shrubs or small trees about 5 m. tall; internodes often inflated but without holes..........................C. *ridleyi*.

22a. Calyx-lobes not over 2/3 the length, the segments ovate or deltoid.

24. Corolla externally glabrous; branchlets without distinct lenticels...............................C. *longiflorum*.

24a. Corolla externally puberulent; branchlets with distinct light-colored lenticels.

25. Calyx externally densely puberulent.C. *quadriloculare*.

25a. Calyx externally glabrous.

26. Calyx tubular, inflated, 2--3.5 cm. long; leaf-blades glabrous on both surfaces......C. *minahassae*.

26a. Calyx campanulate, 1--1.5 cm. long; leaf-blades puberulent on both surfaces.............C. *capitatum*.

7a. Well developed leaves widest below the middle; basal secondaries much stronger than the others; leaf-blades basally obtuse to rounded or cordate.

27. Corolla-tube 10--12 cm. long; calyx externally glabrous....... C. *hastatum*.

27a. Corolla-tube less than 10 cm. long; calyx externally pilose.
28. Inflorescence leafy, composed of cymes in the axils of normal leaves.
29. Corolla externally glabrous; calyx very small, in fruiting stage smaller than the fruit...............C. *colebrokianum*.
29a. Corolla externally pilose; calyx rather large, in fruiting stage larger than the fruit.
30. Cymes capitate, densely many-flowered, with large, foliaceous, persistent bracts; leaf-blades densely villous on both surfaces, marginally entire.............C. *bracteatum*.
30a. Cymes loose, rather few-flowered, with small deciduous bracts; leaf-blades very sparsely pilose on both surfaces or glabrous except for the venation, marginally distantly serrate-dentate or the lowest 3-lobed......C. *trichotomum*.
28a. Inflorescence terminal, most of the cymes in the axils of bracts.
31. Inflorescence dense, globose, or composed of capitate cymes; bracts usually large and foliaceous, subpersistent; corolla-lobes regularly spreading.
32. Corolla externally densely villous........C. *macrostegium*.
32a. Corolla externally glabrous.
33. Corolla-tube 2--3 cm. long; calyx 1.5--2.5 cm. long, externally with many large peltate glands; leaf-blades marginally irregularly crenate-serrate or rarely entire.
34. Corollas all "single", not "doubled"...C. *philippinum*.
34a, Corollas mostly or all "doubled.
35. Corollas all "doubled"..C. *philippinum* f. *multiplex*.
35a, A few "single" corollas interspersed with "doubled" ones...................C. *philippinum* f. *subfertile*
33a. Corolla-tube 4--6 cm. long; calyx 1--1.2 cm. long, without peltate glands; leaf-blades marginally entire... C. *cunninghamii*.
31a. Inflorescence elongate, paniculate; bracts small and caducous; corolla more or less oblique.
36. Corolla-tube externally distinctly and densely pilose, usually with long hairs.
37. Calyx and corolla internally long-pilose; corolla-tube usually less than 1½ times as long as the calyx, rarely longer.
38. Calyx deeply cleft to the middle, greenish.C. *villosum*
38a. Calyx lobed not as far as the middle, red.
39. Calyx less than 1 cm. long, externally appressed short-pilose except on the subglabrous short-deltoid lobes; corolla small, the tube 0.5--1 cm. long; leaf-blades marginally entire............C. *brachyanthum*.
39a. Calyx 1--1.5 cm. long, externally densely long-pilose, the lobes lanceolate; corolla large, the tube 1--2 cm. long; leaf-blades marginally distantly serrate-dentate or rarely subentire..C. *lanuginosum*.
37a. Calyx and corolla internally short-pilose or glabrous; corolla-tube more than 1½ times as long as the calyx.

40. Calyx cleft beyond the middle, usually almost to the base, the lobed broadly ovate, dorsally sparsely strigose-pilose, with many large glands..........................C. *viscosum*.

40a. Calyx not cleft as far as the middle, the lobes oblong-lanceolate, dorsally densely hairy but without obvious glands.

41. Calyx 2--2.5 cm. long; leaf-blades marginally distantly serrate-dentate..............................C. *preslii*.

41a. Calyx less than 1.5 cm. long; leaf-blades marginally entire.

42. Corolla-tube less than twice as long as the calyx; calyx externally long-pilose..................C. *cumingianum*.

42a. Corolla-tube more than twice as long as the calyx; calyx externally short-pilose..............C. *buruanum*.

36a. Corolla-tube externally glabrous or minutely and inconspicuously pubescent.

43. Calyx not or scarcely incised as far as the middle; corolla mostly white,

44. Calyx-teeth triangular-acute, 2--3 mm. long.................
C. *buruanum* f. *lindawianum*.

44a. Calyx-lobes 4 mm. long, apically long-acuminate or caudate...........................................C. *confusum*.

43a. Calyx incised beyond the middle; corolla orange or red.

45. Leaf-blades hairy beneath, not squamulose.

46. Calyx 3--5 mm. long, the lobes narrow, lanceolate, erect or appressed; corolla-tube 5--6 times as long as the calyx, its lobes 7--10 mm. long, 4--5 mm. wide; buds 3--5 mm. wide; stamens 2--2.5 cm. long, twice as long as the corolla-lobes; style 3--4 cm. long...........C. *buchanani*.

46a. Calyx 7--12 mm. long, the lobes ovate or deltoid, spreading; corolla-tube 3--4 times as long as the calyx, the lobes 1--2.5 cm. long, to 10 mm. wide; buds 7--12 mm. wide; stamens 4--6 cm. long, 3 times as long as the corolla-lobes; style 6--7 cm. long.....C. *speciosissimum*.

45a. Leaf-blades glabrous beneath except on the venation, densely glandular-punctulate or peltate-squamulose.

47. Calyx and corolla externally more or less pubescent or puberulent; leaf-blades densely squamulose beneath (rarely minutely glandular).

48. Leaf-blades normally 3--7-lobed; calyx 2--5 mm. long, the lobes ovate, 1.5--2 mm. long, apically subobtuse; corolla orange, the tube 4--6 times as long as the calyx...................................C. *paniculatum*.

48a. Leaf-blades not lobed; calyx 5--15 mm. long, the lobes oblong or elliptic, more than 4 mm. long, apically acute; corolla dark-red, its tube less than 4 times as long as the calyx.

49. Calyx 1--1.5 cm. long; corolla to 2.4 cm. long, the tube equaling or slightly longer than the calyx.......
C. *japonicum*.

49a. Calyx less than 1 cm. long; corolla to 3.8 cm. long,

the tube twice as long as the calyx............*C. kaempferi.*
47a. Calyx and corolla externally glabrous; leaf-blades densely punctulate beneath.
50. Leaf-blades basally cordate-rotund; calyx 1.8--2.5 cm. long, 3-partite; corolla-tube 2.5--3.3 cm. long, the lobes 2--2.5 cm. long; stamens 3--4 cm. long....................*C. hettae.*
50a. Leaf-blades basally cuneate or subtruncate; calyx 1.3--1.7 cm. long, 2--5-partite; corolla-tube 1.4--2 cm. long, the lobes 1--1.5 cm. long; stamens 7--9 cm. long...*C. magnificum.*

Material of *Clerodendrum klemmei* has been misidentified and distributed in some herbaria as *C. commersonii* Lam., *C. longiflorum* Decaisne, *C. quadrangulare* Merr., *C. quadriloculare* (Blanco) Merr., and *C. mindorense* Merr. On the other hand, the *Ramos PBS 7251*, distributed as typical *C. klemmei*, actually is the type collection of its var. *puberulum* Mold.

Citations: PHILIPPINE ISLANDS: Luzon: *Allard s.n.* [1/25/38] (Or--52745); *Ahern's Collector, Herb. Philip. For. Bur. 1881* (N); *C. F. Baker 941* (Mu--4227); *P. T. Barnes, Herb. Philip. For. Bur. 339* (N); *M. S. Clemens 16256* (Ca--283715, N); *17238* (Ca--302749, Gg--158302), *17239* (Ca--302748), *s.n.* [Baguio, Oct. 1927] (Ca--346744); *Costales, Herb. Philip. For. Bur. 30178* (Ca--320892); *H. M. Curran, Philip. For. Bur. 16618* (W--16618); *Curran & Merritt, Herb. Philip. For. Bur. 15834* (W--711525); *F. W. Darling, Herb. Philip. For. Bur. 14415* (N); *Elmer 5964* (Bz--19739), *8679* (Bz--19740--isotype, L--isotype, Ld--isotype, Ld--photo of isotype, N--isotype, W--629964--isotype); *Klemme, Herb. Philip. For. Bur. 5684* (N, W--709455); *Loher 5042* (W--447137), *12322* (Bz--19737); *R. C. McGregor, Herb. Philip. Bur. Sci. 20191* (N, W--901773); *E. D. Merrill 2338* (N), *3746* (N); *M. Ramos 1336* (Bz--20089, N), *Herb. Philip. Bur. Sci. 7712* (N, W--629295), *Philip. Bur. Sci. 27024* (W--1293797); *Ramos & Edaño, Herb. Philip. Bur. Sci. 46831* (Ca--309329, N, W--1527801), *Herb. Philip. Bur. Sci. 48506* (Bz--19736, Ca--322118, N, Pd, Pd, S, W--1527911), *Herb. Philip. Bur. Sci. 48612* (Ca--322043, N); *Vanoverbergh 1528* (Go, Lu, S, Ut--53621, Vi, W--1238093), *2368* (Ws); *Weiss 4248* (Bz--20087); *R. S. Williams 394* (N), *2051* (N, N).

*CLERODENDRUM KLEMMEI* var. *PUBERULUM* Mold., Phytologia 23: 315. 1972.

Bibliography: E. D. Merr., Enum. Philip. Flow. Pl. 3: 402. 1923; Anon., Biol. Abstr. 54 (7): B.A.S.I.C. S.53. 1972; Mold., Phytologia 23: 315. 1972; Hocking, Excerpt. Bot. A.23: 291. 1974; Mold., Phytol. Mem. 2: 306 & 538. 1980; Brenan, Ind. Kew. Suppl. 16: 71. 1981; Holmgren & al., Ind. Vasc. Pl. Type Microf. 442. 1985.

This variety differs from the typical form of the species in having the inflorescences, including the peduncles, sympodia, pedicels, calyxes during anthesis, and outer surface of the corolla-tubes, densely puberulent.

The variety is based on *Maximo Ramos, Herb. Philip. Bur. Sci. 7251* from the province of Abra, on the island of Luzon, Philippine Islands, collected in January or February of 1909, and deposited in the United States National Herbarium in Washington. The general appearance of the inflorescence is much like that seen in *C. quadri-*

*loculare* (Blanco) Merr. or C. *mindorense* Merr., but the calyx-lobes are quite different. Thus far the variety is known to me only from the type collection, originally distributed and cited by Merrill as typical C. *klemmei* Elm.

Citations: PHILIPPINE ISLANDS: Luzon: *M. Ramos, Herb. Philip. Bur. Sci. 7251* (N--isotype, W--629193--type).

*CLERODENDRUM KWANGTUNGENSE* Hand.-Mazz., Anz. Akad. Wiss. Wien Math.-Nat. 59: 111 [as "*Clerodendron*"]. 1922; Mold., Known Geogr. Distrib. Verbenac., ed. 1, 57 & 90. 1942.

Synonymy: *Clerodendron kwangtungense* Hand.-Mazz., Anz. Akad. Wiss. Wien Math.-Nat. 59: 111. 1922. *Clerodendrum kewangtungense* Hand.-Mazz., in herb.

Bibliography: Hand.-Mazz., Anz. Akad. Wiss. Wien Math.-Nat. 59: 111. 1922; Krause, Justs Bot. Jahresber. 59 (2): 90. 1924; A. W. Hill, Ind. Kew. Suppl. 7: 51. 1929; Fedde & Schust., Justs Bot. Jahresber. 53 (1): 1072. 1932; P'ei, Mem. Sci. Soc. China 1 (3): 125 & 152--153, pl. 28. 1932; Worsdell, Ind. Lond. Suppl. 1: 238. 1941; Mold., Known Geogr. Distrib. Verbenac., ed. 1, 57 & 90. 1942; Mold., Alph. List Inv. Names Suppl. 1: 6. 1947; Mold., Alph. List Cit. 4: 1011. 1949; Mold., Known Geogr. Distrib. Verbenac., ed. 2, 131 & 182. 1949; Mold., Résumé 169, 265, & 450. 1959; Mold., Résumé Suppl. 15: 19. 1967; Mold., Fifth Summ. 1: 288, 448, & 463 (1971) and 2: 868. 1971; Altschul, Drugs Foods 247. 1973; Mold., Phytol. Mem. 2: 277, 538, & 539. 1980; Mold., Phytologia 60: 181. 1986.

Illustrations: P'ei, Mem. Sci. Soc. China 1 (3): pl. 28. 1932.

A woody shrub, about 1.7 m. tall; branches slender, very finely strigillose-tomentellous, sparsely and minutely lenticellate; leaves decussate-opposite; petioles ¼ to 1/3 as long as the leaf-blades, angular, deeply sulcate above, sparsely strigillose; leaf-blades concolorous, ovate, 717--15.5 cm. long, 2--2 2/3 times narrower than long, apically subcaudate-acuminate, marginally entire or here and there coarsely spreading sinuate-dentate, basally broadly cuneate or rounded to truncate and very slightly extended into the petiole-apex, glabrous or subglabrous on both surfaces except for the ciliolate margins and the sparsely strigillose midrib and larger venation; midrib prominulent and flattish above, prominent beneath; secondaries 4 or 5 per side, the basal ones very oblique, confluent near the margins; veinlet reticulation loose; inflorescence corymbose, the dimensions 9 x 13--14 x 22 cm., rather flattish, loose, basally trichotomous or shortly racemose, very finely strigillose-tomentellous, the ramifications elongate, 3--5 times dichotomous, "cum floribus alaribus" [fide Handel-Mazzetti]; bracts reduced or the lower ones foliaceous and 10 mm. long; pedicels 1.5--3 mm. long (in fruit to 14 mm. long), rather rigid; flowers numerous, fragrant; calyx green, 3.5--5 mm. long and wide, divided to 2/3 or 3/4 its length, the lobes ovate-oblong, herbaceous, externally sparsely asperous, the basal cup in fruit elongated to 4 mm.; corolla white, externally loosely glandular with the lower glands short-stipitate and the upper ones sessile, with a few scattered short setae intermixed, the tube very slender, short, 2.2--2.5 cm. long, the lobes narrowly oblong, 4--6 mm. long, undulate, apically rounded; stamens exserted 5--18 mm. beyond the corolla-mouth; anthers oblong, 1.2 mm. long, centrally attached, obtuse at both ends; style surpassing the corolla by scarcely 1 cm; fruit drupaceous, externally smooth.

This species is based on *Mell 914* from 800 m. altitude at Lungtoushan, Kwangtung, China, collected in September of 1917, and deposited in the Vienna herbarium. P'ei (1932) comments that "This is allied to C. *trichotomum* Thunb., from which it differs by much smaller and more numerous flowers. *Ching 2021*, tentatively referred here, differs from the type of *Clerodendron kwangtungense* Hand.-Maz. by its pilose and glandular calyx and bracts and in the absence of lenticels. The specimen has very young flowers and when mature material is available it may prove to represent a distinct specie [sic]." He cites only *Mell 914* from Kwangtung and *Ching 2021* from Chekiang -- the Ching collection is now regarded as representing var. *puberulum* Li.

This species is a member of Subgenus *Euclerodendron,* Subsection *Paniculata*. Curiously, Fedde & Schuster (1932) cite the original publication by Handel-Mazzetti to "Akad. Anz. Wien Nr. 12 (1922) p. 11". Altschul (1973) reports that the fruits are edible. Tsang encountered the plant in dry sandy soil of thickets, in flower in September, and reports the vernacular name "pak tsz shue". He refers to it as "fairly common".

A key to help distinguish C. *kwangtungense* from other Chinese species will be found under C. *henryi* P'ei in the present series of notes [60: 180--181].

Citations: CHINA: Kwangtung: *Mell 914* [R. M. King neg. 295] (N--photo of isotype, W--photo of isotype); *Sin 11396* (N); *Tsang 21581* (Ca--11130, I, Mi, N, N, S). MOUNTED ILLUSTRATIONS: P'ei, Mem. Sci. Soc. China 1 (3): pl. 28. 1932 (Ld--photo of isotype).

*CLERODENDRUM KWANGTUNGENSE* var. *PUBERULUM* Li, Journ. Arnold Arb. 25: 426 [as "*Clerodendron*"]. 1944; Mold., Known Geogr. Distrib. Verbenac., ed. 2, 131 & 182. 1949.

Synonymy: *Clerodendron kwangtungense* var. *puberulum* Li, Journ. Arnold Arb. 25: 426. 1944.

Bibliography: P'ei, Mem. Sci. Soc. China 1 (3): 153. 1932; Li, Journ. Arnold Arb. 25: 426. 1944; Mold., Known Geogr. Distrib. Verbenac., ed. 2, 131 & 182. 1949; Mold., Résumé 169, 265, & 450. 1959; Mold., Fifth Summ. 1: 288 & 449 (1971) and 2: 868. 1971; Mold., Phytol. Mem. 2: 277 & 539. 1980.

This variety differs from the typical form of the species in the leaf-blades being sparsely puberulent on both surfaces and the inflorescence densely puberulent.

The variety is based on *T. M. Tsui 785* from Yang-Shan, in the Yang Shan District of Kwangtung, China, collected between July and September, 1932. The collector describes the plant as a shrub, 9 feet tall, with bluish fruit. The Ching collection, from partially shaded woods, at 125--185 m. altitude, is described as "a shrub of tree form, 5 feet tall, the calyx tinged purplish", originally identified as C. *trichotomum* Thunb. and by P'ei as perhaps C. *kwangtungense* or perhaps a distinct species.

Citations: CHINA: Chekiang: *Barchet 125* (E--118829); *Ching 2021* (W--1246880). Kwangtung: *Tsui 785* (N--isotype).

*CLERODENDRUM LACINIATUM* Balf. f., Journ. Linn. Soc. Lond. Bot. 16: 19 [as "*Clerodendron*"]. 1877; Mold., Alph. List Comm. Vern. Names 5 & 22. 1939.

Synonymy: *Clerodendron laciniatum* Balf. f., Journ. Linn. Soc. Lond. Bot. 16: 19. 1877.

Bibliography: J. G. Baker, Fl. Maurit. 254 & 255. 1877; Balf. f., Journ. Linn. Soc. Lond. Bot. 16: 19. 1877; Balf. f., Phil. Trans. Roy. Soc. Lond. 168: pl. 32. 1879; Baill., Dict. Bot. 3: 418. 1891; Jacks. in Hook. f. & Jacks., Ind. Kew., imp. 1, 1: 561. 1893; Gerth van Wijk, Dict. Plantnames, imp. 1, 1: 335 (1911) and imp. 1, 2: 176 & 1041. 1916; Stapf, Ind. Lond. 2: 238. 1930; Mold., Alph. List Comm. Vern. Names 5 & 22. 1939; Mold., Known Geogr. Distrib. Verbenac., ed. 1, 53 & 90. 1942; Mold., Phytologia 2: 100. 1945; Mold., Known Geogr. Distrib. Verbenac., ed. 2, 123 & 182. 1949; Mold., Résumé 157 & 450. 1959; Gerth van Wijk, Dict. Plantnames, imp. 2, 1: 335 (1962), imp. 2, 2: 176 & 1041 (1962), imp. 3, 1: 335 (1971), and imp. 3, 2: 176 & 1041. 1971; Mold., Fifth Summ. 1: 261 (1971) and 2: 868. 1971; Mold., Phytol. Mem. 2: 252 & 539. 1980; Mold., Phytologia 60: 186. 1986.

Illustrations: Balf. f., Phil. Trans. Roy. Soc. Lond. 168: pl. 32. 1879.

A shrub or small tree; branchlets ashy-gray, terete, apically minutely puberulent; leaves decussate-opposite, petiolate; leaf-blades membranous or membranous-coriaceous, ovate or ovate-oblong (when adult) to rhomboid, 5--7.8 cm. long, apically acute, marginally entire, basally cuneate to subdeltoid, glabrous, paler beneath, the "juvenilibus filiformiter tripinnatipartitis, segmentis distantibus puberulis ligulatis obtusis per formas intermedias in adultam transeuntibus" [fide Balfour] or "bipinnatifid with distant long ligulate obtuse segments ½ to 1/6 in. broad" [fide Baker]; cymes axillary, short-pedunculate, few-flowered, twice trifid [fide Balfour] or the flowers in close terminal corymbs 5--7.8 cm. wide [fide Baker], spreading; bractlets very minute; pedicels 3--6 mm. long, puberulent; calyx campanulate or cupuliform, 3 mm. long, glabrous, the rim truncate, entire or obscurely lobed, finally spreading; corolla infundibular, 1.2--1.8 cm. long, about 6 times as long as the calyx, the tube internally resinous-papillate, the lobes obovate, subequal, shorter than the tube, apically obtuse; filaments shortly exserted, about twice as long as the corolla-limb.

The type of this species, with its leaves so different in the juvenile form, was collected by Balfour on the island of Rodriguez in the Mascarene Islands, where is is said to be "not uncommon on the hillslopes and in the valleys", according to Baker (1877) or widely dispersed, according to Balfour (1877). The latter author asserts that C. *heterophyllum* (Vent.) R. Br., of Mauritius, "is a near ally, but differs in the character of its heterophylly and in the flowers". The vernacular name on the island for C. *laciniatum* is "bois cabri" or "nasty tree". A key, suggested by Baker (1877), to distinguish it from other Mascarene and Seychelles species is found under C. *heterophyllum* (Vent.) R. Br. in the present series of notes [60: 186].

Nothing is known to me of this species beyond what is given in its rather brief bibliography (above).

*CLERODENDRUM LAEVIFOLIUM* Blume, Bijdr. Fl. Ned. Ind. 14: 808. 1826 [not C. *laevifolium* Decaisne, 1834].

Synonymy: *Clerodendrum ellipticum* Zipp. ex Span., Linnaea 15: 329. 1841. *Clerodendron laevifolium* Blume apud D. Dietr., Syn. Pl. 3: 616. 1842 [not C. *laevifolium* Bakh., 1942, nor H. J. Lam, 1921]. *Clerodendron ellipticum* Zipp apud Jacks. in Hook. f. & Jacks., Ind. Kew., imp. 1, 1: 561. 1893. *Clerodendron disparifolium* Hassk. apud Bakh. in Lam & Bakh., Bull. Jard. Bot. Buitenz., ser. 3, 3: 109 in syn. 1921 [not *Clerodendron disparifolium* Bakh., 1938, nor Blume, 1855, nor Kochum., 1980, nor *Clerodendrum disparifolium* Blume, 1826]. *Clerodendrum laeuifolium* Farnsworth, Pharmacog. Titles 5 (4): iv sphalm. 1970. *Clerodendron disparifolium* var. *pubiflorium* Bakh., in herb. *Clerodendron javanicum* L., in herb. [not C. *javanicum* Spreng., 1825, nor Walp., 1844]. *Clerodendron laevigatum* Blume, in herb.

Bibliography: Blume, Bijdr. Fl. Ned. Ind. 14: 808. 1826; Decaisne, Nouv. Ann. Mus. Hist. Nat. Paris 3: 399--400. 1834; Steud., Nom. Bot. Phan., ed. 2, 1: 383. 1840; Span., Linnaea 15: 329. 1841; D. Dietr., Syn. Pl. 3: 616. 1842; Hassk., Cat. Pl. Hort. Bot. Bogor. Cult. Alt. 136. 1844; Walp., Repert. Bot. Syst. 4: 103. 1845; Schau. in A. DC., Prodr. 11: 674. 1847; Buek, Gen. Spec. Syn. Candoll. 3: 106. 1858; Miq., Fl. Ned. Ind. 2: 872. 1858; Jacks. in Hook. f. & Jacks., Ind. Kew., imp. 1, 1: 561. 1893; Koord. & Valet., Meded. Lands Plant. Bog. 42 [Bijdr. Boomsart. Java 7]: 212. 1900; Backer, Tropische Natuur 5: 94. 1916; H. J. Lam, Verbenac. Malay. Arch. 266, 363, 364, & [371]. 1919; Bakh. in Lam & Bakh., Bull. Jard. Bot. Buitenz., ser. 3, 3: 74, 80--81, 85, 108, 109, & IX. 1921; E. D. Merr., Univ. Calif. Publ. Bot. 15: 264. 1929; Corner, Wayside Trees, ed. 1, pl. 213 (dext.). 1940; Meeuse, Blumea 5: 74. 1942; Mold., Known Geog. Distrib. Verbenac., ed. 1, 54, 61, 63, 65, 66, & 90. 1942; Jacks. in Hook. f. & Jacks., Ind. Kew., imp. 2, 1: 561. 1946; Mold., Alph. List Cit. 1: 26 (1946), 2: 449 (1948), and 4: 1017, 1232, & 1260. 1949; Mold., Known Geogr. Distrib. Verbenac., ed. 2, 124, 126, 138, 143--147, & 182. 1949; Corner, Wayside Trees, ed. 2, 695, 700, & 701, pl. 13, fig. 256. 1952; Mold., Biol. Abstr. 27: 3121. 1953; Mold., Résumé 159, 161, 177, 179, 187, 188, 190, 192, 193, 196, 197, 216, 450, & 451. 1959; Jacks. in Hook. f. & Jacks., Ind. Kew., imp. 3, 1: 561. 1960; Mold., Résumé Suppl. 3: 19 & 20 (1962), 4: 9 (1962), and 5: 6. 1962; Chan & Teo, Chem. Pharm. Bull. Tokyo 17: 1284--1286. 1969; Farnsworth, Pharmacog. Titles 5 (4): iv. 1970; Willaman & Li, Lloydia 33, Suppl. 3a: 220. 1970; Farnsworth, Pharmacog. Titles 5, Cumul. Gen. Ind. 1971; Mold., Fifth Summ. 1: 267, 271, 273, 295, 300, 304, 322, 330, 359, 449, & 463 (1971) and 2: 868. 1971; Mold., Phytologia 28: 454 (1974) and 34: 265. 1976; Mold., Phytol. Mem. 2: 259, 270, 284, 291, 295, 313, 320, 349, & 539. 1980; Mold. in Dassan.

& Fosb., Rev. Handb. Fl. Ceyl. 4: 440. 1983; Holmgren & al., Ind. Vasc. Pl. Type Microf. 441. 1985; Mold., Phytologia 58: 183 (1985), 59: 325, 330, 331, 481, & 482 (1986), and 61: 105. 1986.

Illustrations: Corner, Wayside Trees, ed. 1, pl. 213, fig. 256 (1940) and ed. 2, pl. 13, fig. 256. 1952.

A small, slender, spindly tree or treelet, 3--18 m. tall, or a very lax and slender bush, shrub, or undershrub, 1--4 m. tall, often already flowering at slightly over a meter in height, when arborescent with a clear bole, 3--6.8 m. high, a girth of 75 cm., and a stem diameter to 6 cm., erect; stems tetragonal; outer bark smooth or with checkered cracks, pale- or light-green to whitish, gray, or yellowish-brown; inner bark greenish or pale-greenish to yellowish or grayish-brown; sapwood white or whitish to yellowish; branches spreading and re-branched; twigs slender, green, shiny, glabrous; leaves decussate-opposite, spreading, quickly wilting, very variable in size, those on the upper side of the twigs being small and those on the underside large (hence every other node bears a pair of unequally-sized leaves); petioles very slender, 0.6--10 cm. long, apically and basally swollen; leaf-blades thin-membranous, rather narrowly elliptic or oblong-lanceolate, 2.5--25 cm. long, 1.8--11.5 cm. wide, apically long-attenuate or acuminate, marginally entire, basally acuminate, pale-green on both surfaces or paler only beneath, glabrous on both surfaces, shiny, rather crinkled; midrib very slender; secondaries 5--7 pairs, very slender; inflorescence terminal, erect, paniculate, 7.5--20 cm. long, brachiate, basally leafy, the axes purple-tinged, the panicle-branches "all on the lower side, drooping, often reddish [fide Corner]; pedicels ascending, green or greenish, elongate; bracts often red; calyx campanulate, red or dull-reddish to purple, sometimes "green outside, violet inside" [fide Corner], deeply 5-fid, the lobes 6 mm. long, apically pointed; corolla hypocrateriform, white or light-yellow to yellow, glabrous, the tube slender, 1.5--2.5 cm. long, the limb 5-parted; filaments white; anthers yellow-brown; style yellow-green; infructescence-axes dark-green to brownish; fruiting-pedicels brown; fruiting-calyx enlarged, fleshy, spreading in star-like fashion, 1.2 to 2.5 cm. wide, red or crimson to red-brown, turning dark-red, occasionally white; fruit drupaceous, globose, about 1 cm. long and wide, at first dull-green or greenish, then turning red or purple to blue, finally black or blackish, pendent.

This species was based by Blume on his unnumbered collection from Mt. Salak, Mt. Gede, "etc.", Java. His original (1826) description is: "C. foliis oppositis oblongo-lanceolatis utrinque acuminatis integerrimis glaberrimis, panicula terminali brachiato, caule tetraedro (calix campanulatus profunde quinquefidus, purpurascens; flores albidi). Crescit in fruticetis montanis Salak, Gede, etc. Floret: Martio, etc."

Decaisne (1834) modified this description to "C. ramis subtetragonis, laevibus, glabris; foliis oppositis oblongo-lanceolatis ovatisve basi et apice acuminatis, integerrimis glaberrimisque, subconcoloribus, laete viridibus, petiolatis; cymis terminalibus brachiatis foliis brevioribus;" [to be continued]

## BOOK REVIEWS

Alma L. Moldenke

"CLASSIFICATION, EVOLUTION, AND PHYLOGENY OF THE FAMILIES OF DICOTYLEDONS" by Aaron Goldberg, iii & 314 pp., 164 multi-draw., 1 fig., & 2 tab. Smithsonian Institution Press, Washington, D.C. 20560. 1986. paperbound.

This careful, important study is printed in the Smithsonian Contributions to Botany, Number 58. It will be much used and much appreciated by botanists and botanical students of several levels and kinds, especially the taxonomically interested. Of the nearly 1,000 published family names the author accepts 334 in 59 orders and arranges them in Table I along with those of Cronquist '81, Takhajan '83, Thorne '83, Dahlgren '83, Emberger '60, Hutchinson '73, Melchior '64, Stebbins '74, Rouleau '81, Young '81, and Benson '79. The next important table also offers well organized material on evolutionary trends in dicots for 59 structures such as pollen, xylem as to whether they represent primitive or derived states and are reversible. The suggested phylogenetic tree of orders goes straight to the *Asterales*. The bulk of the text is comprized of descriptions of the families in each order accompanied by excellent, clear-cut drawings of the diagnostic figures of plant parts. For a study this detailed the "other" family names proposed in botanical literature should certainly have been "disposed of" -- and the reasons for so doing -- with equivalents, rather than just ignored.

"A PALYNOLOGICAL STUDY OF THE *LIABEAE* (*ASTERACEAE*)" by Harold Robinson & Clomomiro Marticorema, iii & 50 pp., 40 b/w fig. & 168 SEM photo. Smithsonian Contributions to Botany No. 64. 1986.

In this important study "Surface features and internal structure of the spines in the pollen of the *Liabeae* are illustrated [very clearly and really beautifully] by scanning electron microscopy and by drawings made from oil immersion light microscopy" for all 16 genera in this group of composites. These pictured studies, text and key indicate the group's closest similarity to the *Vernonieae* rather than to the sometimes suggested *Senecioneae*. An appendix lists the very many specimens examined palynologically.

"A SCANNING ELECTRON MICROSCOPE SURVEY OF THE EPIDERMIS OF EAST AFRICAN GRASSES, IV" By Patricia G. Palmer & Susan Gerbeth-Jones, iv & 120 pp. & 86 6-parted SEM photo. Smithsonian Contributions to Botany No. 62. 1986.

"The purpose of this survey is to develop a reference collection of the microanatomical features of the leaves of modern grasses. The reference collection will provide a standard of comparison for identifying fossil leaf fragments that are abundant in East Africa lake sediments....This volume includes 43 genera representing three tribes: *Arundinellae, Isachneae* and *Paniceae*." The easy visibility and clarity of these many SEM illustrations will prove to be a great asset to future studies.

"THE BIRDS OF THE WETLANDS" by James Hancock, 152 pp., 124 color photo. & 1 map. Facts on File Publications, Inc., New York, N. Y. 10016. 1984. $22.95.

Choosing a major wetland from each continent the author-photographer-ornithophile, conservationist par excellence, James Hancock, has flushed this book with many of his beautiful bird photographs, descriptions and anecdotal tales. From North America he chooses the Florida Everglades, perhaps the most visited of these areas. From South America he chooses the "progress"-threatened forest edges in northern Argentina. From Africa he selects the Tana River in Kenya that forms a large shallow lake in the rainy seasons. From Asia he considers the Bharatpur present-day preserve that formerly was used by the maharajas and British viceroys for their game shooting parties. It is interesting to note the comparisons of the herons, spoonbills, etc. of these areas. For each of the places so vividly and helpfully described for potential visitors "Further Readings" are also provided. How can people -- the world's wet and dry lands' most intelligent inhabitants -- keep "messing things up" in such a beautiful world!

This is a wonderful book to have!

"THE WORLD OF SCIENCE INDEX" edited by Penny Clark, 64 pp., 56 color photo., 2 b/w photo. & 13 color charts. Facts on File Publications, New York, N. Y. 10016. 1986. $9.95.

This index is for the 25 volumes in the World of Science Series for the older juvenile or young adult market for home, school and public libraries. Entries such as Swallow B43 & 51, Swaziland X46, Swordfish C40, Synclavier R36 have the letter represent the proper one of the books in the series and the number refers to the page(s) within it. Thus access to desired topics is made very easy. The wide scope of topics considered is also indicated in this sample listing. The illustrations are most attractive and the charts interesting. Previous recent issues of the present journal have had reviews or mentions of 13 of these volumes.

"FLORISTIC REGIONS OF THE WORLD" by Armen Takhtajan, xxii & 522 pp., end-page & 3 floristic region maps, University of California Press, New York, Los Angeles, & Berkeley, California 94720. 1986. $60.00.

How fortunate for so many of the world's English-reading - but not Russian-reading - botanists, botanical students, taxonomists, naturalist-geographers and ecologists that this book has now been "translated by Theodore J. Crovello with the assistance and collaboration of the author and under the editorship of Arthur Cronquist", by whom the treatment of North America has been much more detailed and enlarged. Mabel Cronquist has been responsible for the huge indexing task, a feature of this translation and not of the Russian original. With its full classification and description of floristic kingdoms, regions and provinces there are also map locations for the first two and text boundaries for the last. Families with their specific genera are listed and often commented upon for each of the geographic and geopolitical regions, making this study unique, full of information and therefore of great value to geography and botany scholars and students the world over.

"THE BACKGROUND OF ECOLOGY -- Concept and Theory", by Robert P. McIntosh, xiii & 383 pp., Cambridge University Press, London & New York, N. Y. 10022. 1985. $39.50.

This is a highly successful "attempt to write a general account of the origin, development and current problems of ecology....built upon traditions of natural history beginning in classical antiquity but developed as a science in the context of late 19-century biology, natural history surveys, and conservation." Among the many proposed founders the author accepts Charles Darwin as at the beginning of the formal science and then mentions several others who have led new emphases within the field: the Odums, Bormann, Egler, Ehrlich, Gleason, Hutchinson, Slobodkin, and so many others, along with their contributions, but I missed mention of Herbert G. Baker with his anthecology and its emphasis on pollination effects. Ecology course students would have their horizons broadened by reading this book just before the end of their courses, as would advanced students who missed the reading earlier in their studies.

"GEOLOGICAL FACTORS AND THE EVOLUTION OF PLANTS" edited by Bruce H. Tiffney, viii & 294 pp., 31 b/w fig., 21 maps & 12 tab. Yale University Press, 92A Yale Station, New Haven, Connecticut 06520. 1985. $25.00.

The first paper, by the editor, indicates and explains where possible the geological factors involved in the transition from prokaryote to karyote cells when the former invade either or both the latter as commensals and so establishing structured cells that grouped for colonies and tissues and then moved on to land where they develop necessarily cell coverings to check water loss and supporting tissue (in the absence of water) for extension upwards. Some of the 8 other papers are in a similar vein or are about early Devonian photogeography, the influence of climate on the evolution of Pennsylvanian coal-swamp plants (an area with which I have some acquaintance) and wildfire. This is an interesting, important book needed in relevant courses and in college and university libraries.

"DAWN OF MODERN SCIENCE -- From the Arabs to Leonardo Da Vinci" by Thomas Goldstein, xvii & 297 pp., 54 b/w fig. & 7 maps, Houghton Mifflin Company, Boston, Massachusetts 01208. 1980, $12.95 clothbound & 1982, $7.95 paperbound.

The author is a teaching professor and an authority on medieval history with a skilled outlook on what went on before and after in terms of causes and effects and in terms of human thinking and feeling. The book starts with an analytical description of the "idea of the earth in Renaissance Florence", followed by its "ancient roots". This is followed by Islamic influences and then these by "scholastics, mystics and alchemists" setting the stage for "the art and science in the Renaissance" to which modern philosophies and scientific achievements have added great medical and ecological advances, as well as the highly destructive mechanisms of and for war and other forms of destruction. An excellent feature of this book for the general interested reader is the chapter by chapter collection of annotated bibliographic notes.

"CRY OF THE KALAHARI -- Seven Years in Africa's Last Great Wilderness" by Mark & Delia Owens, ix & 341 pp., 2 end-page maps, 30 b/w & 48 color photo. Houghton-Mifflin Company, Boston, Massachusetts 02108 & New York, N. Y. 10017. 1984 $19.95 clothbound & 1985 $7.95 paperbound.

Like Dr. Jane Goodall's "In the Shadow of Man" with its report of mountain gorillas and recently murdered Dr. Dian Fossey's "Gorillas in the Mist", this book offers fascinating reading about wildlife observations, especially of lions and brown hyenas, of the milieu of their camp in Deception Valley, a dry river basin, of the foraging and migrations of the herbivores for water and fresh greens seriously hampered by modern fencing to protect expanding settlers' and cattle needs. Like these other authors' works on different animals in different areas of Africa, the Owens' studies in scientific format and with many more details and evaluations will be offered for their well-deserved Ph.D's. Then they hope to return to Africa as did Goodall and Fossey. Except for occasional bushmen, the Owens were the first and only human beings encountered by the local animals. A pride of lions often slept very near the Owens' camp; hyenas often and leisurely raided the supplies. Hornbills often landed on their breakfast table. In this book, in several "cities" and stations in Africa and elsewhere, the authors have campaigned for the preservation of this wonderful wildlife.

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# A ROTIFER EPIPHYTIC ON A GREEN FILAMETOUS ALGA

**Wafaa S. Abou El-Kheir,[1] Laila E. Mekkey,[1] and Siham A. Al-Qadaib.[2]**

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## INTRODUCTION

Algae are able to form associations with a variety of organisms from both Plant and Animal Kingdoms (see for example, El-Saadawi and Abou El-Kheir, 1973; Richardson, 1981; Abou El-Kheir et al. 1986a). The plant associated with the alga may be chlorophylous or achlorophyllus. Algal associations with the latter type of organisms are the lichens in which the mode of association is symbiotic. Algal association with green plants varies from epiphytism to intracellular endophytism (see Darwish, 1984). The green plant associated with the alga may be another alga (El-Nayal, 1931; Abou El-Kheir and Al-Qadaib, 1986), a brgophyte (El-Saadawi and Abou El-Kheir, 1973; El Saadawi et al., 1986; Abou El-Kheir et al. 1986a), or an aquatic vascular macrophyte (El-Nayal, 1935; Eminson, 1978; Abou El-Kheir and Ismail, 1986 a,b and Abou El-Kheir et al. 1986b). Algae also form associations with animals. Thus certain snails occur closely associated and intermingled with Cladophora (Chlorphyceae) filaments in innumerable counts which drove Mohsen and Bokhary (1969) to suggest a possible symbiotic relation between the alga and the animals. Furthermore a number of species of green algae live as epiphytes on animals and still others (Chlorella for example)are endophytic in the cells of certain protozoa (e.g. Paramecium), coelentrates and sponges (Blod, 1973; Goldman and Horne,1983).

The mode of association varies greatly between the two partners in each case of association, however, little is known about the exact relationship between the two partners in many of these associations (Abou El-Kheir et al., 1986a).

The main concern in this paper, however, is to put on record a peculiar association between an animal and a filamentous alga in waters collected from Egypt (Mekkey, 1984) and Saudi Arabia (Al-Qadaib, 1986). As far as the authors are aware this is the first record of an animal epiphytic on an alga.

## MATERIAL AND HABITAT DESCRIPTION

The material consists of three samples; one collected from Egypt and two from Saudi Arabia. The three samples contained filamentous algae of which one type of filaments was relatively but prominently larger than the other types of filaments. Scores of an animal (a metazoan) were seen attached only to this type of large algal filaments in the three samples. Less numbers of this microscopic metazoan were seen free in the water.

The large algal filaments have been determined as belonging to species of the genus Enteromorpha; namely E. flexuosa (Wulten ex Roth) J. Agardh in the Egyptian sample (Fig. 1), E. compressa Grev. in the first Saudi

Arabian sample and E. ramulosa (Engl. Bot.) Hooker in the second Saudi Arabian sample. Enteromorphas are thalloid Ulvaceae that are essentially marine, but some occur in fresh-water (Fritsch, 1961). The three Enteromorphas recorded here are attached marine forms capable of existing in a rather wide range of salinities.

The animal epiphyte (Fig. 1) was kindly identified by Dr. Magdi Tawfiek (Zoology Dept., Ain Shams Univ.) as a species of the genus Filinia or of the genus Pedetes. Both belong to the Rotifera which includes over 1800 spp. (Goldman and Horne, 1983). Most rotifers occur in freshwaters, but some occur in saline waters. Most rotifers attach to solid substrates with their foot and creep in leechlike fashion (Goldman and Horne, 1983).

Description of the habitats in which these organisms exist, estimation of nutrients present in the water samples and other details are given in the two following tables.

**Table 1.** Habitat details: date of collection, sample no., kind and source of water, locality, and algal flora recorded in the three samples.

| Alga | E. flexuosa | E. compressa | E. ramulosa |
|---|---|---|---|
| **Date of collection** | 9.3.1979 | 10.2.1984 | 13.7.1984 |
| Sample ref. no. | 7 | 2 | 15 |
| Kind of water | Brackish | Brackish | Saline |
| Source of water | A stagnant swamp | An irrigation stream in a plant nursery | A salt marsh |
| Locality | Helwan City, near Ciaro, Egypt | Kharj City, near Riyadh, Saudi Arabia | Khobar City, near Dammam, Saudi Arabia |
| **Algal flora in samples:** | | | |
| Diatoms | 12 species | 30 species | 33 species |
| Blue-greens | 5 species | 15 species | 13 species |
| Greens | 1 species | 2 species | 5 species |
| Reds | - | - | 1 species |
| No. of filamentous forms other than Enteromorpha | 5 blue-greens | 12 blue-greens<br>1 greens | 9 blue-greens<br>1 greens<br>1 reds |
| State of occurrence of Enteromorpha | Predominant | Common | Common |

**Table 2.** Values of pH, temperature, and nutrients (estimated as p.p.m. except Cl as gm/l) of the three samples.

| Sample No. | Alga | pH | Temp. °C | $NO_3$ | $PO_4$ | K | Mg | Ca | Na | Cl gm/L |
|---|---|---|---|---|---|---|---|---|---|---|
| 7 | E. Flexuosa | 9 | 16 | 0.0 | 1.4 | 23.4 | 6.2 | 10.1 | 1150 | 11.2 |
| 2 | E. compressa | 7.7 | 26 | 18.4 | 6.2 | 55 | 154 | 444 | 320 | 0.5 |
| 19 | E. ramulosa | 7.7 | 33 | 0.0 | 4.7 | 925 | 1929 | 417 | 16300 | 23.7 |

The habitat particulars in the two tables are given to show the ecological range in which this association occurs.

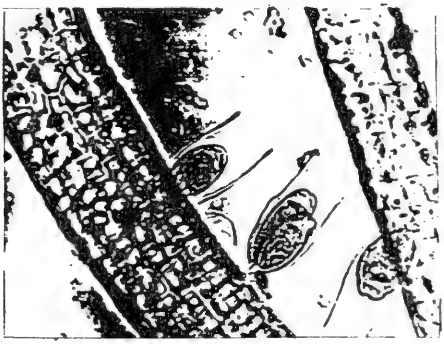

**Fig. 1.** Three individuals of the rotifer growing epiphytically on filaments of Enteromorpha flexuosa collected from Helwan, Egypt. Note that one individual is in state of division into two. X 400.

## CONCLUDING REMARKS

The occurrence in the present work of the same rotifer epiphyte on 3 different species of Enteromorpha in Egypt and Saudi Arabia means that this rotifer is widespread or cosmopolitan. In fact many rotifers are cosmopolitan (Goldman and Horne, 1983). The iteration of this association in 3 widely separated localities cannot be easily overlooked specially that the rotifer does not attach itself to other forms of filamentous algae present in the three samples (see table 1). The large size of the filaments of the recorded Enteromorphas compared to other filamentous algae may drive one to think that this association is brought about most probably by Enteromorpha filaments forming a suitable substrate for the rotifer or by dependence of the latter on the alga for epiphytism. The long thick filaments of the alga allow ideal positions for the numerous individuals of this omnivorous rotifer; suitable for the process of drawing in suspended food particles. Thus it is not only a mere similarity of ecological amplitude between the epiphyte and the host. However, little is known about the relationship of epiphytes with their host plants (see also Prowse, 1959).

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# NOTES ON SOIL ALGAE IN DIFFERENT REGIONS IN EGYPT

BY

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**Abstract:**

A study on the algal flora in eight soil samples from Maadi, Barrage, Fayum and Heliopolis revealed the presence of 49 taxa belonging to Bacillariophyceae, Cyanophyceae, Chlorophyceae and Xanthophyceae. Botrydium granulatum, Vaucheria sessilis and Spirogyra sp. were the dominants in the field soil. Microcoleus chthonoplastes, Osillatoria tenuis, Mougeotia sp., and Vaucheria sessilis were the dominants in the plant nursery soils. Oscillatoria brevis was a common species in the four localities of collection. Although the diatoms had the largest number of taxa, yet not a single taxon was found to be common.

## INTRODUCTION

Soil algae occupy a position far more important than some other groups of microorganisms. This fact appears clearly from the extensive studies of algae in various types of soil in different regions in the world. An important role in the maintenance of soil fertility is played by algae, especially blue-green algae, since many of them are capable of fixing atmospheric nitrogen.

The majority of algal studies in Egypt were done on the algal flora inhabiting water sources. Whereas little work was done concerning soil algae in the country. The following is a brief reference to the results given in earlier publications, that we are aware of, concerning Egyptian soil algae. El-Nayal (1935) stated that terrestrial algae are common on wet soil especially on the banks of the Nile and its tributaries after the flood water recedes, and in desert they are common in wadies under stones after a shower of rain. He mentioned that they include Protosiphon, Vaucheria, Oliveria, Botrydium and some Myxophyceae. He found that Hydrodictyon reticulatum and Protosiphon botryoides were common in a few samples collected from a rice field at Giza. El-Ayouty and Ayyad (1972) described common blue-green algae (22 species) in soil of a field in the Nile Delta and provided an account of their distribution in relation to variation in soil characteristics. In 1974 El-Ayouty and Ibrahim gave further notes on Egyptian soil blue-green algae. As far as we are aware, the work of Kobbia and El-Batanouny (1975) is the first recorded quantitative survey of algal flora of different soil types in Egypt. They studied soil algal flora in the region of Wadi El-Natrun. They recorded 28 species of Cyanophyceae, 3 of Chlorophyceae and 2 of Bacillariophyceae. They noticed that the population decreases with the increase in the salinity and the number of species increases with the increase in organic matter content. They found also that the most dominant species were Nostoc muscorum and Fischerella musicola.

The aim of the present study is to make some contribution to the, so far, little work already done on soil algae in Egypt.

## MATERIAL AND METHODS

The samples of study were collected from four localities: Maadi, Barrage, Fayum and Heliopolis. The samples were taken from the surface of different types of soil as tabulated below:

| Regions | Date of collection | Source of soil | No. of samples taken |
|---|---|---|---|
| Maadi | 17/12/79 | Soil surface of a trifolium field | 1 |
| Barrage | 2/7/80 | Soil surface in a garden | 1 |
| Fayum | 5/7/80 | Soil surface under a water basin | 2 |
| Heliopolis | 12/7/80 | Soil surface from pots in a plant nursery | 4 |

pH of soil samples (except for Heliopolis) was measured and various nutrients were estimated (see table 1). Names of algal taxa existing in the samples are given in table 2.

**Table 1:** Values of pH and nutrients in the four localities of collection. Values are given in p.p.m. R = Region, M = Maadi, B = Barrage, F = Fayum and H = Heliopolis.

| R | pH | $No_3$ | $PO_4$ | Cl | Na | Ca | M | K | $Co_3$ | $Hco_3$ |
|---|---|---|---|---|---|---|---|---|---|---|
| M | 6.7 | 0.6 | 2.5 | 26 | 63 | 0.4 | 0.4 | 7.8 | - | 213 |
| B | 6 | 0.3 | 0.05 | 24 | 64 | 0.2 | 0.1 | 15.6 | - | 101 |
| F | 6 | 2.2 | 1.3 | 31 | 109 | 0.1 | 0.03 | 23.4 | 7.5 | 259 |
| | 6.7 | 0.6 | 3.1 | 60 | 241 | 0.5 | 0.6 | 62.4 | 22.5 | 289 |
| H | | 1.3 | 0.3 | 219 | 46 | 4.2 | 0.7 | 15.6 | - | 50 |
| | | 28 | 0.4 | 109 | 97 | 4.6 | 0.2 | 7.8 | - | 61 |
| | | 7 | 1.9 | 17 | 419 | 0.4 | 0.1 | 62.4 | - | 101 |
| | | 28 | 0.7 | 92 | 103 | 0.3 | 0.1 | 23.4 | 45 | 594 |

## RESULTS AND CONCLUSIONS

Talbe 2 shows that Bacillariophyceae is represented by 34 taxa, Cyanophyceae by 8, Chlorophyceae by 5 and Xanthophyceae by 2; making a total of 49 taxa in the localities under investigation. From the same table it is clear that species belonging to the four groups of algae show different distribution in the various localities. Thus at Maddi Botrydium granulatum is predominant while Vaucheria sessilis and Spirogyra sp. are dominant. At Heliopolis Vaucheria sessilis and Mougeotia sp. are predominant while Microcoleus chthonoplastes and Oscillatoria tenuis are dominant. At Fayum Elliopsoidiom stichococcoides is predominant.

Oscillatoria brevis is the only alga met with in the four localities, however, in different states of occurence: predominant at Heliopolis, dominant at Maadi and Fayum, and just-present at Barrage.

It is interesting to note here that Pennales are the group to which belong most of the recorded diatoms since it is represented by 31 taxa, whereas the Centrales are represented by only 3 taxa namely: Cyclotella ocellata at Barrage and Melosira granulata and Stephanodiscus apinuligeres at Fayum. Althoug the diatoms had the largest number of taxa over the other groups of algae present in the samples yet not a single taxon was found common.

Chemical analysis showed that the highest value of nitrates was recorded in Heliopolis (Table 1: samples no. 6 & 8).

El-Nayal (1935) mentioned that the genus Botrydium granulatum (Xanthophyceae) is a terrestrial alga common on wet cultivated soil. The present find of Botrydium granulatum in a trifolium field at Maadi confirms El-Nayal's observation.

Species of the genus Vaucheria (Xanthophyceae) are known to flourish at different times of the year and to dominate other forms of soil algae (see for example: Ralph, 1977, Isrealson, 1949). As also observed in the present study Vaucheria flourished in July at Heliopolis and in December at Maadi.

Oscillatoria spp. (Cyabnophyceae) are usually recorded among dominant forms of soil algae in different parts of the world (e.g. in Saudi Arabia: Abu-Zinada and El-Huseiny, 1975; Abou El-Kheir, 1976). Three species of this genus are recorded, mainly dominant, in the four regions of the present study (see table 2).

Microcoleus chthonoplastes and Nostoc muscorum (Cyanophyceae) are recorded as dominant forms of soil algae in a rice field from Iraqi marshes by Al-Mousawi and Whitton (1983).

The former alga is recorded dominant in the present study and the latter by Kobbia and El-Batanouny (1975) from Wadi El-Natrun.

Navicula sp., Pinnularia sp. (diatoms), Chlorococcum humicola (green) and Phormidium sp. (blue-green) are recorded among the most common Egyptian soil algae from Wadi El-Natrun by Kobbia and El-Batanouny (1975). These four algae are among those recorded in the present study, however, they were met with less frequently.

**Table (2):** The recorded algal taxa in the 8 collected samples. M = Maadi, B = Barrage, F = Fayum, H = Heliopolis, d = dominant, P = Predominant and T = present.

| Algal taxa | Sample No. | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | M. | B. | F. | | H. | | | |
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
| **Bacillariophyceae:** | | | | | | | | |
| 1. Achananthes Bergiani | | | | | | | + | |
| 2. A. brevipes angustat (Grev.) Cl. | | | | | | + | | |
| 3. A. brevipes intermedia Kz. | | | | | | + | | |
| 4. Amphora coffaeiformis borealis (Kz.) Cl. | | | | | + | | | |
| 5. A. coffaeiformis salina (W. sm.) A.Cl. | + | | | | | | | |
| 6. A. pediculus vetteri | | | | + | | | | |
| 7. Cocconeis placentula intermedia (Her. & Per.) Hust. | + | | | | | | | |
| 8. Diploneis elliptica genuina f. minor | + | | | | + | | | |
| 9. Fragilaria virescens exigua Grun. | | | | | | | + | |
| 10. Gomphonema parvulum exilissimum Grun. | | | | | | + | | |
| 11. G. parvulum genuina May | | | + | | | | | |
| 12. Navicula antiqua A.Cl. | | | | | | | + | |
| 13. N. bicapitellate Hust. | | | | + | | | | |

**Table (2): (Cont.)**

| Algal taxa | Sample No. | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | M. | B. | F. | | H. | | | |
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
| 14. N. cryptocephala subsalina Hust. | | | + | + | | | | |
| 15. N. verecunda Hust. | | | + | | | | | |
| 16. Nitzschia amphibia acutiuscular Grun. | | | | + | | | + | + |
| 17. N. apiculata (Greg.) Grun | + | | | | | | | |
| 18. N. fonticola romana (Grun.) A.Cl. | | | | | + | | | |
| 19. N. gotlandiea | | | | | | + | | |
| 20. N. obtusa scalpelliformis Grun. | + | | | | | | | |
| 21. N. sigma clausii (Hant.) Grun. | + | | | | + | + | + | + |
| 22. N. thermalis intermedia Grun. | + | | | + | | | | |
| 23. N. thermalis minor Hilse | | | | | + | | | + |
| 24. Pinnularia globiceps genuina A.Cl. | | | | + | | | | |
| 25. P. inconspicua Oster. | | | + | | | | | |
| 26. Rhicosphenia curvata marina (W.Sm.) Grun. | | | + | + | | | | |
| 27. Rhopalodia gibba ventricosa (Kz.) Grun. | + | | | | | | | |
| 28. R. gibberula constricta (W.Sm.) A.Cl. | | | | + | | | | |
| 29. Surirella abies major | | | | + | | | | |
| 30. S. abies minor | | + | | + | | | | |
| 31. Synedra ulna biceps Long. | | + | | | | | | |
| 32. Cyclotella ocellata Pant | | + | | | | | | |
| 33. Melosira granulata (E.) Ralf. | | | + | | | | | |
| 34. Stephanodiscus apinuligeres Grun. | | | | + | | | | |
| **Chlorophyceae:** | | | | | | | | |
| 35. Chlamydomonas sp. | T | | | | | | | |
| 36. Chlorococcum humicola | | | | T | | | | |
| 37. Oocystis naegelii | | T | | | | | | |
| 38. Mougeotia sp. | | | | | P | P | | P |
| 39. Spirogyra sp. | d | | | | | | | |
| **Cyanophyceae:** | | | | | | | | |
| 40. Chroococcus turgidus | | T | | | | | | |
| 41. Ellipsoidiom stichococcoides | | | P | P | | | | |
| 42. Microcoleus chthonoplastes | | | | | | | d | |
| 43. Osciliatoria brevis | d | T | d | d | | P | P | P |
| 44. O. lutea contorta | | | | T | | | | |
| 45. O. tenuis | T | | | | d | | T | |
| 46. Phormidium ambiguum | | | | | | | | T |
| 47. P. inundaturm | | | | | | | | T |
| **Xanthophyceae:** | | | | | | | | |
| 48. Botrydium granulatum | P | | | | | | | |
| 49. Vaucheria sessilis | d | | | | P | | P | |
| Number of taxa in each sample | 14 | 5 | 8 | 15 | 8 | 7 | 9 | 7 |
| Number of taxa in each region | 14 | 5 | 19 | | 20 | | | |

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# THE EFFECT OF SOME HERBICIDES ON WHEAT

By

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## ABSTRACT

An experiment was initiated to study the effect of 2,4-D amine, ametryne, amitrole, dual and dalapon on the protein content of the wheat and the number or ears per plant. Results showed that 2,4-D amine, ametryne, dalapon and amitrole increased the protein content of the plant. The number of ears significantly increased under the same treatments. Plants treated with dual showed decrease in both protein content and number of ears.

## INTRODUCTION

Wheat is the main cereal crop which is used for human consumption all over the world. As a result of the vast increasing population, particularly in the population-densed developing countries, its production is becoming progressively short of the population need. This problem is of major economic impact in Egypt specially in the light of insufficiency of the native wheat production for local consumption.

Consequently an appreciable proportion, amounting to more than L.E., 100,000,000 in free currency per annum of the nation income is devoted to wheat import.

Efforts are therefore consistently made in order to increase the productivity of wheat in Egypt. Methods for improving the usual agricultural practices including fertilization and irrigation have been exhausted and are no longer becoming effective tools for increasing grain production. The most promising tool now contributing to increasing productivity of many crop plants is the careful and proper application of any of a variety of herbicides which are used widely now in agriculture by many methods of applying, but the foliar spray is the most important aspect of using it.

There is a considerable literature on the effect of 2,4-D on higher plants as regards the physiology, ecology and biology of this group of plants when subjected to various treatment of 2,4-D. (Lee, 1972; Rensburg and Billiers, 1978 a & b; Arkhangel'skii et al. 1982 and several others). All these reports revealed that the lower concentrations of 2,4-D may be have as growth regulators, but at higher concentrations it has antiphotosynthetic effects on all tested plants.

The main phytotoxic effects of 2,4-D seemed to be in decreased chlorophyll content (Nadakavukaren and Mc Cracken, 1977; Mc Cracken et al., 1981).

Comparative biochemical studies showed that 2,4-D induced marked changes in carbohydrate and nitrogen metabolism of treated plants (Radtseva et al., 1975).

Schroeder (1982), found that 2,4-D, dicamba and picloram applied to sugarbeet reduced percentage sucrose. All 3 herbicides also increased storage loss.

It is frequently reported that the herbicides at sub-lethal doses increase the protein content. Thus, 2,4-D increased the protein content of wheat (Khripunova, 1967 and Patil and Kale, 1975).

Ametryne is commonly used in weed control and showed, in most cases, good and promising results (Lo Giudice, 1977).

The main phytotoxic effects of ametryne lie in decreased chlorophyll contents (Ugalava and Khubytiya, 1972). Ametryne was reported to have inhibitory action on photosynthesis of higher plants, viz, wheat (Churchill and Klepper, 1979).

The phytotoxic effects exerted by amitrole were first reported by Hall et al. (1954) as a heterocyclic herbicide or defoliant which caused chlorosis, leaf abscission and growth inhibition. As regards the effect of amitrole on growth, it has been repeatedly established that amitrole induced growth inhibition in both microorganisms and higher plants. (Ali and Fletcher, 1978 and Squires, 1981).

The tolerancy and sensitivity of microorganisms and higher plants towards amitrole varied conspicuously at one and the same conc. (Ashraf et al., 1979). In this connection it may be mentioned that Hodgson and Moore (1972), working on different regional races of canada thistle, found that a group of these ecotypes responded differentially to amitrole. These differences might be attributed to the rate of uptake of the herbicide.

Comparing the effects of different herbicides on seed germination, amitrole seemed to be the least effective in reducing the germination of Urginea idica seeds (Khare and Dubey, 1979). It has been repeatedly established that amitrole interferes with carbohydrate and nitrogen metabolism (Suen et al., 1979).

It must be reported here that many investigators demonstrated that amitrole, not only inhibits chlorophyll and carotenoid biosynthesis in treated plants, but also caused damage and degradation of chlorophyll (Svensson, 1974).

The inhibitory effects of dalapon on germination and shoot elongation were evaluated by Thornton and Charles (1978). On the other hand, the foliar application of dalapon to sorghum proved to increase the seed yield with higher amounts of nitrogen, protein and carbohydrates and improved the seed quality (Santakumari and Reddy, 1980). In this connection, it was found that the increase in seed germination of lentil by dalapon was mainly attributed to the increase in oxidizing enzymatic activities and IAA by the herbicide (Ta Furi et al., 1977).

Dalapon proved to induce variable effects on the enzymatic activities of treated organisms (Volynets and Pal'chenko, 1977).

The main phytotoxic effect of dowpon-M lies in the inhibition of chlorophyll synthesis and/or the disturbances in photosynthesis and respiration processes (Tonecki, 1975a).

The herbicide caused, as well, a decrease in the carbohydrate and hemicellulose contents of rhizomes of phragmites communis (stonov and Bersonova, 1976a). It increased the total nitrogen content of foliage of Cynodon dactylon (Srinivasan and Sakharam, 1973a).

The S-triazines are reported to be more efficient in changing the chemical composition of plant and increasing the protein content of wheat grain (Patil and Kale, 1975).

The aim of the investigation reported in this dissertation was, therefore, assessing the influence of some herbicides as a foliar spray on growth, protein content and yield of wheat plant. It was hoped that a treatment might be attained, which increases the grain yield and protein content of wheat, cheaply and effectively.

## MATERIAL AND METHODS

The herbicides used in this experiment were 2,4-D amine ametryne amitrole, dual and dalapon.

### Determination of Nitrogen

Nitrogen content of wheat grains at harvest was estimated by micro-kjeldahl (A.O.A.C., 1965) and crude protein content worked out.

## RESULTS AND DISCUSSION

The experiment was arranged in a randomised block design with five replications. Plots were fertilized with ammonium sulphate and superphosphate.

An aqueous solution containing 50 ppm of each of the herbicides was sprayed just after anthesis, while control plants were sprayed with water.

Figure (1) shows that the spray treatments of 2,4-D amine, ametryne, amitrole and dalapon significantly increase the protein content of wheat grain over control.

The increase in protein content as a result of treatment with 2,4-D has been reported by many workers (Kedrev and Tjankova, 1962; Huffaker et al., 1967 and Patil and Kale, 1975). These chemical might have increased the protein content by stimulating the pathway of protein synthesis.

Figures 2 and 3 show that treating plants with the mentioned herbicides showed a significant increase in the number of ears per plant, except dual which caused significant decrease in it.

The effect of the herbicides on the yield, calculated as the weight of 100 grains, followed the same pattern as number of ears and protein content of the grains.

The increase in grain yield recorded in the present investigation was in agreement with the finding of El-Shaarawi (1971), working with barley.

Singh et al. (1972) also reported that enzyme activities like nitrate reductase, glutamicpyruvic transaminase, amylase, phosphorylase and adenosine triphosphatase were generally stimulated by triazine treatments. However, detailed studies on mechanism of action of these herbicides and influence on protein synthesis is needed.

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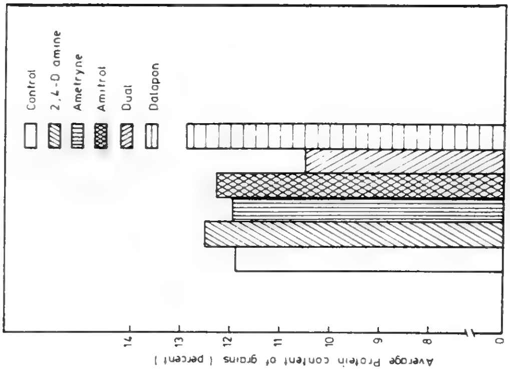


Fig (1). Effect of some herbicides on protein content of grains

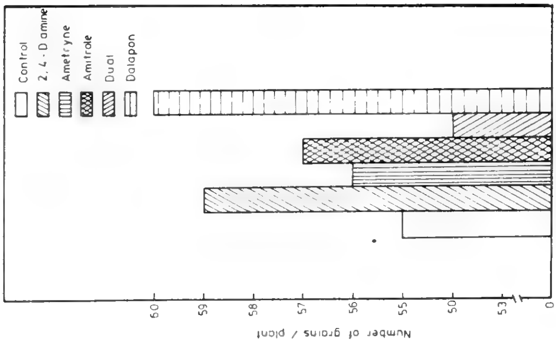


Fig (2) Effect of some herbicides on the number of grains per plant

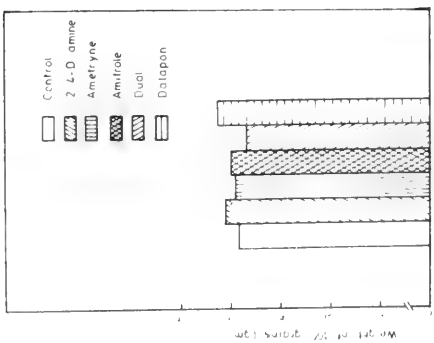


Fig (3) Effect of some herbicides on the weight of grains

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TWO NEW SPECIES OF BRAZILIAN **PHILODENDRON (ARACEAE)**

George S. Bunting

**Philodendron kautskyi** Bunt., sp. nov.

Herba scandens. Caulis 1.8 cm diam. internodiis ad 2 cm longis. Petiolus teres 19-23.5 cm longus 0.8 cm crassus (in medio), parte vaginata 5-6 cm longa ala altera 0.8 cm lata. Foliorum lamina subcoriacea ambitu late ovata vel cordiformis 25.5 cm longa 22.5 cm lata (in loco 1 cm supra basim costae), ad apicem obtusa abrupte et breviter acuminata, ad basim profunde cordata lobis posticis rotundatis sinu parabolico 9 cm longo sejunctis, adaxiale nitida intense viridis costa convexa, abaxiale vix nitida, nervis lateralibus I. utrinque 4 sub angulo ca. 55° abeuntibus, uterque costula in sinu per 1.5-2 cm nuda nervis principalibus latere exteriore 2. Inflorescentia solitaria [specimine ante anthesin]. Pedunculus 4 cm longus. Spatha 12.5 cm longa (quam spadix 1.2 cm longiora), extra ubique viridis, intra viridula, tubo plus minusve fusiformi. Flores pistillati 3.5 cm longi, stylo gracili ovarium globoideum paulum superanti, stigmate globoso, ovario 8-10-loculari, ovulis in quoque loculo 5 (4-6) basim versus centraliter affixis.

TYPUS: George S. Bunting B82-29. Domingos Martins, Espirito Santo, BRAZIL, ca. 800 m. February, 1982 [Holotypus: NY]. The specimen was collected by Mr. Roberto Kautsky and brought to me in Rio de Janeiro by Mr. Luiz Knud Correia de Araujo; both gentlemen are dedicated plantsmen.

Although P. kautskyi clearly pertains to the subgenus Philodendron, the ovary characters do not correspond well to any of the sections of the genus as circumscribed by Krause (Pflanzenreich [Engler]. Heft 60. 1913).

**Philodendron spiritus-sancti** Bunt., sp. nov.

Herba scandens. Caulis 60 cm vel ultra longus 4.5 cm diam. internodiis brevissimis (0.5 cm) attamen cicatricibus foliorum delapsorum ca. 1.8 cm diam. Petiolus abaxiale rotundatus, adaxiale late canaliculatus, apicem versus semiteres adaxiale plus minusve convexus, 53 cm longus 0.9 cm crassus (in medio), sordide luteo-viridis multis maculis ellipticis vinosis et abaxiale vinaceo-suffusus, per 10 cm superiores atrovinosus, parte vaginata 9-11 cm longa alis ochraceis. Foliorum lamina subcoriacea, plana attamen margine revoluto et vinoso (1 mm), ambitu longe triangularis basim versus lobi antici aliquantum repanda, ad apicem acuminata (1-1.5 cm) ad basim sagittata, usque 80 cm longa trans apicem loborum posticorum 16 cm lata, trans insertionem petioli 15 cm lata, in medio lobi antici 12 cm lata; lobi postici oblongo-longe triangulares usque 15.5 cm longi 4.7 cm lati et 18 cm longi 4.3 cm lati (in folio eodem) sinu longe triangulari 15 cm longo sejuncti; abaxiale ubique vinosa ner-

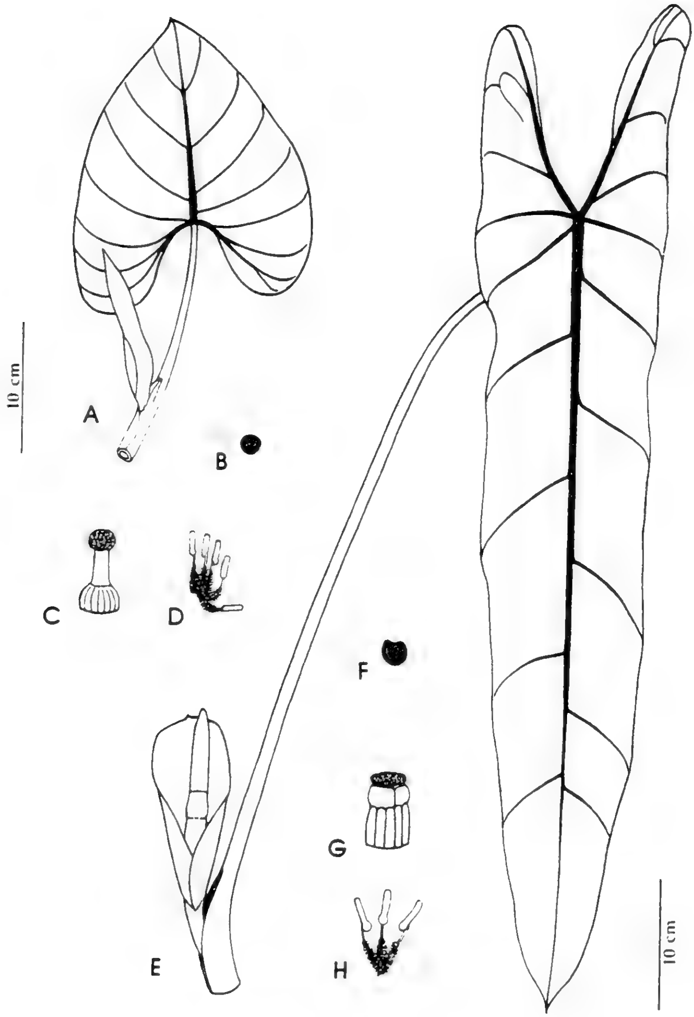


Fig. A-D, Philodendron kautskyi Bunt. **A**, leaf and inflorescence, much reduced; **B**, cross-section of petiole at midpoint, ca. 1/2; **C**, pistil, enlarged; **D**, ovules from a single locule, much enlarged. Fig. E-H, P. spiritus-sancti Bunt. **E**, leaf and inflorescence, much reduced; **F**, cross-section of petiole at midpoint, ca. 1/2; **G**, pistil, enlarged; **H**, ovules from a single locule, much enlarged.

vatione vinosa obscuriore, costa valde convexa; adaxiale impolita intense viridis nervatione flavo-virenti, costa plana vel vix convexa 7 mm lata, nervis lateralibus I. sulcatis utrinque 5-6 sub angulo 45°-65° abeuntibus, uterque costula in sinu per 5-6 cm nuda et in parte distali ex margine tantum 8-11 mm remota nervis principalibus latere exteriore 3. Inflorescentiae solitariae vel binae. Pedunculus 6 cm longus viridis ad apicem vinosus saturatus. Spatha 16.5 cm longa, non constricta et ubique plus minusve eodem diametro (1.9 cm), extra viridis maculis ellipticis vinosis intra viridicremea sursum eburnea, late aperiens. Spadix spatham aequans insertione obliquissima, 14.5 cm longus parte pistillata 6 (2.4) cm longa 1.3 cm crassa, parte staminata sterili 1.9(1.7) cm longa 1.4 cm crassa (ad apicem 1.1 cm crassa), fertili 1.2-1.3 cm crassa. Flores pistillati cylindrici stigmate coronato, 3.8 cm longi 1.8-2 mm crassi, ovario 10-11(-13)-loculari, ovulis in quoque loculo 3 (-4) basim versus centraliter affixis.

TYPUS: George S. Bunting B82-28. In rainforest, "Morro do Suido", Domingos Martins, Espirito Santo, BRAZIL, ca. 800 m. January 20, 1982 [Holotypus: NY]. This specimen was also collected by Mr. Roberto Kautsky and brought to me in Rio de Janeiro by Mr. Luiz Knud Correia de Araujo.

Philodendron spiritus-sancti pertains to sect. Oligospermium Engl. § Macrobelium Schott.

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## ERRATA

re BUNTING, G. S., New taxa of Venezuelan Araceae. Phytologia 60: 293-344. 1986.

| page | line | reads: | should read: |
|---|---|---|---|
| 311 | 27 | en km 25 del trayecto al este de San Cristóbal | entre km 11 y 25 al este de San Cristóbal, o sea 0-14 km al este del Chorro del Indio |
| 311 | 28 | ca. 1100 m, 7 de junio, 1973 | 1100-1150 m, 24 de abril, 1976 |
| 332 | 4 | en km 25 al este de San Cristóbal | entre km 11 y 25 al este de San Cristóbal, o sea 0-14 km al este del Chorro del Indio |
| 332 | 5 | ca. 1100 m, 7 de junio, 1973 | 1100-1150 m, 24 de abril, 1976 |
| 340 | scale | 10 mm | 10 cm |

# NOTES ON NEW AND NOTEWORTHY PLANTS. CLXXIX

Harold N. Moldenke

*VERBENA PARVULA* f. *ALBIFLORA* Mold., f. nov.

Haec forma a forma speciei corollis albis recedit.

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

The form is based on *E. Bastian 36*, collected in "suelo franco arenoso, pH 7, S.-Exp. 3°, area del Ceramitar, Prov. Cercado", at about 1900 meters altitude, in Tarija, Bolivia, on December 4, 1985, deposited in the Lundell Herbarium at the University of Texas

*PAEPALANTHUS AMOENUS* var. *BOLIVIANUS* Mold., var. nov.

Haec varietas a forma typica speciei differt inflorescentiis paucicapitulatis numerosis in parte superiori caulis dispersis, nodis caulinis prominente incrassatis.

This variety differs from the typical form of the species chiefly in having its inflorescences terminating abbreviated branches along the upper part of the erect stem, the stems prominently enlarged at the points of emergence of the short and slender branches, the branches densely covered with antrorse basally appressed leaves, the terminal umbels comprising 2--4 unicapitate peduncles, the sheaths about 3 cm. long, the peduncles about 20 cm. long, and the globose many-flowered heads about 1 cm. long and wide.

The variety is based on *R. Haase 685* from Palmar, on a wet savanna west of the Rio Beni, at 180 meters altitude, Luisita, 13°5' S, 67°15' W, in the province of Iturralde, La Paz, Bolivia, collected on September 2, 1985, and deposited in the Lundell Herbarium at the University of Texas, Austin.

ON AUREOLEJEUNEA Schust. and BRACHIOLEJEUNEA PARAMICOLA Herzog

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The genus Aureolejeunea Schust. was briefly described in this journal (Schuster, 1978) and a review (with illustrations) appeared recently in Nova Hedwigia (Schuster, 1986; in press). In this last paper one of the species treated in some detail is Aureolejeunea paramoensis Schust. (cf. Schuster, 1986, figs. 3-4), unique in the genus in the rather compressed-trigonous perianths which bear accessory plicae distally, so that, on young perianths at least, there are as many as 3 dorsal, 5 ventral, and 2 lateral plicae (cf. fig. 3: 1, 4-7 in Schuster, l.c.).

In spite of the stem anatomy, typically Ptychantoid, and the distinct brown color of Aureolejeunea, it was shown that the seta anatomy places the genus clearly in the Lejeuneoideae. Here it was stated that its affinities were most nearly with Omphalanthus and Leucolejeunea. The often checker-board arrangement of cells recalls Omphalanthus, as does oil-body form (2-4 granular-botryoidal or botryoidal oil-bodies per cell), yet the presence of wall pigments and the elongated leaf lobule (which, in turn, suggests an affinity to Leucolejeunea) suggest that Aureolejeunea is not particularly close to Omphalanthus.

Gradstein et al. (1981) give a key to 5 taxa they refer to Omphalanthus, including one species, O. paramicola (Herz.) Gradst., comb. n., which was based on Brachiolejeunea paramicola Herz., Hedwigia 74: 95, fig. 8a-b, 1934. Gradstein et al. (l.c.) characterize this species as with a flattened perianth that is "6-8-plicate." The plant is further characterized as "reddish-brown to dark brown, autoecious . . . with 2 innovations." These features, in my opinion, exclude Brachiolejeunea paramicola from Omphalanthus s. str.[1] Oil-bodies of Aureolejeunea were described (Schuster, 1978, 1986) as occurring "2-4 per cell, large (length 0.3-0.8 longer diam. of cell lumen), clearly and ± coarsely botryoidal." The diagnosis of the oil-bodies of Brachiolejeunea paramicola in Gradstein et al. (l.c., p. 245) is almost identical: oil-bodies "2-4 per leaf cell, . . . coarsely granulose." Their figure (fig. 1:4) shows finely botryoidal oil-bodies, not substantially different from those I described for Aureolejunea. It is, also, not substantially different from what is seen in Omphalanthus filiformis, the generic type of Omphalanthus, in which I have seen 1-4 large, coarsely granular-botryoidal oil-bodies (Schuster, 1987).

It is therefore clear that Herzog (1934) was far off the mark in ascribing his plant to Brachiolejeunea (subfam. Ptychantoideae; with homogeneous, minute, numerous oil-bodies and semicordate trigones; with a very different stem anatomy; with ental hyaline papillae; with a 16 + 4 seta; cf., Schuster, 1980). Gradstein et al. (l. c.), placing it in Omphalanthus, are much closer, But, in my opinion, the plant is clearly a member of Aureolejeunea, since (a) Omphalanthus does not secrete wall pigments;[2] (b) Omphalanthus has a perianth that is either inflated or bluntly trigonous; (c) all taxa properly assigned to Omphalanthus have obliquely subquadrate or short-oblong lobules, with obliquely ascending keel -- giving the leaf a highly diagnostic aspect (see, e.g., Evans, 1907, pl. 3:1-3); (d) subfloral innovations in Omphalanthus are normally 1, rarely 0 or 2 (mixed in single populations!); bract keels are unwinged (cf. Evans, l.c., pl. 3:1, 7-8) and have an exceedingly reduced lobule. I concluded (Schuster, 1986) that, on the basis of these criteria "confusion with Omphalanthus is hardly possible." Confusion with Brachiolejeunea is even less possible, although the color may throw the unwary off!

On that basis, therefore, Brachiolejeunea paramicola Herzog is transferred to Aureolejeunea Schust., as follows:

Aureolejeunea paramicola (Herz.) Schust., comb. n. [Basionym: Brachiolejeunea paramicola Herzog, Hedwigia 74:95, fig. 8a-b, 1934].

It seems likely that A. paramoensis Schust. may prove to be identical. However, A. paramicola is described as with a 6-8-plicate perianth; that of A. paramoensis is 8-10- plicate. Further collections are needed.

FOOTNOTES

[1] Indeed, Gradstein (1985, p. 18) separates Omphalanthus from Aureolejeunea on the basis of the "stems ± pendulous, long and slender, little branched. Ventral merophytes 4-12 cells wide" vs. "creeping to ascending, branching infrequent or frequent. Ventral merophytes (2)4 cells wide" (for Aureolejeunea). On these bases, Brachiolejeunea paramicola is, clearly, an Aureolejeunea! The copious branching in Aureolejeunea is shown in cladographs of A. fulva Schust. (Schuster, 1980, fig. 659:9-10) and A. paramoensis Schust. (Schuster, l.c., fig. 659:11).

[2] In Schuster (1963, p. 56) it is keyed out with Leucolejeunea, and characterized as being "green."

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THE *AGATHIS* OF ESPIRITU SANTO (*ARAUCARIACEAE*, NEW HEBRIDES)

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Abstract

In October 1986 John Silba financed a private botanical expedition to the island of Espiritu Santo in conjuction with Mike N. Askin of the Flecker Botanic Garden (CAIRNS). Specimens of *Agathis* have been reported from this island previously but have never been collected before. Mike N. Askin was not able to collect specimens from the interior of the island due to hostility of the natives. He did however manage to collect bark, foliage and male cone samples from a cultivated tree on the coast. An analysis of this collection proves this to be a distinct species.

It has long been known that *Agathis* occurs on the island of Espiritu Santo (Vanuatu) but collections have only now been achieved. T. C. Chambers reported in 1971 having seen the trees in 1963. In 1964 D.J. De Laubenfels talked with J. C. Rouleau in Vila and he reported going to see these trees in order to assess their commercial possiblities. He described them as huge in girth but rather short boles and thus not commercially promising. The bark he described as rather smoother than that of *A. obtusa* (Lindl.) Mast. from Erromango and Aneityum, and he felt the Espiritu Santo *Agathis* was distinct. Chambers described the trees as being large emergents. M.N. Askin was told that a tree was measured by ten men holding hands around the trunk. T.C. Whitmore assumed the Espiritu Santo *Agathis* is identical with *A. macrophylla* (Lindl.) Mast. as is *A. obtusa* but reported their location as the west side of the Cumberland Peninsula which appears to be an error. Hostility by the local natives has prevented study of the wild trees but John Silba succeeded in arranging to have M.N. Askin collect fertile material fom a tree brought as a seedling to the coast in 1967 and now about 15 m. tall and 0.5 m. in diameter.

*Agathis silbai* De Laubenfels, sp. nov. Strobili masculi lineari 37-55 x 15-18 mm. partis superis microsporophyllorum 2-2.5 mm. longis et latis apicis gibbo 5-6 lateri instructis, subtus costis medianus. Folia lanceolata non glauca.
Type collection: *Askin 13156* (Holotype-NY, Isotypes at GH, US, K), 31 Oct. 1986, S.W. Espiritu Santo, cultivated near Tasmalum, 35 m. elevation, on coastal limestone.

Leaves on young trees lanceolate, not at all acuminate nor glaucous. Buds globular, 2-3 mm. long x 3 mm. wide, scales obtuse. Juvenile leaves dull light green, 7.6-11.8 cm. long x 2.1-3.7 cm. wide, spreading sideways and somewhat forwards, petiole 1.5-3 mm. long. Male strobili cylindrical, oblong, somewhat broadened on the upper half, coppery-brown to red-brown, peduncle 3.5-4 mm. long x 3.5-4 mm. long. Pollen cones 37-55 x 15-18 mm., linear, with the upper expanded part of the microsporophyll 2-2.5 mm. long and wide and with a 5-6 sided raised boss at the apical end. Between the raised area, which crowds against those of surrounding microsporophylls on immature pollen cones, and the pendent pollen sacks is a broad unraised area with a ridge along the center, narrow where two sides of the raised area meet at its upper end and lanceolate starting as wide as the adjacent side of the raised area where one of those sides is located in the center of the expanded part of the microsporophyll. Bark gray on the surface, the more weathered parts nearly white, straw colored interior and slightly fibrous, on young trees with numerous shallow more or less horizontal splits. When cut the bark yields a pink resin with an aromatic smell.

Scattered as isolated specimens or small populations invariably on the knolls or ridges above the Navaka River south of Namaus at 457-762 m.. This area is on the lower southern slopes of Santo Peak. Branches reaching upward at an angle to the trunk to produce a broad nearly flat crown. Young trees with a conical shape.

This new species is most closely related to A. labillardieri Warb. of New Guinea whose microsporophylls do not have a broad unraised area behind the raised part which in this latter species essentially forms the entire expanded part of the microsporophyll. Agathis macrophylla also differs in that it is known to produce white resin copiously.

Interestingly, M.N. Askin also collected specimens of an Agathis species from a cultivated tree near Wailapa, S. Espiritu Santo, near the coast (Askin 13157, NY). The tree was about 10 m. tall with two trunks and appeared somewhat stunted. This collection consists of juvenile foliage samples and bark samples which seem to be typical of A. macrophylla. The bark was grayish becoming distinctly whitish, breaking off in papery plates and coppery-brown below. This collection does seem to differ somewhat in its somewhat curved non-glaucous leaves and was also noted as being a poor producer of white resin. It seems uncertain whether this specimen was originally obtained from the interior of Espiritu Santo as rumored, or rather it seems more likely that it was transplanted from another island in Vanuatu such as Erromango or Aneityum where typical A. macrophylla occurs.

While M.N. Askin was in Vanuatu he talked to P.E. Neil of the Vanuatu Forestry Department in Vila about the distribution of Agathis in Vanuatu. Mr. Neil stated that Agathis occurs also on the island of Malekula. If so, specimens have probably not yet been collected from Malekula. This could be a range extension of the nearby A. silbaii from Espiritu Santo or possibly yet another entity.

Fig. 1. Type tree of Agathis silbai in center (Askin 13156), near Tasmalum.

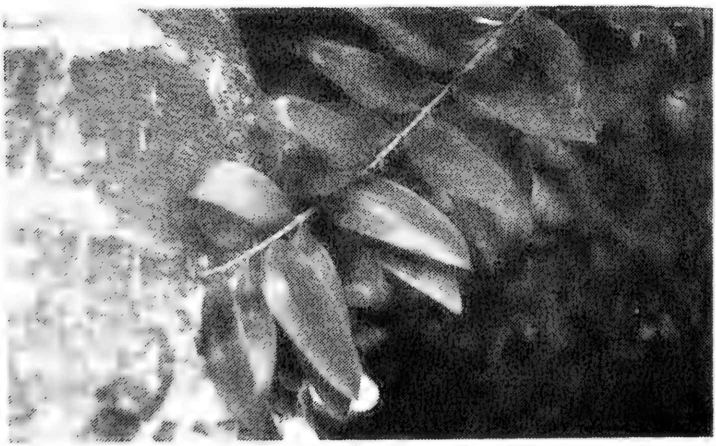

Fig. 2. Close-up of bark and foliage of type tree of Agathis silbai De Laub. (Askin 13156).

Fig. 3. Agathis macrophylla ? Askin 13157, near Wailapa, tree in center between two palm trees, guide is collecting leaves near the base.

Fig. 4. Agathis macrophylla ? Askin 13157, close-up of juvenile foliage, showing curved leaves.

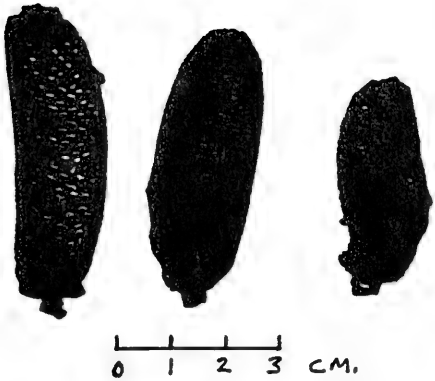


Fig. 5. Agathis silbai De Laub., pollen cones, portion of the holotype (Askin 13156, NY).

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# THE STATUS OF THE GENUS *PEYRISCHIA* (GRAMINEAE: POOIDEAE)

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## Abstract

Recent research on the generic delimitation of *Peyrischia* and the Mexican and Central American species of *Trisetum* and *Deschampsia* is summarized and found to support the union of *Peyritschia* and *Trisetum*, which is proposed. The correct names under *Trisetum* are *Trisetum altijugum* (Fourn.) Scribn. (= *P. koelerioides* (Peyr.) Fourn.) and *T. kochianum* I. Hdz. T., *nom. nov.* (= *P. pringlei* (Scribn.) S.D. Koch).

*Peyritschia* Fourn., a small genus of Mexican and Central American grasses, and the Mexican and Central America species of *Deschampsia* Beauv. and *Trisetum* Pers. form a group in which genera are difficult to delimit because of a lack of correlation among characters (McVaugh 1983, p. 393-394). This group has recently been subjected to detailed study in the hope that the use of a larger number of characters, including several not previously used at the generic level in the tribe Aveneae, would clarify the situation. The results are briefly summarized here and the necessary name changes are presented so that the new names can be used in current floristic projects. More detailed versions have been published elsewhere or are in preparation (see Literature Cited).

On the basis of 12 morphological characters and chromosome number, Koch (1979) showed that the Mexican and Central American species of *Trisetum* and *Deschampsia* constitute discrete groups, and that *Peyritschia* differs from *Trisetum* only in minor characters. Subsequent studies (Hernández T. 1986) of species for which material was previously unavailable or incomplete have shown that three species of *Trisetum* are like *Deschampsia* with respect to one character (solid vs. liquid endosperm) thought by Koch (1979) to be reliable. However, the distinction between *Deschampsia* on one hand, and *Trisetum* and *Peyritschia* on the other, is still clear when all characters are considered.

Despite the lack of important differences between *Peyritschia* and *Trisetum*, Koch (1979) did not unite them, principally because leaf blade anatomy had not yet been studied. This has now been done (Hernández T. 1986). No important differences were found between these genera, but there were consistent differences between these two and *Deschampsia*.

It is therefore proposed that *Trisetum* and *Peyritschia* be united under the older name, *Trisetum*. A consequence of this is that the currently used specific epithets of both *Peyritschia* species must be changed as presented below:

*Trisetum altijugum* (Fourn.) Scribn., Rhodora 8:89. 1906. *Graphephorum altijugum* Fourn., Mex. Pl. 2: 111. 1886. TYPE: Mexico, Veracruz, in Monte Orizabensi, 12-14,000', *Liebmann 603* (holotype: P; isotype: US!).

*Aira koelerioides* Peyr., Linnaea 30: 5. 1859. *Deschampsia koelerioides* (Peyr.) Benth., J. Linn. Soc., Bot., 19: 96. 1881. *Peyritschia koelerioides* (Peyr.) Fourn., Mex. Pl. 2:110. 1886. TYPE: Mexico, Estado de Mexico, Toluca, 8800 ft., *Heller 311*. *Non Trisetum koelerioides* Bornm. & Hack. 1898.

*Trisetum kochianum* I. Hernández T., *nomen novum*. *Deschampsia pringlei* Scribn., Proc. Acad. Nat. Sci. Philadelphia 1891:300. 1891. *Peyritschia pringlei* (Scribn.) S.D. Koch, Taxon 28: 233. 1979. TYPE: Mexico, Chihuahua, 7 Oct 1887, *Pringle 1429* (holotype: US!; isotype: MEXU!). *Non Trisetum pringlei* (Scribn.) Hitchc. 1927.

ACKNOWLEDGEMENT

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NOTES ON THE GENUS *CLERODENDRUM* (*VERBENACEAE*). XXX

Harold N. Moldenke

*CLERODENDRUM* Burm.

Additional & emended bibliography: Ait., Hort. Kew., ed. 1, 2: 364. 1789; Jacq., Collect. Bot. Suppl. 117--119, pl. 4, fig. 1, & pl. 5, fig. 1. 1796; D. Dietr., Syn. Pl. 613--616. 1842; A. Rich. in Sagra, Hist. Fis. Polit. Nat. Cuba 11 [2] [Fl. Cub. Fanerog. 2]: 146--147. 1850; Regel, Gartenfl. 11: 64/65, pl. 353. 1862; Regel, Trans. Russ. Hort. Soc. 1862: pl. 79. 1862; Hemsl., Biol. Cent.-Amer. 2: 540. 1882; Friedrich, Abh. Geol. Specialkarte Preuss. 4 (3): 339 [181], pl. 23, fig. 4, & pl. 28, fig. 14. 1883; J. Ramírez, Veg. Méx. 110. 1899; T. S. Brandeg., Univ. Calif. Publ. Bot. 6: 191. 1915; Br., Merr., & Yates, Philip. Journ. Sci. Bot. 12: 222 & 240. 1917; J. G. Baker in Rendle, Journ. Bot. Brit. 63: Suppl. 81. 1925; P. C. Standl., Field Mus. Publ. Bot. 3: 400. 1930; Roys, Tulane Univ. Mid. Amer. Res. Ser. Publ. 2: [Ethno-Bot. Maya] 248 & 319. 1931; Lundell, Carnegie Inst. Wash. Publ. 478: 25, 26, 75, 138, 183, & 203. 1937; Mold., Revist. Sudam. Bot. 8: 170. 1950; Roig, Dicc. Bot. Nom. Vulg. Cub. 2: 287, 496, 607, 715--716, 878, & 1005. 1953; Anon., Assoc. Étud. Tax. Fl. Afr. Trop. Ind. 1954: 66. 1955; Anon., Trav. Lab. Bot. Syst. Brux. 16: 66. 1955; Hocking, Excerpt. Bot. A.11: 103 & 504. 1967; Thom, Journ. Ecol. 55: 315 & 320. 1967; Gibson, Fieldiana Bot. 24 (9): 179 & 192--195, fig. 36. 1970; A. R. Sm., Hook. Icon. Bot. Pl. 37 [ser. 5, 7]: pl. 3691. 1971; Anon., Assoc. Etud. Tax. Fl. Afr. Trop. Ind. 1971: 57. 1972; Rouleua, Taxon Ind. 1: 92. 1972; Buck, Bull. Torrey Bot. Club 113: 81. 1986; Mold., Phytologia 61: 378--420. 1986.

*CLERODENDRUM LAEVIFOLIUM* Blume

Additional & emended bibliography: Bakh. in Lam & Bakh., Bull. Jard. Bot. Buitenz., ser. 3, 3: 74, 80--81, 85, 108, 109, VIII, & IX. 1921; Mold., Phytologia 61: 411 & 419--420. 1986.

Continuing the emended description by Decaisne (1834): "calycibus fructiferis profunde 5-fidis, segmentis subdeltoideo-lanceolatis acutis glaberrimis introrsum rubro-purpureis; drupis laevibus nigris calyce brevioribus....Obs. Les échantillons incomplets que j'ai sous les yeux, me dispensent de faire presque uniquement pour les feuilles, une description plus étendue. Je rapporte également avec doute cette plante au *Clerodendrum laevifolium* cité par M. Blume, parce qu'elle paroit avoir aussi de l'analogie avec le *Clerodendrum macrophyllum* du même auteur." The specimens he refers to here were apparently from Timor, from which area *C. laevifolium* is also known.

Dietrich (1843) repeats Blume's original description in slightly abbreviated form. Steudel (1840) lists the species from both Java and Timor. Spanoghe (1841) cites it from Timor as "Herb. Timor. p. 71" and gives *C. macrophyllum* Blume as a possible synonym (but I regard the latter as representing *C. phyllomega* Steud.).

Merrill (1929) cites *Elmer 20287* & *20625* from near Sandakan and

Tawao, Borneo, describing the plant as "An undershrub in dry forests and thickets near tidewater, the calyx red, corolla yellowish green to yellow. Malay Peninsula, Penang, Sumatra, and Java; not previously recorded from Borneo. The first number cited was originally determined by me as *Clerodendron disparifolium* Blume, a manifest error, and the duplicates were so distributed."

Corner (1952) lists *C. laevifolium* from Western Malaysia, noting that it is "common throughout Malaya in villages, open country, and lowland and mountain woods to 4,000 ft. The shoots wilt quickly when plucked." He distinguishes the species from others which he regards as common wayside trees in the tropics as follows:

1. Leaf-blades velvety, heart-shaped; flowers and fruiting-calyx white..............................................C. *villosum*.
1a. Leaf-blades, flower, and fruiting-calyx not as above.
  2. Flowers and fruits in dense heads turned to the underside of the twigs or stem..............................C. *deflexum*.
  2a. Flowers and fruits not as above.
    3. Leaf-blades marginally entire; corollas yellow, with a long tube; fruiting-calyx star-like.............C. *laevifolium*.
    3a. Leaf-blades marginally dentate; corollas greenish-white and lilac; fruiting-calyx not star-like...........C. *serratum*

Meeuse (1942) comments that "Bakhuizen van den Brink misinterpreted Blume's species *Cl. laevifolium* and *Cl. disparifolium*. A study of Blume's specimens in Herb. L.-B. showed, that *Cl. laevifolium* is a synonym of *Cl. nutans* Wall., a plant which occurs in Java only in a cultivated state, though Blume apparently erroneously states, that it occurs in primary forests on Mt. Salak and Mt. Gedeh. A study of the type of *Cl. disparifolium* Bl. reveals, that this is Bakhuizen van den Brink's '*Cl. laevifolium*'. The name *Cl. disparifolium* was used by Bakhuizen van den Brink for a third species, viz. *Cl. eriosiphon* Schau. (which is mentioned by him as a synonym)." I am not prepared to follow Meeuse in this radically different interpretation. Merrill notes that "this [species, i.e., C. *laevifolium*] never has a nodding inflorescence" as does Wallich's C. *nutans*, [now known as C. *wallichii* Merr.].

Hochreutiner remarks that "Koorders et Valeton indiquent cette plante seulement à des altitudes basses et ils la considèrent comme un arbuste, mais c'est un véritable arbre de 8--10 m. à l'endroit où nous l'avons récolté."

Collectors have found C. *laevifolium* growing on hillsides and hilltops, in primary, evergreen, and montane forests, in clearings and recently logged virgin forests, along streamsides and roadsides, on sandy beaches, at the margins of evergreen forests, in second-growth in wet places, in jungles near tidewater, on flatlands, steep slopes, and granitic hills, and in the dry soil of woods, at 18 to 1330 m. altitude, in flower from March to January, in fruit from October to February and in June and July.

The corollas are described as having been "yellow" on *Elmer 20287*, *Kalantas SAN.90612*, *Mahmud 4810*. and *Yates 1669* & *1930*, "yellowish" on *Hochreutiner 1724*, *Krispinus SAN.95818*, and *Madani SAN. 31716*, "pale-yellow" on *Kochummen FRI.23143* and *Stone 10769*, "yellowish-green" on *Elmer 20625, Fidilis & Sumbing SAN.96061*, and *Krispinus SAN.95874*, "greenish-yellow" on *Abbe & Abbe 10163*, "light-green" pn *Geesink & al. 7334*, "whitish" on *Fidilis & Sumbing SAN. 88993*, "yellowish-red" on *Krispinus SAN.95906* and *Madani SAN.91691*, "reddish" on *Krispinus SAN.95402* and *Larsen & Larsen 32908*, and "tube very pale yellow-green, petals yellow-green" on *Jacobs 9642*.

Geesink and his associates refer to the species as a common shrub in sunny places in Thailand.

Common and vernacular names reported for the species are "chekop manis gajah", "kajoe haraboe", "kajoe haboe-haboe", "kajoe si marhaboe-haboe", "kajoe si marhaboe haboe", "kibangbara", "ki sai", "lampin budak", "leukong", "patah ajam", "sepang", "sipang", and "swaddling flower".

In regard to the homonymous synonyms referred to in the synonymy (above) *Clerodendrum disparifolium* Blume is regarded by me as a valid species (which see), with *Clerodendron disparifolium* Blume and *Clerodendron disparifolium* Kochum. as synonyms of it, while *C. disparifolium* Bakh. is a synonym of *C. garrettianum* Craib; *C. javanicum* Spreng. belongs in the synonymy of *C. inerme* (L.) Gaertn. and *C. javanicum* Walp. is a synonym of *C. serratum* (L.) Moon; *C. laevifolium* Bakh. is *C. disparifolium* Blume, *C. laevifolium* Decaisne is *C. longiflorum* Decaisne, and *C. laevifolium* H. J. Lam is *C. wallichii* Merr.

It should be mentioned that *Bartlett 8195, Boeea 1842*, and *Toroes 1433, 2059, & 2637* are all accompanied by wood samples in the University of Michigan museum. *Yates 1930* is accompanied by a photograph of the plant <u>in situ</u>.

The unnumbered Martens collection, cited below, was taken from material cultivated in Belgium from seeds sent by Reinwardt from Java,

A key to help distinguish *C. laevifolium* from other Indonesian taxa will be found under *C. klemmei* Elm. in the present series of notes [61: 410--415].

Material of *C. laevifolium* has been misidentified and distributed in many herbaria as *C. acuminatum* Wall., *C. disparifolium* Blume, *C. disparifolium* β *denticulatum* Hort., *C. eriosiphon* Schau., and even *Solanaceae*. On the other hand, the *Gibot SAN.29570*, distributed as *C. laevifolium*, actually is *C. barba-felis* H. Hallier.

Citations: THAILAND: *Geesink, Hattink, & Charoenphol 7334* (Ac); *Larsen & Larsen 32908* (Ac, Ld); *Maxwell 72-15* (Ac); *Winit 5871* (N). VIETNAM: Tonkin: *Pételot 825* (Ca--223718), *1260* (Ca--234269). MALAYA: Kelantan: *Haniff & Nur 10094* (Bz--19885, Ca--346266). Malacca: *Hervey s.n.* [1886] (Pd); *Kiah 37226* (Bz--19172). Negri Sembilan: *Khoo & Ming N.K.002* (Kl--8839). Pahang: *Best 14135* (Ca--237349); *Mahmud 4810* (Ld, Ne--33493); *Nur 11303* (Bz--19883), *32748* (Ca--3258, W--2157498); *B. C. Stone 10769* (Kl--15915). Penang: *Haniff 7* (Ca--355249). Perak: *Scortechini 297a* (Ca--528992). Selangor: *Kochummen FRI.23143* (Ac); *Poore 392* (Kl--392). Singapore: *Abbe & Abbe 10163* (N); *N. J. Andersson s.n.* [28 Jan. 1853] (S, S); *C. B. Clarke s.n.* (Pd); *Clemens & Clemens 22566* (N, N); *Goodenough s.n.* [Changi, 1889] (Ca--267604); *Kuntze 6093* (N, N); *Liew 36495* [tree

404] (Bz--19884); *Maxwell 76-810* (Ac); *Nur 35599* (S); *Ridley s.n.* [1896] (Bz--19886); *Wilkes s.n.* [Singapore](W--74537). Trengganu: *Corner 33479* (Bz--19880). Wellesley: *Ridley s.n.* (Bz--19887, Bz--19888). State undetermined: *Griffith 6046/1* (Mu--772, Pd, S, Ut--11528). GREATER SUNDA ISLANDS: Anambas: *Van Steenis 1260* (Ut--97084). Boegoeran: *Van Steenis 1092* (Bz--19876, Bz--19877, Ut--97082), *1260* (Bz--19878, Bz--19879). Java: *Arsin 19525* (Bz--19778); *Backer 1254* (Bz--19802, Bz--19803), *1345* (Bz--19814, Bz--19815), *1774* (Bz--19809, Bz--19819), *4126* (Bz--19810, Bz--19811), *5829* (Bz--19774), *7083* (Bz--19773), *9900* (Bz--19771, Bz--19772), *10085* (Bz--19769, Bz--19770), *10296* (Bz--19812, Bz--19813), *19812* (Bz--19793, Bz--19794), *21076* (Bz--19793, Bz--19794), *21113* (Bz--19790, Bz--19791, Bz--19792), *22076* (Bz--19788), *23195* (Bz--19783), *25945* (Bz--19829, Bz--19830); *Bakhuizen 280* (Bz--19785), *286* (Bz--19775), *509* (Bz--19817, Bz--19818, Ut--24890A, Ut--58423), *633* (Bz--19776), *1151* (Bz--19805), *1731* (Bz--19786), *1732* (Bz--19787, Bz--25520), *2109* (Bz--19784), *3081* (Bz--19762, Bz--19763. Bz--25521, Ca--265971), *3117* (Bz--19758, Bz--19759, Ut--63807), *3135* (Bz--19760), *3182* (Bz--19795, Bz--19796), *3186* (Bz--19761), *3802* (Bz--19789), *4084* (Bz--19804), *5450* (Bz--19826, Bz--19827, Bz--19828, L, Ut--66907), *5825* (Bz--19781, Bz--19782), *6137* (Bz--19767, Bz--19768), *6235* (Bz--19756, Bz--19757), *6442* (Bz--19766, Ca--301396, Ut--81348), *7261* (Bz--19785); *Forbes 443* (Bz--19820, Bz--19821), *529* (Bz--19822, Bz--19823); *Hallier s.n.* [Depok, 1.IX.1896] (Bz--19797, Bz--19798), *s.n.* [14.VIII.1896] (Bz--19779, Bz--19780), *s.n.* [28.VIII.1896] (Bz--19799, Bz--19800); *Hochreutiner 1724* (Ca--41444); *Kollman 139* (Mu--826), *s.n.* (Br); *Koorders 24451b* [952*] (Bz--19841, Bz--19842, Bz--25498, Pd, Ut--80822), *31280b* [1785*] (Bz--19839, Bz--19840), *34345b* [1698*] (Bz--19837), *40668b* [56*] (Bz--19831, Bz--19832), *40746b* [150*] (Bz--19833), *41250b* [133*] (Bz--19835, Bz--19836), *41377b* (Bz--19834), *44037b* [30*] (Bz--19838); *Lam 3821* (Bz--19753, Bz--19754, Bz--19755); *Lanjouw 145* (Bz--72903); *Noerkas s.n.* [1912] (Bz--19824, Bz--19825); *Soegandiredja 185* (Bz--19807, Bz--19808), *288* (Bz--19801, Bz--19806); *Van Steenis 5946* (Bz--19764), *12616* (Bz-19816), *12677* (Bz--19751, Bz--19752, N); *Voogd s.n.* [25/3/1941] (Bz--72802). Kalimantan: *Dachlan 69* [Boschwezen 2372] (Bz--19747, Ca--227877); *Rutten 219* (Ut--22694), *264* (Ut--22708, Ut--22709); *Slooten 2111* (Bz--19742), *2190* (Bz--19743); *Wilkes, United States Expl. Exped. s.n.* [Borneo] (C, T); *Winkler 2280* (Bz--19745), *3310* (Bz--19741). Paliat: *Backer 29566* (Bz--19843, Bz--19844). Sabah: *Elmer 20287* (Bi, Bz--19746, Ca--229017, K, Mi, N, Um--146), *20625* (Bi, Br, Bz--19744, Ca--312128, Du--163740, Mu, N, S, Ut--84964, W--2605810); *Endert 1554* (Bz--72720), *1558* (Bz--72718), *2152* (Bz--72722), *2670* (Bz--72724), *3389* (Bz--72726), *5207* (Bz--72729); *Fedilis & Sumbing SAN.88414* (Sn--56528), *SAN.88993* (Ld), *SAN.96061* (Ld); *Gibot SAN.37102* (Sn--40677); *Kalantas SAN.90612* (Ld); *Krispinus SAN. 95402* (Ld), *SAN.95818* (Ld), *SAN.96874* (Ld), *SAN.95906* (Ld); *Madani SAN.81716* (Sn--46685), *SAN.91691* (Ld); *Polah & Main 2065* (Bz--72999); *Sales 3911* [field no. 463] (Ca--347167); *Tanglon A.1566* (Kl). Sarawak: *Foxworthy 78* (W--713231). Sumatra: *Bangham & Bangham 610* (N); *Bartlett 8195* (Mi, N, W--1552644, W--1552645); *Boeea 1842* (Mi), *5974* (Mi, N), *6036* (Mi, N), *7842* (Ca--14709, S, W--1682368), *7944* (Ca--14585, Mi, S, W--1682300), *8480* (Mi, N, W--2275297); *Bünnemeijer 3005* (Bz--19854, Bz--19855), *3557* (Bz--19864, Ut--58424), *3622* (Bz--19867, Bz--19868), *3750* (Bz--19856, Bz--19857, Bz--19858, N), *3833* (Bz--19865, Bz--19866), *4204* (Bz--19848, Bz--19849); *Jacobs 4642* (E--1955621); *Jacobson 2449* (Bz--19850); *Junghuhn s.n.* (Ut--43909); *Krukoff 4198* (Mi, N); *Lörzing 4205* (Bz--19874), *4394* (Bz--19872, Bz--19873), *4600* (Bz--19870), *6879* (Bz--19863); *Lörzing & Jochems 7478* (Bz--19853); *Meer Mohr 13* (Bz--19847, Bz--19851, Bz--19852); *Roderkerk 12* (Bz--19869); *Saimondt s.n.* [Posthumus 866] (B, Bz--19846, Ut--97083); *Toroes 942* (Ca--42223, Mi, S), *1433* (Ca--91960, Mi, N, S), *2059* (Ca--531318, Du--234558, Ew, I, Mi, Mi, N, W--1680022), *2277* (Ca--531494, I, Mi, N, W--1703754), *2412* (Mi, N, W--1861042), *2637* (Ca--531441, Du--339602, Mi, N, S, W--1861132), *2720* (Ca--530167, Du--234589, Mi, Mi, N, W--1680383, W--1861171), *3251* (Mi, N), *3857* (Mi, N, W--1681314), *3974* (Ca--530860, Mi, N, S, W--1680603), *4374* (Ca--531412, Mi, N, W--1676357), *4772* (Ca--530595, Mi, Mi, N, W--1681018, W--1681019), *s.n.* [22-30 June 1933] (W--1681176); *Ultee 131*(Bz--19871); *Wilde & Wilde-Duyfjes 14891* (W--2996638); *Yates 1192* (Bz--19859, Bz--19860, Ca--251167, Mi, N), *1669* (Bz--19861, Ca--264061, Mi, N), *1930* (Ca--287116, Mi), *2479* (Bz--19862, Ca--318537, N, S). Toedjoej: *Bünnemeijer 6072* (Bz--19875). LESSER SUNDA ISLANDS: Banka: *Posthumus 722* (Bz--19845). Timor: *Herb. Mus. Paris s.n.* (L). CULTIVATED: Belgium: *Martens s.n.* (Br). Java: *Collector undetermined 296* (Bz--19749), *297* (Bz--19748, Bz--19750); *Herb. Hort. Bot. Bogor. XV.J.A.XXXIII.2* (Bz--26387), *XV.J.A. XXXIII.2a* (Bz--26388, Bz); *Herb. Hort. Bog. Jav. s.n.* (Pd, Pd, Pd). Singapore: *Furtado s.n.* [16 Nov. 1928] (Bz--19881, Bz--19882). LOCALITY OF COLLECTION UNDETERMINED: *Collector undetermined 93* (S), *103* (Pd), *s.n.* (Bz--19777).

*CLERODENDRUM LAEVIFOLIUM* var. *FLETCHERI* Mold., Phytologia 4: 289. 1953.

Bibliography: Fletcher, Kew Bull. Misc. Inf. 1938: 404. 1938; Mold., Biol. Abstr. 27: 3121. 1953; Mold., Phytologia 4: 289. 1953; Mold., Résumé 177, 216, & 450. 1959; Mold., Fifth Summ. 1: 295 & 359 (1971) and 2: 868. 1971; Mold., Phytol. Mem. 2: 284, 349, & 539. 1980; P. Holmgren & al., Ind. Vasc. Pl. Type Microf. 441. 1985; Mold., Phytologia 59: 331. 1986.

This variety differs from the typical form of the species in having the leaf-blades marginally sinuate-dentate and the calyces deeply 5-fid and 4--11 mm. long during anthesis.

The variety is based on *H. B. G. Garrett 899* from waste ground, Forestry Department, Chiengmai, Thailand, collected on November 26, 1934, and deposited in the herbarium of the Royal Forestry Department at Bangkok.

Winit describes the plant as a shrub, 1 m. or "a few feet" tall, generally simple-stemmed, often with many root-suckers, probably exotic, the flowers white (on *no. 643*) or cream (on *no. 1690*), tinted reddish outside, and has encountered it at 120 m. altitude.

Khid Suvarnasuddhi, in a letter to me dated July 14, 1953, says that this plant is commonly found in waste ground, but not in the forests of Thailand. It is not definitely known to be exotic, but its Thai vernacular name of "ka-sa-long Thet" means "the foreign *Millingtonia*" in allusion to its flowers which resemble those of *Millingtonia hortensis*.

The Garrett and Winit collections, cited below, were cited by Fletcher (1938) as *C. disparifolium* Blume, and, indeed, this plant has the general appearance of a smooth variety of that species. It has been collected in anthesis in November and December.

Citations: THAILAND: *Garrett 899* (Bk--type, Ld--photo of type, N--fragment of type, N--photo of type); *Maxwell 71-90* (Ac); *Rock 589* (W--1090399); *Winit 643* (Bk), *1690* (Bk).

**CLERODENDRUM LAEVIFOLIUM** var. **PUBIFLORUM** Bakh. ex Mold., Résumé 187, 190, 192, & 451, nom. nud. 1959; var. nov.

Synonymy: *Clerodendron laevifolium* var. *pubiflorum* Bakh., in herb.

Bibliography: Mold., Résumé 187, 190, 192, & 451. 1959; Mold., Fifth Summ. 1: 322 (1971) and 2: 868. 1971; Mold., Phytol. Mem. 2: 313 & 539. 1980.

This variety appears to be based on *F. W. Richards 1838* from Mount Fulit, Ulu Koyan Division, Sarawak, collected on September 15, 1932, and deposited in the Buitenzorg herbarium.

As yet I have not been able to ascertain where Bakhuizen formally published this taxon, but on the type sheet the following inscription occurs: "folia primum supra sparse puberula, mox costa excepta utrinque glaberrima, inflorescentia terminalis villosa, calyx et corolla extus sparse puberuli, corolla albida; forma transit inter *C. laevifolium* Bl. et *C. disparifolium* Bl. ponenda videtur."

Collectors describe the plant as a slender tree, about 6 m. tall, the corolla white, puberulous on the outer surface. They have found it growing in white sand of "heath" forests, at 60--800 m. altitude, in flower in September.

The unnumbered Blume collection, cited below, was originally identified as *Clerodendron disparifolium* in an old handwriting (probably not Blume's because the generic name is spelled "*Clerodendron*", whereas Blume always wrote it as "*Clerodendrum*" in all his publications). I do not regard it as representing Blume's type, since we have another Blume specimen which does fit the modern concept of typical *C. disparifolium* Blume and which I therefore regard as representing the type collection thereof.

Citations: GREATER SUNDA ISLANDS: Java: *Blume s.n.* (T). Sarawak: *Richards 1838* (Bz--19889--type, Ld--photo of type, N--photo of type). Singkep: *Bünnemeijer 7376* (Bz--19890).

**CLERODENDRUM LANCEOLATUM** F. Muell., Fragm. Phyt. Austral. 3: 145 [as "*Clerodendron*"]. 1863; Mold., Known Geogr. Distrib. Verbenac., ed. 1, 49--51 & 90. 1942 [not *C. lanceolatum* N. E. Br., 1959, nor Gürke, 1893].

Synonymy: *Clerodendron lanceolatum* F. Muell., Fragm. Phyt. Austral. 3: 145. 1863.

Bibliography: F. Muell., Fragm. Phyt. Austral. 3: 145. 1863;

Benth. & F. Muell., Fl. Austral. 5: 61, 63, & 67. 1870; F. Muell., Sec. Syst. Cens. Austral. Pl. 1: 173. 1889; Jacks. in Hook. f. & Jacks., Ind. Kew., imp. 1,1: 561. 1893; S. Moore, Journ. Linn. Soc. Lond. Bot. 34: 236. 1899; F. M. Bailey, Queensl. Fl. 4: 1181 & 1183. 1901; F. M. Bailey, Compreh. Cat. Queensl. Pl. 386 & 389, fig. 364. 1913; Stapf, Ind. Lond. 2: 239. 1930; C. A. Gardn., Enum. Pl. Austral. Occid. 3: 112. 1931; Mold., Known Geogr. Distrib. Verbenac., ed. 1, 49--51 & 90. 1942; Jacks. in Hook. f. & Jacks., Ind. Kew., imp. 2, 1: 561. 1946; Mold., Known Geogr. Distrib. Verbenac., ed. 2, 116, 118, 120, & 182. 1949; Mold., Résumé 427 & 451. 1959; Jacks. in Hook. f. & Jacks., Ind. Kew., imp. 3, 1: 561. 1960; Mold., Résumé Suppl. 3: 26. 1962; Beard, Descrip. Cat. W. Austral. Pl., ed. 1, 91. 1965; Mold., Résumé Suppl. 15: 14. 1967; Beard, Descrip. Cat. W. Austral. Pl., ed. 2, 113. 1970; Mold., Fifth Summ. 1: 345 (1971) and 2: 868. 1971; T. B. Muir, Muelleria 2: 166. 1972; Mold., Phytol. Mem. 2: 335 & 539. 1980

Illustrations: F. M. Bailey, Compreh. Cat. Queensl. Pl. 389, fig. 364. 1913.

Mueller's original (1863) description is: "Velutinum, foliis ovato- v. oblongo-lanceolatis oppositis petiolo duplo triplove longioribus integerrimis, paniculis corymbosis axillaribus et terminalibus, floribus breviuscule pedicellatis, bracteolis oblongis v. linearibus, calycis 5-fidi lobis fere semiovatis, corollae extus breviter pubescentis tubo praelongo. In collibus rupestribus ad sinum Nickol Bay. Pemb. Walcott. Arbuscula saepius 14'. Folia pleraque 2--3", 3/4--1½" lata, nunc sensim acutata, nunc obtusiuscula. Bracteolae circiter 1½" longae. Calyces floriferi circiter 2½'" longi, fructiferi conspicue aucti et incrassati, fere semipollicem metientes, lobis denique reflexis et deltoideis. Corollae tubus circiter pollicaris, lobi 2--3'" longi. Filamenta conspicue exserta. Antherae 2/3'" longae. Fructus vix maturi 3--4'" metientes."

Beard (1970) describes the plant as an "Elegant shrub 6--9 ft." tall, with black "berries" [actually drupes]. Moore (1899) avers that it is found in the desert north of 30$^{o}$ among the endemics which have advanced from Western Australia into the northern part of the Western Australian desert. Bentham & Mueller (1870) admit that the species is almost indistinguishable from *C. tomentosum* and consists of both narrow- and broad-leaved forms.

The *C. lanceolatum* N. E. Br. and *C. lanceolatum* Gürke, mentioned above, are synonyms of *C. ternatum* var. *lanceolatum* (Gürke) Mold., in southern Africa.

Nothing is known to me of *C. lanceolatum* F. Muell. beyond what is stated in its bibliography (above) and I anxiously await Dr. Munir's disposition of it.

*CLERODENDRUM LANCEOLIFERUM* S. Moore ex J. G. Baker in Rendle, Journ. Bot. Brit. 63: Suppl. 81 [as "*Clerodendron*"]. 1925; Mold., Known Geogr. Distrib. Verbenac., ed. 1, 63 & 90. 1942.

Synonymy: *Clerodendron lanceoliferum* S. Moore ex J. G. Baker in Rendle, Journ. Bot. Brit. 63: Suppl. 81. 1925.

Bibliography: J. G. Baker in Rendle, Journ. Bot. Brit. 63: Suppl.

81. 1925; Greene, Kew Bull. Misc. Inf. 1930: 43. 1930; Fedde & Schust., Justs Bot. Jahresber. 53 (1): 1072. 1932; A. W. Hill, Ind. Kew. Suppl. 8: 54. 1933; Mold., Known Geogr. Distrib. Verbenac., ed. 1, 63 & 90. 1942; Mold., Alph. List Cit. 1: 207. 1946; Mold., Known Geogr. Distrib. Verbenac., ed. 2, 143 & 182. 1949; Mold., Résumé 188 & 451. 1959; Mold., Fifth Summ. 1: 322 (1971) and 2, 868 & 971. 1971; Mold., Phytol. Mem. 2: 313, 387, & 539. 1980.

Moore's original (1925) description of this plant is: "Arbor grandis; ramis subteretibus bene foliosis minute pubescentibus postea glabrescentibus; foliis oppositis vel ternis ejusdem paris saepe inaequalibus majoribus 17--20 x 3.5--4 cm. minoribus summum circa 8 x 2.5 cm. oblongo-lanceolatis acuminatis margine integris leviterve undulatis basi trinervibus membranaceis supra scabriusculis subtus in costis puberulis petiolis 5.5--7 cm. long. foll. minorum circa 2 cm.; cymis axillaribus foliis paullo brevioribus patentibus laxifloris bracteis paucis foliaceis inferioribus saepe 6 x 1 cm. onustis superioribus gradatim imminutis; pedunculis minute pubescentibus 5.5--8 cm. long.; pedicellis tenuibus calyci subaequilongis uti calyx glanduloso-pubescentibus; calyce 14--15 mm. long. segmentis linearibus acuminatis 11 mm. long.; corollae axtus glanduloso-pubescentis tubo recto 23 x 1 (ipso sub limbo fere 2) mm. lobis subaequilongis anticis concavis 7 mm. long.; antheris ovatis 2 mm. long."

The species is based on *Forbes 2813* from virgin forest at Tandjong-Ning, R. Bliti, Palembang, Sumatra, at an altitude of 600 feet. The corollas are said to have been white and a reported vernacular name for the plant is "katoempoeng".

In the herbarium of the Botanisches Institut der Universität in Vienna, I have seen a specimen purporting to be of *Forbes 2813*, the type collection of this species, but it proves to be not even verbenaceous! I suspect that it represents a case of mixed labels during mounting, since the specimen itself does not agree at all in its characters with Moore's published description (above).

Nothing else is known to me of this taxon.

*CLERODENDRUM LANESSANII* Dop in Lecomte, Notul. Syst. 4: 9 [as "*Clerodendron*"]. 1920; Mold., Known Geogr. Distrib. Verbenac., ed. 1, 59 & 90. 1942.

Synonymy: *Clerodendron lanessanii* Dop in Lecomte, Notul. Syst. 4: 9. 1920.

Bibliography: Dop in Lecomte, Notul. Syst. 4: 9. 1920; A. W. Hill, Ind. Kew. Suppl. 6, imp. 1, 49. 1926; Fedde & Schust., Justs Bot. Jahresber. 48 (1): 497. 1927; Dop in Lecomte, Fl. Gén. Indo-chine 4: 852 & 877. 1935; Mold., Known Geogr. Distrib. Verbenac., ed. 1, 59 & 90. 1942; H. N. & A. L. Mold., Pl. Life 2: 68. 1948; Mold., Known Geogr. Distrib. Verbenac., ed. 2, 136 & 182. 1949; A. W. Hill, Ind. Kew. Suppl. 6, imp. 2, 49. 1959; Mold., Résumé 175 & 451. 1959; Mold., Fifth Summ. 1: 300 (1971) and 2: 868. 1971; Mold., Phytologia 31: 395. 1975; Mold., Phytol. Mem. 2: 291, 387, & 539. 1980; Mold., Phytologia 60: 142. 1986.

A shrub; branches glabrous, lenticellate; leaves decussate-opposite; petioles slender, about 4 cm. long; leaf-blades membranous, obovate or obovate-oblong, about 13 cm. long and 4.5 cm. wide, apically rounded and short-acuminate, marginally subentire or irregularly sinuate-dentate, basally acute, glabrous; midrib rounded, very prominent; secondaries slender, 12--14, arcuate; tertiaries subparallel; veinlet reticulation somewhat distinct; inflorescence terminal, paniculate, 8--10 cm. long, 5--6 cm. wide, glabrous, the ramifications slender, re-branched; bracts small, linear; bractlets obsolete; pedicels short; calyx campanulate, 6--7 mm. long, glabrous, deeply divided, the tube almost obsolete, the lobes linear-oblong, 6 mm. long, 1 mm. wide, apically acute; corolla hypocrateriform, glabrous, the tube cylindric, 10 mm. long, the lobes spatulate, 5--6 mm. long, apically obtuse; stamens long-exserted; filaments glabrous; anthers oblong; style slender; stigma shortly bifid; ovary glabrous; fruit not known.

This species is based on an unnumbered de Lanessan collection from Poulo-Condor, Cochinchina, Vietnam. A key to help distinguish it from other Indochinese taxa in this genus will be found under *C. hahnianum* Dop in the present series of notes [60: 141--143].

Nothing is known to me of this plant beyond what is stated in its rather brief bibliography (above).

*CLERODENDRUM LANKAWIENSE* King & Gamble, Kew Bull. Misc. Inf. 1908: 110 [as "*Clerodendron*"]. 1908; Fletcher, Kew Bull. Misc. Inf. 1938: 404, 407, 424, & 426. 1938.

Synonymy: *Clerodendron lankawiense* King & Gamble, Kew Bull. Misc. Inf. 1908: 110. 1908. *Clerodendron langkawiense* K. & G. apud M. R. Henderson, Gard. Bull. Straits Settl. 7: 118. 1933.

Bibliography: King & Gamble, Kew Bull. Misc. Inf. 1908: 110. 1908; Gamble in King & Gamble, Journ. Asiat. Soc. Beng. 74 (2 extra): 826 & 830. 1908; Ridl., Journ. Roy. Asiat. Soc. Straits 59: 156. 1911; Prain, Ind. Kew. Suppl. 4, imp. 1, 50. 1913; H. J. Lam, Verbenac. Malay. Arch. 249 & 364. 1919; Bakh. in Lam & Bakh., Bull. Jard. Bot. Buitenz., ser. 3, 3: 95, 109, & IX. 1921; Ridl., Fl. Malay Penins. 2: 624 & 625. 1923; M. R. Henderson, Gard. Bull. Straits Settl. 7: 118. 1933; Fletcher, Kew Bull. Misc. Inf. 1938: 404, 407, 424, & 426--427. 1938; Mold., Known Geogr. Distrib. Verbenac., ed. 1, 55, 56, 60, 61, & 90. 1942; Mold., Alph. List Cit. 1: 268. 1946; Prain, Ind. Kew. Suppl. 4, imp. 2, 50. 1958; Anon., Kew Bull. Gen. Ind. 77. 1959; Mold., Résumé 165, 166, 177, 179, & 451. 1959; Mold., Fifth Summ. 1: 282, 285, 295, 304, & 307 (1971) and 2: 868. 1971; Mold., Phytologia 32: 46. 1975; Anon., Biol. Abstr. 61: AC1.581. 1976; Hocking, Excerpt. Bot. A.28: 171. 1976; Mold., Phytologia 34: 264. 1976; Mold., Phytol. Mem. 2: 272, 284, 295, 298, & 539. 1980; Brenan, Ind. Kew. Suppl. 16: 71. 1981; Mold., Phytologia 60: 198 (1986) and 61: 89 & 187. 1986.

A shrub; branchlets obtusely tetragonal, canaliculate, scabrid-puberulous; leaves decussate-opposite; petioles about 6 mm. long, scabrid-pubescent; leaf-blades chartaceous, oblong or oblong-lanceolate to oblanceolate or obovate, 7.5--10 cm. long, 1.2--2.5 cm. wide, apically acute, marginally entire, basally attenuate, subglabrous to sparsely hispid with jointed hairs on both surfaces, pubescent on the larger venation beneath; midrib stout; secondaries 8--10 pairs, curving arcuately upwards to and along the margins; tertiaries transverse, few, irregular; veinlets reticulate; inflorescence terminal, paniculate, pyramidal, leafy, thyrsoid, the lower ramifications axillary to the uppermost leaves, to 23 cm. long and 10 cm. wide, scabrid-pubescent; sympodia about 2.5 cm. long; cymes pedunculate, trichotomous, rather few-flowered; bracts foliaceous, lanceolate; bractlets small, setaceous; pedicels slender, about 4 mm. long; buds clavate, to 1.8 cm. long; calyx campanulate, externally scabrous-hispid, internally glabrous and with large peltate glands, cleft to about 2/3 the length, prominently venose, the lobes ovate, 4--6 mm. long, basally 2 mm. wide; corolla hypocrateriform, the tube slender, cylindric, about 1.2 cm. long, externally pubescent, the lobes obovate, spreading, the middle lobe of the lower lip longer than the others; stamens long-exserted; filaments very slender, glabrous; anthers oblong, 1 mm. long, with 2 parallel thecae; style very slender; stigma very shortly bilobed; ovary rounded, externally glabrous; fruit not known.

This species is based on *Curtis 3789* from Terutan on Langkawi island, Kedah, Malaya, deposited in the Singapore herbarium. King & Gamble note that "Only one specimen of this species is available. It is near C. *Griffithianum*, Clarke, but differs in the inflorescense, calyx, &c."

Henderson (1933) comments that this species is probably related to *C. hispidum* M. R. Henderson, which, however, differs in its "ramis pubescentibus pilis longis, foliis multo latioribus, hispidis, petiolis longioribus, calyce maiore, tubo corollae multo breviore."

Collectors have encountered *C. lankawiense* in evergreen forests and in scrub near streams, from near sealevel to 900 m. altitude.

Ridley (1911) cites also *Ridley 2515* from Langkawi; Fletcher (1938) cites *Haniff & Nur 2084 & 2735* and *Kerr 11722, 12927, 16283, 16283a, & 17525* from Thailand and *Robinson 6257* from Langkawi. Bakhuizen (1921) lists the species from Malacca.

Citations: THAILAND: *Put 2096* (Ed). MALAYAN ISLANDS: Langkawi: *Curtis 3789* (N--photo of type, W--photo of type).

*CLERODENDRUM LANKAWIENSE* var. *ANDAMANENSE* Mold., Phytologia 32: 46. 1975.

Bibliography: Mold., Phytologia 32: 46. 1975; Anon., Biol. Abstr. 61: AC1.581. 1976; Hocking, Excerpt. Bot. A.28: 171. 1976; Mold., Phytologia 34: 264. 1976; Mold., Phytol. Mem. 2: 274 & 539. 1980; Brenan, Ind. Kew. Suppl. 16: 71. 1981; Mold., Phytologia 61: 187. 1986.

This variety differs from the typical form of the species in having its leaf-blades perfectly elliptic, 6--25 cm. long, 2--10 cm. wide, acute at both ends or slightly subacuminate and very minutely apiculate at the apex and the calyx during anthesis conspicuously marked with crateriform glands on the outer surface.

The variety is based on an unnumbered Sulphiz Kurz collection from North Corbyna Cove on South Andaman Island in the Andaman Islands and is deposited in the Munich herbarium.

Citations: ANDAMAN ISLANDS: South: *Helfer 6046/1* (L); *Kurz s.n.* (Ld--photo of type, Mu--1149--isotype, Mu--3808--type).

*CLERODENDRUM LANUGINOSUM* Blume, Bijdr. Fl. Ned. Ind. 14: 810. 1826.

Synonymy: *Bignonia comosa* Roxb., Hort. Beng., imp. 1, [95] nom. nud. 1814; Fl. Indica, ed. 2, imp. 1, 3: 103. 1832 [not *B. comosa* Cham., 1832]. *Spathodea ? comosa* G. Don, Gen. Syst. 4: 222. 1838. *Clerodendron lanuginosum* Blume apud D. Dietr., Syn. Pl. 3: 617. 1842.

Bibliography: Roxb., Hort. Beng., imp. 1, [95]. 1814; Blume, Bijdr. Fl. Ned. Ind. 14: 810. 1826; Cham., Linnaea 7: 693. 1832; Roxb., Fl. Indica, ed. 2, imp. 1, 3: 103. 1832; G. Don, Gen. Syst. 4: 222. 1838; Steud., Nom. Bot. Phan., ed. 2, 1: 383. 1840; D. Dietr., Syn. Pl. 3: 617. 1842; Walp., Nov. Act. Nat. Cur. 19, Suppl. 1: 380. 1843; A. P. DC., Prodr. 9: 144. 1845; Walp., Repert. Bot. Syst. 4: 109. 1845; Schau. in A. DC., Prodr. 11: 672. 1847; Buek, Gen. Spec. Syn. Candoll. 3: 106. 1858; Miq., Fl. Ned. Ind. 2: 751 & 882. 1858; Miq., Ann. Mus. Bot. Lugd. 3: 253. 1867; Roxb., Fl. Indica, ed. 2, imp. 2, 3: 103. 1874; Jacks. in Hook. f. & Jacks., Ind. Kew., imp. 1, 1: 561. 1893; E. D. Merr., Philip. For. Bur. Bull. 1: 52. 1903; Pulle in Lorentz, Nova Guinea, ser. 1, 8: 403. 1911; H. Hallier, Meded. Rijks Herb. Leid. 37: 68. 1918; H. J. Lam, Verbenac. Malay. Arch. 293--294 & 364. 1919; Bakh. in Lam & Bakh., Bull. Jard. Bot. Buitenz., ser. 3, 3: 76, 90, 96, 109, & IX. 1921; E. D. Merr., Enum. Philip. Flow. Pl. 3: 402--403. 1923; Bakh. in Bakh. & Lam, Nova Guinea, ser. 1, 14, Bot. 1: 171. 1924; Mold., Alph. List Comm. Vern. Names 3, 19, 27, & 29. 1939; Mold., Known Geogr. Distrib. Verbenac., ed. 1, 62, 66, & 90. 1942; Mold., Phytologia 2: 100. 1945; Jacks. in Hook. f. & Jacks., Ind. Kew., imp. 2, 1: 561. 1946; Mold., Alph. List Cit. 1: 191. 1946; Mold., Alph. List Inv. Names Suppl. 1: 6. 1947; Mold., Alph. List Cit. 2: 449 (1948) and 4: 1155 & 1236. 1949; Mold., Known Geogr. Distrib. Verbenac., ed. 2, 141, 148, & 182. 1949; Mold., Biol. Abstr. 26: 1471. 1952; Van Steenis, Act. Bot. Neerl. 2: 305--306. 1953; Bremekamp, Biol. Abstr. 29: 2933. 1955; Mold., Résumé 183, 193, 199, 237, 265, 345, & 451. 1959; Jacks. in Hook. f. & Jacks., Ind. Kew., imp. 3, 1: 561. 1960; Mold., Fifth Summ. 1: 316, 322, 332, 396, & 449 (1971) and 2: 623 & 868. 1971; Roxb., Fl. Indica, ed. 2, imp. 3, 3: 103. 1971; Altschul, Drugs Foods 248. 1973; Mold., Phytol. Mem. 2: 306, 313, 322, & 539. 1980; Roxb., Hort. Beng., imp. 2, [95]. 1980; P. Holmgren & al., Ind. Vasc. Pl. Type Microf. 441. 1985; Mold., Phytologia 57: 467 & 468 (1985), 58: 448 (1985), 59: 119 (1986), and 61: 413. 1986.

A shrub, 3--7 m. tall; stems to 6.5 cm. in diameter; branches and branchlets densely lanuginous; leaves decussate-opposite, petiolate; petioles densely lanuginous; leaf-blades chartaceous, ovate, apically acuminate, marginally distantly serrate-dentate or denticulate, subentire when young, basally usually subcordate, softly pubescent on both surfaces; calyx campanulate, 1--1.5 cm. long, purple, externally lanuginous with wide-spreading hairs, deeply 5-fid, the segments apically acuminate; corolla hypocrateriform, white; fruit drupaceous, purple.

Blume's original (1826) description of this plant is: "C. foliis oppositis ovatis acuminatis basi interdum subcordatis remote denticulatis utrinque mollibus junioribus (subintegerrimis) ramulis calicibusque (externe) lanuginosis, pedunculis dichotomis (calix campanulatus, quinquefidus, laciniis acuminatis). Crescit: in montosis insularum Moluccanarum. Floret: toto anno."

Hallier (1918) comments, in speaking of *C. lanuginosum*: "*Elmer no. 11338* vom Berge Apoh auf Mindanao gehört nicht zu dieser Art, sondern ist wohl nur eine stärker behaarte Abart des nahe verwandten *Cl. Preslii* Elm. (Negros: *Elmer no. 10223*), das durch seine violettrothen Kelche seine nahe Verwandtschaft zu den letzten beiden Arten [*C. catalpifolium* H. Hallier & *C. brunfelsiiflorum* H. Hallier], in der Form des Kelches aber auch eine solche zu *Cl. Minahassae* T. et B. bekundet." It should be noted that *Elmer 11338*, mentioned above, is the type collection of *C. macrocalyx* H. J. Lam, which see.

Van Steenis (1953), in speaking of *Bignonia comosa* Roxb., says: "The identity of this species, described from the Moluccas, has up till now remained obscure. An authentic specimen (possibly an isotype) is present at Brussels, in the herbarium of v. Martius, with Roxburgh's handwriting and addition of the number '2652'. However, this sheet, which was kindly loaned by Prof. Robijns, does not wholly conform to the description; it contains a leafy twig, and a detached fruit, whereas the description points to leaves and flowers only. On the other hand the leaves exactly match the description. Both Dr. Merrill and I myself are of the opinion that the leaves doubtless represent a *Clerodendron* (*Verbenaceae*). The capsule apparently belonging to a separate small label on which is written: 'Capsule of No 14 Pou Madyro an *Bignonia*', we find doubtless bignoniaceous (but not *Bignonia chelonoides*, Roxb. l.c. 106), and I can add that it belongs to a species which is certainly not native in Malaysia, but presumably in SE. Asia. I assume the pod was added later, anyhow erroneously to the sheet, as it was not mentioned in the type description. The leaves, therefore, should be taken as typifying Roxburgh's species. In verifying these leaves with the Rijksherbarium collections I have found them exactly matching those of *Clerodendron lanuginosum* Bl. (1825). *Bignonia comosa* Roxb. is therefore to be added to the synonymy of the latter."

Collectors have encountered *Clerodendrum lanuginosum* in secondary forests, old clearings, along roadsides, and on coral-limestone strand, from sealevel to 50 m. altitude, in flower in April and from June to November, in fruit in July and October, but Blume avers that it flowers all through the year. Olsen comments that it is "common in secondary forests" on Tawi-tawi island.

The corollas are described as "white" on all collections where any note at all is made of flower color (viz., *DeBruyn 38l*, *Ebalo 897*, *Teijsmann 5243* & *5631*, and *Williams 3120*. *Edano 239* [Herb. Philip. Bur. Sci. 75881], tentatively cited below, is said to have had whitish-pink flowers and black stamens and may prove not to be this species or even verbenaceous at all.

Distinctly serrate leaf-blades may be seen on *Sallnam 81*, *Beguin 961*, and *Herb. Philip. Bur. Sci. 41803* & *44009*, and finely denticulate ones on *Williams 3120*.

Dietrich (1843) lists C. *lanuginosum* from Java -- and only from there -- but this is probably an error since he quotes only Blume's original description wherein the species is plainly accredited, not to Java, but to the Molucca Islands.

Bakhuizen lists the species from the Philippines, the Moluccas, and New Guinea [West Irian, Biak & Schouten islands].

A key to help distinguish this species from other Indonesian taxa will be found under C. *klemmei* Elm. in the present series of notes [61: 410--415].

Vernacular names recorded for C. *lanuginosum* are "antutuñgau-taluk", "asni", "derunal", "magalablab", "mal-mal", "paiton", "pait-pait", "salumpapait", "takipan", "tanogo", and "tingkao".

Hallier (1918) cites *Collector undetermined s.n.* from Ternate, *De Vriese & Teijsmann s.n.* from Ceram, and *Reinwardt s.n.* from Banda. Merrill (1921) cites *Alviar, Philip. For. Bur. 25911, Elmer 13559, Hallier s.n., Merrill 8239, Ramos 14477, Ramos & Edaño 38617, Reillo 15404*, and *Weber 1102* from Basilan, Camiguin de Misamis, and Mindanao, in the Philippines, noting that in the Philippines the species occurs "In thickets and secondary forests at low altitudes". He gives as extra-limital distribution Banda, Ceram, and Ternate.

Altschul (1973) cites *Añonuevo 210* and *Frake 588* from the Philippines, reporting that there the leaves are used medicinally to treat splenomegaly (enlargement of the spleen) and that the scraped off bark is applied to the forehead to treat headaches.

It may be noted here that the original Blume (1826) reference in the species' bibliography is sometimes cited, erroneously, as part "9" and dated "1825".

*Olsen 673*, on its collector's label, indicates that the "flowers" were "purple", but only fruits, not flowers, appear on the specimen, so it is most probable that it is fruit color, and not corolla color, that was intended by the notation.

The *Edaño, Philip. Bur. Sci. 41803* and *Ramos & Edaño, Philip. Bur. Sci. 44009* collections, cited below, were erroneously mis-cited by me as representing C. *cumingianum* Schau. in a previous installment of the present notes -- the former was actually so regarded by both Bakhuizen and Merrill, but examination shows the calyx far too broad for that taxon.

Bakhuizen (1921) includes a "*Clerodendron pubescens* Walp." in the synonymy of C. *lanuginosum*, but this binomial belongs, instead, in the synonymy of C. *viscosum* Vent.

Material of *Clerodendrum lanuginosum* has been misidentified and distributed in some herbaria as C. *adenophysum* H. Hallier, C. *cumingianum* Schau.. C. *macrostegium* Schau., C. *philippinum* Schau., and C. *villosum* Blume. On the other hand, the *Bünnemeijer 2414*, distributed as C. *lanuginosum*, actually is the type collection of C. *leparense* Mold., while *Ahern 691. Antonio, Philip. Bur. Sci 31154, Clemens 1960, DeVore & Hoover 173, Elmer 11338, Lagrimas 213, Mallonga, Philip. For. Bur. 26265, Ramos & Pascasio, Philip. Bur. Sci. 35024*, and *Wenzel 2621* & *3376* are C. *macrocalyx* H. J. Lam (the *Elmer 11308* collection being its type collection) and *Bartlett 15567* is

*C. villosum* Blume.

Citations: PHILIPPINE ISLANDS: Basilan: *Ebalo 897* (Mi). Jolo: *R. S. Williams 3120* (N, N). Leyte: *Edaño, Philip. Bur. Sci. 41803* (Bz--19103, Ca--239645). Luzon: *Edaño, Philip. Bur. Sci. 75881* (N); *Loher 4421* [=Vidal 1650"] (Mu). Mindanao: *Frake & Frake 162* [Philip. Nat. Herb. 36023] (W--2277029); *Ramos & Edano, Philip. Bur. Sci. 38617* (Bz--19901, W--1292230); *Zwickey 13* (Mi, N). Tawi-tawi: *S. Olsen 673* (Cp), *687* (Cp), *776* (Cp); *Ramos & Edaño, Philip. Bur. Sci. 44009* (B, Bz--19106, Ca--257643, N). Island undetermined: *Herb. N. Y. Bot. Gard. s.n.* (N). GREATER SUNDA ISLANDS: Kalimantan: *Schuitemaker 107* (Bz--20952, Bz--20953, Bz--20954). MOLUCCA ISLANDS: Batjan: *Teijsmann 5631* (Bz--19891, Bz--19892). Halmahera: *Anang 648* (Bz--72997), *637* (Bz--72913); *Lam 3727* (Bz--19898). Morotai: *Main & Aden 1489* (Bz--72714). Obi: *Atasrip 84* (Bz--19893, Bz--19894, Bz--26622, Bz--26623); *Sallnam 81* (Bz--19895, Bz--19896, Bz--19897). Ternate: *Anang 83* (Bz--72996); *Beguin 961* (Bz--19900); *Teijsmann 5243 H.B.* (Bz--19899, Ut--43904). LOCALITY OF COLLECTION UNDETERMINED: *Zollinger 1143* (Ut--43905).

*CLERODENDRUM LANUGINOSUM* var. *ADPRESSIPILUM* Mold., Phytologia 4: 49. 1952.

Bibliography: Mold., Biol. Abstr. 26: 1471. 1952; Mold., Phytologia 4: 49. 1952; Mold., Résumé 183 & 451. 1959; Mold., Fifth Summ. 1: 316 (1971) and 2: 868. 1971; Mold., Phytol. Mem. 2: 306 & 539. 1980; P. Holmgren & al., Ind. Vasc. Pl. Type Microf. 441. 1985; Mold., Phytologia 59: 119. 1986.

This variety differs from the typical form of the species only in having the dense pubescence closely appressed to the exterior of the calyx.

The variety is based on *Elmer 13559* from Cabadbaran, Mt. Urdaneta, in the Province of Agusan, Mindanao, Philippine Islands, collected in August, 1912, and deposited in the Buitenzorg herbarium.

The type and thus far only known collection of this taxon was previously misidentified and distributed in herbaria as *C. cumingianum* Schau.

Citations: PHILIPPINE ISLANDS: Mindanao: *Elmer 13559* (Bi--isotype, Bz--19109--type, Ld--photo of type, N--isotype, N--photo of isotype, W--1172281--isotype).

*CLERODENDRUM LASIOCEPHALUM* C. B. Clarke in Hook. f., Fl. Brit. India 4: 594 [as "*Clerodendron*"]. 1885; Mold., Prelim. Alph. List Inv. Names 20. 1940.

Synonymy: *Clerodendron lasiocephalum* C. B. Clarke in Hook. f., Fl. Brit. India 4: 594. 1885. *Clerodendron lasiocephalus* C. B. Clarke ex Mold., Prelim. Alph. List Inv. Names 20 in syn. 1940. *Clerodendron lasciocephalum* C. B. Clarke apud Nath, Bot. Surv. South. Shan States 305. 1960.

Bibliography: C. B. Clarke in Hook. f., Fl. Brit. India 4: 594. 1885; Collett & Hemsl., Journ. Linn. Soc. Lond. Bot. 28: 111. 1890; Jacks. in Hook. f. & Jacks., Ind. Kew., imp. 1, 1: 561. 1893; Brandis, Indian Trees, imp. 1 & 2, 507--508 (1906), imp. 2a, 507--508

(1907), imp. 3, 507--508 (1911), and imp. 4, 507--508. 1921; Rodger in Lace, List Trees Shrubs Burma, ed. 2, 132. 1922; Fletcher, Kew Bull. Misc. Inf. 1938: 405, 407, 425, & 430. 1938; Kanjilal, Das, Kanjilal, & De, Fl. Assam, imp. 1, 3: 486, 489, & 546. 1939; Mold., Prelim Alph. List Inv. Names 20. 1940; C. E. C. Fischer, Kew Bull. Misc. Inf. 1940: 299. 1941; Mold., Alph. List Inv. Names 18. 1942; Mold., Known Geogr. Distrib. Verbenac., ed. 1, 54 & 90. 1942; Jacks. in Hook. f. & Jacks., Ind. Kew., imp. 2, 1: 561. 1946; Mold., Alph. List Cit. 1: 105. 1946; Mold., Known Geogr. Distrib. Verbenac., ed. 2, 126 & 182. 1949; E. J. Salisb., Ind. Kew. Suppl. 11: 56. 1953; Anon., Kew Bull. Gen. Ind. 77. 1959; Mold., Résumé 161, 265, & 451. 1959; Jacks. in Hook. f. & Jacks., Ind. Kew., imp. 3, 1: 561. 1960; Nath, Bot. Surv. South. Shan States 305. 1960; Deb, Bull. Bot. Surv. India 3: 314. 1961; Hundley & Ko in Lace, Trees Shrubs Burma, ed. 3, 203. 1961; Rao & Rabha, Bull. Bot. Surv. India 8: 301. 1966; Panigrahi & Joseph, Bull. Bot. Surv. India 8: 151. 1966; Mold., Résumé Suppl. 15: 18. 1967; Pande, Bull. Dept. Med. Pl. Nepal 1: 36. 1967; Mold., Résumé Suppl. 16: 9. 1968; Brandis, Indian Trees, imp. 5, 507--508. 1971; Mold., Fifth Summ. 1: 273, 282, & 449 (1971) and 2: 868. 1971; Mold., Phytologia 28: 444. 1974; Mold., Phytol. Mem. 2: 259, 272, & 539. 1980; Kanjilal, Das, Kanjilal, & De, Fl. Assam, imp. 2, 486, 489, & 546. 1982; Mold., Phytologia 54: 238 (1983), 60: 135 (1986), and 61: 90. 1986.

A shrub, to about 3.3 m. tall; branchlets antrorsely pubescent or tomentose; leaves decussate-opposite; petioles 2.5--15 cm. long; leaf-blades membranous, ovate or elliptic-oblong, 8--25 cm. long, 6--13 cm. wide, apically acuminate, marginally dentate, basally cuneate or rounded, sparsely pubescent or tomentose on both surfaces; secondaries 5--7 per side; inflorescence paniculate, terminal, erect, subcapitate, sessile, 5--7.5 cm. wide, depressed globose, pubescent, the cymes compact, corymbiform, subcapitate; bracts linear; flower-buds violet; calyx pubescent, about 1.8 cm. long, divided nearly to the base, the segments flaccid, lanceolate or triangular-lanceolate, 1.2--2 cm. long, apically acuminate or caudate, basally subcordate, pubescent; corolla hypocrateriform, the tube slender, 2.5--4 cm. long, the limb 5-lobed, the lobes oblong or obovate, about 8 mm. long; fruit drupaceous, about 8 mm. wide, red.

This little-known species is based on *W. Griffith 6055* from the Mishmee hills in Upper Burma. Brandis (1906) lists the species as from "Mishmi and Duffa hills. Khasi hills. Shan hills, Upper Burma". Rao & Ragha (1966) record it from Assam, while Panigrahi & Joseph (1966) describe it as "scarce" in Nefa.

Collectors have encountered the species in secondgrowth, at 550 m. altitude, in flower in May. Deb asserts that it is "frequent in valleys" in Manipur, while Kanjilal and his associates (1939) assert that it flowers from April to July in Assam and fruits there at the end of the rainy season.

Vernacular names recorded for *C. lasiocephalum* are "pet pein", "pet-pein", and "syntew-domahi".

Collett & Hemsley (1890) cite *Aplin s.n.* from the Shan States of Burma; Fletcher (1938) cites only *Winit 784* from Thailand; Deb (1961) cites *Deb 173* from Manipur and Panigrahi & Joseph (1966) cite their *no. 15074* from Nefa. Pande (1967) lists the species from Nepal.

Keys to help distinguish *C. lasiocephalum* from other Indian and Assam taxa will be found under *C. griffithianum* C. B. Clarke in the present series of notes [60: 134--136] and from other Thailand taxa under *C. inerme* (L.) Gaertn. [61: 88--90].

It would appear that this species is very closely related to (if not identical with) the ancestral form of *C. philippinum* Schau.; in fact, the *Ihapa & Pradhan 4449*, distributed as *C. lasiocephalum*, actually is *C. philippinum*.

Citations: INDIA: Assam: *C. B. Clarke 44122a* (L). BURMA: Upper Burma: *Khalil s.n.*[1893] (W--369344).

*CLERODENDRUM LASTELLEI* Mold., Lloydia 13: 206. 1950.

Bibliography: Mold., Lloydia 13: 206. 1950; E. J. Salisb., Ind. Kew. Suppl. 11: 56. 1953; Mold. in Humbert, Fl. Madag. 174: 152, 204--206, & 268, fig. 33 (2). 1956; Mold., Résumé 155 & 451. 1959; Mold., Fifth Summ. 1: 260 (1971) and 2: 868. 1971; Mold., Phytol. Mem. 2: 249 & 539. 1980; P. Holmgren & al., Ind. Vasc. Pl. Type Microf. 441. 1985; Mold., Phytologia 58: 187. 1985.

Illustrations: Mold. in Humbert, Fl. Madag. 174: 205, fig. 33 (2). 1956.

A shrub; branchlets and twigs slender, grayish, obtusely tetragonal, often sulcate, sparsely lenticellate, glabrous; nodes not annulate; principal internodes 1.3--2.8 cm. long; leaves decussate-opposite; petioles slender, about 4 mm. long, glabrous; leaf-blades lightly coriaceous, uniformly bright-green on both surfaces, elliptic, shiny, 3--5 cm. long, 1.2--2.3 cm. wide, apically acute or slightly subacuminate, marginally entire, basally acute, glabrous on both surfaces; midrib slender, flat above, prominent beneath; secondaries very slender, 2--6 per side, irregular, ascending, arcuately joined near the margins beneath, obscure or subprominulous above; veinlet reticulation rather sparse, only the largest parts prominulous beneath, obscure above; inflorescence apparently terminal, cymose, few-flowered, usually only 3-flowered; peduncles slender, about 2.5 cm. long, glabrous, stramineous; pedicels comparatively stout, stramineous, 1.5--2 cm. long, glabrous; calyx coriaceous but not heavy, stramineous, not nigrescent, conspicuously venose, tubular-campanulate, about 2 cm. long, glabrous, its 5 lobes ovate, erect, about 5 mm. long, apically acute; corolla hypocrateriform, its tube very narrowly cylindric, 2 cm. long, externally glabrous, the limb about 2 cm. wide; stamens and pistil exserted 2--3 cm. from the corolla-mouth; fruiting-calyx and fruit not known.

This endemic Madagascar species is based on an unnumbered Lastelle collection, collected in 1841, and deposited in the Paris herbarium. It is known to me thus far only from the original collection. A key to help distinguish it from other Madagascar taxa will be found under *C. baronianum* Oliv. in the present series of notes [58: 184--190].

Citations: MADAGASCAR: *Lastelle s.n.* [1841] (E--photo of type, F--photo of type, Ld--photo of type, N--fragment of type, N--photo of type, P--type).

*CLERODENDRUM LATIFOLIUM* Friedrich, Abh. Geol. Specialkarte Preuss. 4 (3): 339 [181], pl. 23, fig. 4, & pl. 28, fig. 14 [as "*Clerodendron*"]. 1883; Mold., Prelim. Alph. List Inv. Names 20. 1940.

Synonymy: *Clerodendron latifolium* Friedrich, Abh. Geol. Specialkarte Preuss. 4 (3): 339 [181]. pl. 23, fig. 4, & pl. 28, fig. 14. 1883.

Bibliography: Friedrich, Abh. Geol. Specialkarte Preuss 4 (3): 339 [181], pl. 23, fig. 4, & pl. 28, fig. 14. 1883; Mold., Prelim. Alph. List Inv. Names 20. 1940; Mold., Alph. List Inv. Names 18. 1942; Mold., Known Geogr. Distrib. Verbenac., ed. 1, 75 & 90. 1942; H. N. & A. L. Mold., Pl. Life 2: 42. 1948; Mold., Known Geogr. Distrib. Verbenac., ed. 2, 166 & 182. 1949; Mold., Résumé 226, 265, & 451. 1959; Mold., Fifth Summ. 1: 375 & 449 (1971) and 2: 868. 1971; Mold., Phytol. Mem. 2: 368 & 539. 1980; Mold., Phytologia 57: 345. 1985.

Illustrations: Friedrich, Abh. Geol. Specialkarte Preuss. 4 (3): pl. 23, fig. 5, & pl. 28, fig. 14. 1883.

This species is described from the Oligocene of Germany.

*CLERODENDRUM LAXICYMOSUM* DeWild., Bull. Jard. Bot. Brux. 7: 171 [as "*Clerodendron*"]. 1920; B. Thomas, Engl. Bot. Jahrb. 68: [Gatt. Clerod.] 68. 1936.

Synonymy: *Clerodendron laxicymosum* DeWild., Bull. Jard. Bot. Brux. 7: 171. 1920.

Bibliography: DeWild., Bull. Jard. Bot. Brux 7: 171. 1920; De Wild., Pl. Bequaert. 2: 262--264. 1922; A. W. Hill, Ind. Kew. Suppl. 6, imp. 1, 49. 1926; Fedde & Schust., Justs Bot. Jahresber. 48 (1): 497 (1927) and 53 (1): 1072. 1932; B. Thomas, Engl. Bot. Jahrb. 68: [Gatt. Clerod.] 39, 68, & 94. 1936; Mold., Known Geogr. Distrib. Verbenac., ed. 1, 48 & 90 (1942) and ed. 2, 115 & 182. 1949; A. W. Hill, Ind. Kew. Suppl. 6, imp. 2, 49. 1959; Mold., Résumé 137, 141, 143, & 451. 1959; Mold., Fifth Summ. 1: 220, 229, & 233 (1971) and 2: 868. 1971; Mold., Phytologia 31: 395. 1975; Mold., Phytol. Mem. 2: 210, 219, 223, 387, & 539. 1980; P. Holmgren & al., Ind. Vasc. Pl. Type Microf. 441. 1985; Mold., Phytologia 58: 206, 298, & 299. 1985.

A branched, climbing shrub, 2--4 m. tall, or liana, branched from the base, glabrous almost throughout; stems often "as thick as a man's upper arm", spiny; leaves decussate-opposite or alternate, borne on long slender shoots; petioles 1.5--6 cm. long, more or less verrucose, articulate 1--3 mm. from the base, the basal portion persisting as a woody spine about 3 mm. long; leaf-blades oval or elliptic to obovate, 7--15 cm. long, 2--7.5 cm. wide, apically acuminate (the acumen itself obtuse or subacute), marginally entire, basally broadly cuneiform, glabrous on both surfaces; secondaries 6 or 7 per side, more prominent beneath than above, anastomosing in an arc before reaching the margins; inflorescence axillary and terminal, the cymes pedunculate, lax, to 19 cm. long; peduncles green, sometimes carrying 1 or 2 bud-traces, to 9 cm. long; rachis and ramifications of the inflorescence glabrous or very shortly puberulent, the lateral branches about 2 cm. long, dichotomous, 7-flowered;

bractlets linear, to 5 mm. long, ciliolate, caducous; pedicels 3--4 mm. long; flowers cauliflorous, often borne directly on the main stem far below the lowest leaves; calyx green, more or less campanulate, 7--9 mm. long, externally glabrous, the rim 5-toothed, the teeth deltoid, about 2.5 mm. long, apically subacute; corolla white or pale-rose, hypocrateriform, the tube slender, 8--9 mm. long, apically enlarged, the limb 5-lobed. the lobes reflexed, about 3 mm. long; stamens 4, white, exserted about 4 mm. from the corolla-mouth; anthers brown; pistil 1; style long-exserted.

This species is based on *J. Bequaert 1844* from a secondary forest at Avakubi, Zaire, collected on January 9, 1914, and deposited in the Brussels herbarium.

Collectors have encountered this plant in forests and montane forests, often growing in clayey=sandy soil, at altitudes of 450--1780 m., in flower in April and from August to December. The only vernacular name recorded for it is "mbambake e boliki".

The corollas are described as having been "white" on *Bequaert 6438, Eggelsing 2271, Ghesquière 4279,* and *Gille 138* and "pale-rose" on *Lebrun 6000.*

DeWildeman (1920) observes that "Cette espèce se caractérise nettement par ses cymes axillaires et terminales, formant, semble-t-il, à l'extrémité des rameaux, d'amples inflorescences feuillées. Par ses cymes non capitées, ses fleurs petites, elle se classerait dans le groupe des espèces réunies par M. Baker (Flora of trop. Africa, V p. 293) sous les n. 7-20; les trois dernières étant écartées par la forme cordée des feuilles. Il est malheureusement plus difficule de la classer dans une des deux sections: Feuilles oblongues (n. 7--15). Feuilles ovales, arrondies à la base (n. 16--18). Car, sur le même rameau, nous observerons des feuilles: franchement ovales, elliptiques et mêmes obovales. Il est aisé d'écarter toute une série des espèces de cette subdivisions par la pubescence de leurs feuilles. Quant au caractère sur lequel M. Baker attire l'attention pour separer *C. kentrocaule* Baker, *C. glabrum* Meyer, *C. volubile* Pal. Beauv. et *C. formicarum* Gürke: base du pétiole persistante dans la première, il nous parait de faible valeur, car il existe, entre autres, nettement chez le *C. volubile* Pal. Beauv., qui en serait privé,"

Gille describes *C. laxicymosum* as a "grosse liane dépendant autour de forte tronce, a aspect tordu; les fleurs constituées en grappe sont portées sur une petite hampe florale delaquelle partent opposées deux a deux, les pédicelles rigoureusement horizontaux de l'extrémité desquels sortent 5fleure côte à côte". He states that in Zaire the stems are used to make liana bridges over streams. This is the only species in the *Verbenaceae* that I know of which is used for this purpose.

A key that may prove helpful to distinguish *C. laxicymosum* from some of its near relatives is the following:

1. Leaf-blades always marginally entire.
   2. Inflorescence mostly cauliflorous at or near the base of the stems; larger branches mostly very conspicuously long-spiny; leaves mostly glabrous.

3. Inflorescence congested, often subcapitate......*C. botryodes*.
3a. Inflorescence not congested.
4. Calyx narrow-elongate, 6--8 mm. long; leaf-blades thin-membranous, fragile in drying
5. Petioles all short and entirely glabrous, 5--18 mm. long; calyx glabrous...........................*C. silvestre*.
5a. Petioles elongate, to 4 cm. long or longer, pubescent at least on the upper margin; calyx puberulent......... *C. buchholzii*.
4a. Calyx broadly obconic; leaf-blades somewhat leathery, not fragile in drying........................*C. laxicymosum*.
2a. Inflorescence plainly axillary or terminating the branchlets.. *C. thonneri*.
1a. Leaf-blades marginally more or less dentate....*C. tanganyikense*.

It should be noted here that Fedde & Schuster (1927) mis-cite the type collection of *C. laxicymosum* as *Bequaert "1814"* instead of *"1844"*, doubtless due to a typographic error. Thomas (1936) cites only *Bequaert 1844* and *Pogge 1203* from Zaire.

Material of *C. laxicymosum* has been misidetnified and distributed in some herbaria as *C. buchholzii* Gürke.

Citations: GHANA: *Vigne 4256* (Br). ZAIRE: *Bequaert 1844* (Br--type, Ld--photo of type, N--fragment of type, N--photo of type), *6438* (Br); *Ghesquière 4299* (Br); *Gille 138* (Br, Br, Br, Br, Br); *Lebrun 3904* (Br, Br, N), *3987* (Br, Br), *6000* (Br, Br, N), *6072* (Br), Br); *B. Lemaire 149* (Br); *Louis 13592* (Br), *15691* (Br); *Renier 60* (Br, N). UGANDA: *P. Chandler 1587* (N); *Eggelsing 2271* (Br).

*CLERODENDRUM LAXIFLORUM* J. G. Baker, Journ. Linn. Soc. Lond. Bot. 20: 229 [as "*Clerodendron*"]. 1883; Mold., Revist. Sudam. Bot. 8: 170. 1950.

Synonymy: *Clerodendron laxiflorum* J. G. Baker, Journ. Linn. Soc. Lond. Bot. 20: 229. 1883.

Bibliography: J. G. Baker, Journ. Linn. Soc. Lond. Bot. 20: 229. 1883; Jacks. in Hook. f. & Jacks., Ind. Lew., imp. 1, 1: 561 (1893) and imp. 2, 1: 561. 1946; Mold., Revist. Sudam. Bot. 8: 170. 1950; Mold. in Humbert, Fl. Madag. 174: 154, 223, 225--227, 266, & 268, fig. 36 (5 & 6). 1956; Mold., Résumé 155, 417, & 451. 1959; Jacks. in Hook. f. & Jacks., Ind. Kew., imp. 3, 1: 561. 1960; Mold., Fifth Summ. 1: 260 (1971) and 2: 770 & 868. 1971; Mold., Phytol. Mem. 2: 249 & 539. 1980; Mold., Phytologia 58: 189. 1985.

Illustrations: Mold. in Humbert, Fl. Madag. 174: 223, fig. 36 (5 & 6). 1956.

An erect shrub or small tree, to 10 m. tall; branchlets and twigs very slender, obtusely tetragonal, more or less densely puberulent or short-pubescent, sometimes somewhat compressed, lenticellate; leaf-scars large and corky; nodes not annulate; principal internodes 1.5--3 cm. long; leaves decussate-opposite or approximate, short-petiolate; petioles slender, 2--15 mm. long, more or less puberulent; leaf-blades membranous, brunnescent in drying, lighter beneath, elliptic, 2.5--9 cm. long, 1.5--4.5 cm. wide, apically acute or short-acuminate, marginally entire, narrowed from the middle to the acute base, more or less puberulent (often densely so) on both surfaces (or glabrous, fide Baker); midrib slender, flat above, prominulous beneath; secondaries filiform, 5--7 per side, obscure or indiscernible above, very slightly subprominulous beneath, arcuate-ascending, arcuately joined in many loops near the margins; veinlet reticulation sparse, mostly obscure; inflorescence axillary and terminal, the axillary cymules mostly 3-flowered and lax, the terminal panicles composed of several pairs of cymes, densely puberulent or short-pubescent throughout; peduncles and panicle-ramifications very slender or subfiliform, 1--3 cm. long; pedicels filiform, 6--12 mm. long, densely puberulent; foliaceous bracts often present, 1--1.5 cm. long, 5--7 mm. wide, puberulent on both surfaces; bractlets similarly foliaceous or else linear-setaceous and much smaller; calyx greenish, tubular-campanulate or obconic, 1--1.8 cm. long, more or less densely puberulent, thin-membranous, venose-costulate, often subplicatulate, the tube 6--8 mm. in diameter, the rim distinctly 5-lobed, the lobes erect, triangular-ovate, 2--4 mm. long, apically acute; corolla yellow, hypocrateriform, the tube slender, basally cylindric, apically ampliate-infundibular, mostly 1.5--2 cm. long, externally glabrous, the limb about 1.5 cm. wide, the lobes spreading, 6--8 mm. long; stamens exserted 1--1.5 cm. from the corolla-mouth, usually reaching only to the tips of the corolla-lobes; style eventually slightly exserted beyond the stamens; fruit drupaceous, often insect-galled.

This endemic Madagascar species is based on *Baron 1291* from forests in the Province of Imerina, Madagascar, and an unnumbered Parker collection from Andrangaloaka, in central Madagascar, collected in 1881, both deposited in the Kew herbarium.

Baker (1883) describes this species as "glabrous in all its parts", but this is not true of the specimens examined by me! The vernacular names, "tsimatadakato" and "yandrika", have been reported for it. The Index Kewensis states that the species is from the Fiji Islands, but this is an obvious error. It is endemic to Madagascar. Its leaves bear great resemblance to those of *C. arenarium* J. G. Baker, also of Madagascar.

Collectors have encountered *C. laxiflorum* in forests and in forest clearings, in flower in August and November, and in fruit in September. A key to help distinguish it from other Madagascar taxa in this genus will be found under *C. baronianum* Oliv. in the present series of notes [58: 184--190].

Material has been misidentified and distributed in some herbaria as *C. arenarium* J. G. Baker and *C. involucratum* Vatke.

Citations: MADAGASCAR: *Baron 1291* (K--cotype, P--cotype), *5719* (P); *d'Aleizette 1080m* (P), *1363m* (P); *Decary 5190* (N, P); *Grandidier s.n.* [Cote sud-ouest] (P); *Herb. Jard. Bot. Tananarive 2787* (P); *G. W. Parker s.n.* [Central Madagascar, 1881] (E--photo of cotype, F--photo of cotype, K--cotype, Ld--photo of cotype, N--photo of cotype).

*CLERODENDRUM LEANDRII* Mold., Lloydia 13: 207--208. 1950.

Thanks to the kindness of Dr. J. Leandri, who wrote to me in a letter dated October 29, 1955, it has been determined that this taxon is not a species of *Clerodendrum*, nor even verbenaceous, but is scrophulariaceous, probably a species of *Radamaea*.

*CLERODENDRUM LECOMTEI* Dop in Lecomte, Notul. Syst. 4: 11 [as "*Clerodendron*"]. 1920; Mold., Known Geogr. Distrib. Verbenac., ed. 1, 59 & 90. 1942.

Synonymy: *Clerodendron lecomtei* Dop in Lecomte, Notul. Syst. 4: 11. 1920.

Bibliography: Dop in Lecomte, Notul. Syst. 4: 11. 1920; A. W. Hill, Ind. Kew. Suppl. 6, imp. 1, 49. 1926; Fedde & Schust., Justs Bot. Jahresber. 48 (1): 497. 1927; Dop in Lecomte, Fl. Gén. Indo-chine 4: 852, 865, & 876, fig. 89 (1 & 2). 1935; Mold., Known Geogr. Distrib. Verbenac., ed. 1, 59 & 90. 1942; H. N. & A. L. Mold., Pl. Life 2: 68. 1948; Mold., Known Geogr. Distrib. Verbenac., ed. 2, 136 & 182. 1949; A. W. Hill, Ind. Kew. Suppl. 6, imp. 2, 49. 1959; Mold., Résumé 175 & 451. 1959; Mold., Fifth Summ. 1: 300 (1971) and 2: 868. 1971; Mold., Phytologia 31: 395. 1975; Mold., Phytol. Mem. 2: 291, 387, & 539. 1980; Mold., Phytologia 60: 142. 1986.

Illustrations: Dop in Lecomte, Fl. Gén. Indo-chine 4: 865, fig. 89 (1 & 2). 1935

A shrub, about 1.5 m. tall; branchlets tetragonal, canaliculate, lightly puberulent, soon glabrescent; bark whitish; leaves decussate-opposite; petioles 5--10 mm. long, canaliculate above; leaf-blades oblong or lanceolate, 9--22 cm. long, 3--6 cm. wide, apically acuminate, marginally entire, basally long-attenuate and acute, green even in drying, glabrous on both surfaces; secondaries 8 per side, very slender, arcuate; vein and veinlet reticulation inconspicuous; panicles racemiform, lax, almost leafless, subglabrous, perhaps nutant, about 20 cm. long and 10 cm. wide; peduncles slender, about 3 cm. long; cymes dense, trichotomous; bracts foliaceous, perhaps deciduous; bractlets linear, 5 mm. long, apically acute; calyx spreading-campanulate, 4 mm. long, externally lightly puberulent, the tube obsolete, the lobes lanceolate, basally 1 mm. wide; corolla hypocrateriform, orange-yellow, 2.5 cm. long, the tube slender, 1.8 cm. long, recurved, the lobes ovate, 7 mm. long, apically obtuse; stamens slightly exserted; ovary globose; style slender; stigma shortly bifid; fruit not known.

This species is based on *Lecomte & Finet 241* & *249* from Lang-son, Tonkin, Vietnam.

Dop (1920) comments that "Cette espèce est voisine de la précédente [C. *tonkinense* Dop]; elle s'en distingue par la forme des feuilles et l'inflorescence racemiforme". A key to help distinguish it from other Indochinese taxa will be found under C. *hahnianum* Dop in the present series of notes [60: 141--143]. Nothing is known to me of it beyond what is stated in its bibliography (above).

*CLERODENDRUM LEPARENSE* Mold., Phytologia 4: 49--50. 1952.

Bibliography: Mold., Biol. Abstr. 26: 1471. 1952; Mold., Phytologia 4: 49--50. 1952; Mold., Résumé 197 & 451. 1959; G. Taylor, Ind. Kew. Suppl. 12: 36. 1959;Mold., Fifth Summ. 1: 330 (1971) and 2: 868. 1971; Mold., Phytol. Mem. 2: 320 & 539. 1980; P. Holmgren & al., Ind. Vasc. Pl. Type Microf. 441. 1985.

A tall tree; only the very small leaves from directly beneath the inflorescence known, these leaves have their petioles 8--11 mm. long, very densely yellow-tomentose-pubescent, the blades chartaceous, elliptic, 1.7--4 cm. long, 7--14 mm. wide, apically long-apiculate, marginally entire, basally obtuse, rather sparsely pilosulous above, more densely so on the midrib, rather densely yellow-puberulent beneath, especially on the midrib, the apiculum densely yellowish-puberulent; inflorescence apparently axillary, surpassing the subtending leaves, possibly aggregated in a dense terminal cluster, each cymule apparently 3-flowered, borne on a stout, medullose peduncle which is 3--5 cm. long and densely yellowish-short-pubescent, the 3 cyme-branches are each 1 cm. long, the pedicels are about 1 cm. long, exactly similar to the cyme-branches in texture, color, and pubescence; calyx tubular-campanulate, 13--15 mm. long, 6--8 mm. wide, nigrescent, externally densely pilose-puberulent, the rim 5-lobed, the lobes ovate, 4--5 mm. long, apically attenuate.

This poorly known species is based on *Bünnemeijer 2414* from Lepar island, near Banka, in the Molucca Islands, collected on December 12, 1917, and deposited in the Buitenzorg herbarium. Bakhuizen, in his revision of this family in 1920, annotated the type specimen as *C. lanuginosum* Blume, from which, however, it differs widely. In fact, with the known material so fragmentary, it is uncertain as to the exact taxonomic position of this plant. It is to be hoped that a new expedition to Lepar may produce more complete material.

Citations: MOLUCCA ISLANDS: Lepar: *Bünnemeijer 2414* (Bz--19908--type, Ld--photo of type, N--fragment of type, N--photo of type).

*CLERODENDRUM LEPRIEURI* Mold., Phytologia 4: 50. 1952.

Bibliography: Mold., Biol. Abstr. 26: 1471. 1952; Mold., Phytologia 4: 50. 1952; Mold., Résumé 135, 136, & 451. 1959; G. Taylor, Ind. Kew. Suppl. 12: 36. 1959; Mold., Fifth Summ. 1: 214 & 215 (1971) and 2: 868. 1971; Mold., Phytol. Mem. 2: 225 & 539. 1980.

A shrub; branchlets slender, very obscurely tetragonal, densely ferruginous- or fulvous-villose, more densely so on the younger parts; nodes not annulate; principal internodes 1.8--3.5 cm. long; leaves decussate-opposite; petioles medium-slender, 3--10 mm. long, densely ferruginous-villose, borne on stiff spine-like sterigmata 2--6 mm. long; leaf-blades thin-chartaceous, bright-green above, lighter beneath, ovate-elliptic, 3--8 cm. long, 2--4.3 cm. wide, apically acuminate, marginally entire, basally rounded or cordate, rather sparsely long-pilose above, very densely ferruginous-tomentose beneath; midrib slender, flat or subimpressed above, prominulous beneath; secondaries slender, 6--8 per side, arcuate-ascending, flat or subimpressed above, prominulous beneath, anastomosing near the margins; veinlet reticulation rather abundant, obscure above, hidden by the tomentum beneath; inflorescence terminal, capitate or subcapitate, densely many-flowered, about 2 cm. long and 2--3 cm. wide; peduncles and inflorescence ramifications abbreviated, densely ferruginous-villous; pedicels 1 mm. long or obsolete, ferruginous-villous; bractlets linear or filiform, 5 mm. long or longer, villous;

calyx campanulate, about 3 mm. long, externally sparsely villous, its rim with 4 elongate-filiform lobes about 3 mm. long, villous; corolla about 1 cm. long, the limb about 5 mm. wide.

This species is based on an unnumbered Leprieur collection from the Gambia, collected in about 1830, and deposited in the Stockholm herbarium. The plant has much the general appearance of *Premna chrysoclada* (Bojer) Gürke from the same general area.

Citations: SENEGAL: *Leprieur s.n.* [1830] (N, V--70998). GAMBIA: *Leprieur s.n.* (Ld--photo of type, N--photo of type, S--type).

*CLERODENDRUM LEUCOPHLOEUM* Balf. f., Proc. Roy. Soc. Edinb. 12: 91 [as "*Clerodendron leucophoeum*" sphalm]. 1884; A. R. Sm., Hook. Icon. Pl. 37 [ser. 5, 7]: pl. 3691. 1971.

Synonymy: *Clerodendron leucophoeum* Balf. f., Proc. Roy. Soc. Edinb. 12: 91 sphalm. 1884. *Clerodendron leucophloeum* Balf. f., Trans. Roy. Soc. Edinb. 31: 236. 1888.

Bibliography: Balf. f., Proc. Roy. Soc. Edinb. 12: 91. 1884;Balf. f., Trans. Roy. Soc. Edinb. 31: 236--237. 1888; Jacks. in Hook. f. & Jacks., Ind. Kew., imp. 1, 1: 561 (1893), imp. 2, 1: 561 (1946), and imp. 3, 1: 561. 1960; Anon., Kew Rec. Tax. Lit. 270. 1971; A. R. Sm., Hook. Icon. Pl. 37 [ser. 5, 7]: pl. 3691. 1971; Anon., Assoc. Étud. Tax. Fl. Afr. Trop. Ind. 1971: 57. 1972; Mold., Phytol. Mem. 2: 253, 387, & 539. 1980.

Illustrations: A. R. Sm., Hook. Icon. Pl. 37 [ser. 5, 7]: pl. 3691. 1971.

A strong-smelling, often stunted shrub or small tree, to 2.5 m. tall, dichotomously branched; bark white, lenticellate; the ultimate branchlets angulate, fulvous-tomentose, the terminal ones elongate, the lateral ones often contracted; leaves small, decussate-opposite; petioles to 8 mm. long, pubescent; leaf-blades thinly membranous, oblong-elliptic or elliptic-obovate to obovate, 1.6--6.5 cm. long, 0.8--3 cm. wide, apically obtuse or rarely subacute or emarginate, marginally entire, basally attenuate or cuneate, sparsely glandular-puberulent above, pubescent beneath, becoming glabrescent, nigrescent above in drying; inflorescence axillary toward the tips of the branchlets, cymose, mostly 3-flowered, long-pedunculate, opposite, bracteose and bracteolose; peduncles to 3 cm. long, pubescent, articulate above the middle and bibracteolate; bracts and bractlets 1--2 mm. long, pubescent; flowers pedicellate; pedicels about 3 mm. long; calyx campanulate, 5-lobed, the tube 2 mm. long, the lobes 1 mm. long, apically obtuse, densely pubescent; corolla hypocrateriform, white or whitish, somewhat zygomorphic, the tube 5 mm. long, inflated, externally glabrous, internally puberulent at the mouth, the limb 5-lobed, the posterior lobe cucullate-crested and 7 mm. long, the remainder 6 mm. long; stamens 4, inserted in the corolla-tube, 1.9--2 cm. long; anthers 1.5 mm. long, verruculose; style 1.5 cm. long; stigma bifid; ovary 2 mm. long, dark-green, 4-lobed, glabrous; fruiting-calyx conspicuously accrescent and spreading; fruit drupaceous, nodding, somewhat fleshy, about 1 cm. wide, 4-lobed, the endocarp thin, crustaceous.

This endemic species was definitely based by Balfour (1884) on

*Balfour, Cockburn, & Scott 182* & *385* and, in 1888, on *nos. 182* & *335*, all from Socotra and deposited in the Edinburgh herbarium, but Smith (1971) has arbitrarily designated *Balfour, Cockburn, & Scott 335* as the type collection.

Although Balfour described this as "a very common tree" on the island in 1880, when he collected it in fruit in February and March, Smith, in 1971, reports that "only the one small clump of bushes was encountered on the 1967 expedition, and these in an area not easily accessible to goats". It thus appears that the species has almost been exterminated through the browsing by introduced goats.

The species is obviously a member of the Subgenus *Cyclonema* and is known locally as "seminha". Originally, before the introduction of goats, it was abundant on the plains and up to 2000 feet elevation on the peaks, mostly at the base of coralline limestone cliffs. *Balfour, Cockburn, & Scott 513* is said to have differed in being "quite inodorous"; *no. 385* was faintly odorous even when dry.

Balfour (1888) cited only *Balfour, Cockburn, & Scott 182, 265, 335, 385, 513,* & *580*; Smith (1971) cites the same collections plus *Smith & Lavranos 607*.

Citations: MOUNTED ILLUSTRATIONS: A. R. Sm., Hook. Icon. Pl. 37 [ser. 5, 7]: pl. 3691. 1971 (Ld).

*CLERODENDRUM LEVEILLEI* Fedde ex Levl., Cat. Pl. Yun-nan 277 [as "*Clerodendron*"]. 1917; Mold., Known Geogr. Distrib. Verbenac., ed. 2, 131 & 182. 1949.

This taxon, previously accepted by me in several publications, is now reduced to the synonymy of C. *japonicum* (Thunb.) Sweet, which see.

*CLERODENDRUM LIGUSTRINUM* (Jacq.) R. Br. in Ait., Hort. Kew., ed. 2, 4: 64. 1812.

Synonymy: *Volkameria inermis* β Ait., Hort. Kew., ed. 1, 2: 364. 1789. *Volkameria ligustrina* Jacq., Coll. Bot. Suppl. 118--119, pl. 5, fig. 1. 1796. *Volkameria foliis oblongo-lanceolatis, integerrimis; petiolis, pedunculis calicibusque hirsutis* Willd. ex Poir. in Lam., Encycl. Méth. Bot. 8: 689. 1808. *Volkameria ligustrina* Willd. apud Pers., Sp. Pl. 3: 363. 1819. *Volkameria longifolia* Gmel. ex Steud., Nom. Bot. Phan., ed. 1, 890 in syn. 1821. *Volkameria ligustrina longifolia* Gmel. ex Steud., Nom. Bot. Phan., ed. 1, 890 in syn. 1821. *Clerodendron ligustrinum* R. Br. apud Spreng. in L., Syst. Veg., ed. 16, 2: 758. 1825. *Clerodendrum ligustrinum* H.K. ex Loud., Encycl. Pl. 522. 1829. *Clerodendron ligustrinum* Dryand. ex Drapiez, Herb. Amat. Fl. 5: pl. 323. 1831. *Clerodendrum ligustrinum* R. Br. apud Bojer, Hort. Maurit. 255. 1837. *Clerodendron ligustrinum* "[R. Br. in] Ait." apud Jacks. in Hook. f. & Jacks., Ind. Kew., imp. 1, 1: 561. 1893. *Clerodendron culinare* Sessé & Moc., Fl. Mex., ed. 2, 151. 1894. *Clerodendron fortunatum* Sessé & Moc., Fl. Mex., ed. 2, 151. 1894 [not C. *fortunatum* Blanco, 1837, nor Blume, 1844, nor Buch.-Ham., 1831, nor Burm., 1962, nor Wall., 1885, nor *Clerodendrum fortunatum* L., 1756]. *Clerodendron inermis* Sessé & Moc., Fl. Mex., ed. 2, 152. 1894 [not *Clerodendrum inerme* (L.) Gaertn., 1788].

*Volkameria ligustrina* (R. Br.) Jacq. ex Millsp., Field Columb. Mus. Publ. Bot. 1: 316. 1896. *Clerodendron mexicanum* T. S. Brandeg., Univ. Calif. Publ. Bot. 3: 39. 1909. *Clerodendron aculeatum* "(non L.) Millsp." ex Standl., Field Mus. Publ. Bot. 3: 400 in syn. 1930 [not *Clerodendrum aculeatum* (L.) Schlecht., 1831]. *Volkamera ligustrina* Jacq, ex Mold., Prelim. Alph. List Inv. Names 53 in syn. 1940. *Clerodendrum ligustrinum* (Jacq,) R. & S. ex Mold., Prelim. Alph. List Inv. Names 23 in syn. 1940. *Clerodendron ligustrinum* (Jacq.) Roem. & Schult. ex Mold., Prelim. Alph. List Inv. Names 20 in syn. 1940. *Clerodendrum ligustrinum* L. ex Mold., Fifth Summ. 1: 463 in syn. 1971. *Volkameria ligustrina* var. *longifolia* Gmel. ex Mold., Phytol. Mem. 2: 462 in syn. 1980. *Clerodendron lingustrinum* (Jacq.) Roem. & Schult., in herb.

Bibliography: Ait., Hort. Kew., ed. 1, 2: 364. 1789; Jacq., Collect. Bot. Suppl. 118--119, pl. 5, fig. 1. 1796; Willd. in L., Sp. Pl., ed. 4 [5], 3 (1): 383. 1800; Poir. in Lam., Encycl. Méth. Bot. 8: 689. 1808; Willd., Enum. Pl. Hort. Berol. 2: 658. 1809; R. Br. in Ait., Hort. Kew., ed. 2, 4: 64. 1812; A. P. DC., Cat. Pl. Hort. Bot. Monsp. 71. 1813; Desf., Tabl. Ecol. Bot. Mus. Hist. Nat., ed. 2, 64. 1815; Pers., Sp. Pl. 3: 363. 1819; Steud. Nom. Bot. Phan., ed. 1, 207 & 890. 1821; Link, Enum. Hort. Berol. 2: 122. 1822; Spreng. in L., Syst. Veg., ed. 16, 2: 758. 1825; Sweet, Hort. Brit., ed. 1, 2: 322. 1827; Loud., Encycl. Pl. 522. 1829; Loud., Hort. Brit., ed. 1, 247. 1830; Sweet, Hort. Brit., ed. 2, 415. 1830; Drapiez, Herb. Amat. Fl. 5: pl. 323. 1831; Loud., Hort. Brit., ed. 2, 247. 1832; Bojer, Hort. Maurit. 255. 1837; G. Don in Loud., Hort. Brit., ed. 3, 247. 1839; G. Don in Sweet, Hort. Brit., ed. 3, 549. 1839; Steud., Nom. Bot. Phan., ed. 2, 1: 383. 1840; D. Dietr., Syn. Pl. 3: 615. 1842; Voigt, Hort. Suburb. Calcut. 473. 1845; Walp., Repert. Bot. Syst. 4: 101 & 111. 1845; Schau. in A. DC., Prodr. 11: 657 & 660. 1847; Buek, Gen. Spec. Syn. Candoll. 3: 106 & 503. 1858; Benth. in Benth. & Hook. f., Gen. Pl. 2 (2): 1156. 1876; J. E. Gonzalez, Revist. Cientif. Mex. 1 (14): 17. 1881; Hensl., Biol. Cent.-Amer. 2: 540. 1882; Jacks. in Hook. f. & Jacks., Ind. Kew., imp. 1, 1: 561. 1893; Sessé & Moc., Fl. Mex., ed. 2, 151--152. 1894; Briq. in Engl. & Prantl, Nat. Pflanzenfam., ed. 1, 4 (3a): 175. 1895; Jacks. in Hook. f. & Jacks., Ind. Kew., imp. 1, 2: 1219. 1895; Millsp., Field Columb. Mus. Publ. Bot. 1: 316. 1896; Höck, Justs Bot. Jahresber. 23 (2): 76. 1897; Koehne, Justs Bot. Jahresber. 23 (2): 628. 1897; Millsp., Field Columb. Mus. Publ. Bot. 1: 386. 1898; J. Ramírez, Veg. Méx. 110. 1899; T. S. Brandeg., Univ. Calif. Publ. Bot. 3: 391. 1909; Loes., Verhandl. Bot. Ver. Brandenb. 53: 81. 1912; Prain, Ind. Kew. Suppl. 4, imp. 1, 50. 1913; P. C. Standl., Contrib. U. S. Nat. Herb. 23: 1252. 1924; P. C. Standl., Field Mus. Publ. Bot. 3: 400. 1930; Stapf, Ind. Lond. 2: 239. 1930; Roys, Tulane Univ. Mid. Amer. Res. Ser. Publ. 2: [Ethno-Bot. Maya] 248 & 319. 1931; Mold., Brittonia 1: 472. 1934; Lundell, Carnegie Inst. Wash. Publ. 478: 25, 26, 75, 138, 183, & 203. 1937; Mold., Alph. List Comm. Vern. Names 16, 22, & 28. 1939; Mold., Geogr. Distrib. Avicenn. 14--17 & 37. 1939; Mold., Carnegie Inst. Wash. Publ. 522: 211--213. 1940; Mold., Prelim. Alph. List Inv. Names 19--21, 23, & 53. 1940; Mold., Suppl.

List Inv. Names 10 & 11. 1941; Lundell, Contrib. Univ. Mich. Herb. 8: 61. 1942; Mold., Alph. List Inv. Names 3, 16--19, 21, & 56. 1942; Mold., Known Geogr. Distrib. Verbenac., ed. 1, 16, 19, 20, 22, 23, 72, & 90. 1942; Mold., Phytologia 2: 100. 1945; Jacks. in Hook. f. & Jacks., Ind. Kew., imp. 2, 1: 561 (1946) and imp. 2, 2: 1219. 1946; Mold., Alph. List Cit. 1: 5, 38, 100, 193, 198, 201, 218, 227--229, 231, 232, 240, 251--253, 290, 299, 300, 306, 310, & 315 (1946), 2: 327, 328, 330, 333, 334, 336, 337, 339, 340, 343, 345, 349, 350, 357, 417--419, 423, 425, 426, 428, 429, 459, 475, 499, 500, 502, 578. 587, & 603 (1948), 3: 656, 659, 664, 666, 676, 677, 694, 714, 768, 785, 786, 795, 834, 835, 906, 907, 918, 919, 925, & 964 (1949), and 4: 999, 1019, 1023, 1026, 1028, 1031, 1038, 1051, 1053--1055, 1070, 1099, 1131, 1235, 1239, 1242, & 1297. 1949; Mold., Known Geogr. Distrib. Verbenac., ed. 2, 29, 35, 36, 38, 40, 159, & 182. 1949; Matuda, Amer. Midl. Nat. 44: 576. 1950; Prain, Ind. Kew. Suppl. 4, imp. 2, 50. 1958; Mold., Résumé 35, 41, 43, 45, 48, 216, 230, 259, 262, 263, 266, 273, 391, 392, & 451. 1959; Jacks. in Hook. f. & Jacks., Ind. Kew., imp. 3, 1: 561 (1960) and imp. 3, 2: 1219. 1960; Mold., Résumé Suppl. 13: 6. 1966; Thom, Journ. Ecol. 55: 315 & 320. 1967; Mold., Résumé Suppl. 16: 4 (1968) and 17: 2. 1968; Gibson, Fieldiana Bot. 24 (9): 193 & 194, fig. 36. 1970; Mold., Fifth Summ. 1: 69, 79, 81, 90, 359, 439, 443, 445, 449, 450, & 463 (1971) and 2: 732, 733, & 868. 1971; Mold. in Woodson, Schery, & al., Ann. Mo. Bot. Gard. 60: 138 & 143--145. 1973; Mold., Phytologia 28: 449. 1974; Molina R., Ceiba 19: 96. 1975; Mold., Phytologia 34: 280 (1976) and 36: 30 & 48. 1977; Mold., Phytol. Mem. 2: 61, 71, 74, 78, 83, 349, 392, 461, 462, & 539. 1980; F. C. Seymour, Phytol. Mem. 1: 242. 1980; H. N. & A. L. Mold. in Dassan. & Fosb., Rev. Handb. Fl. Ceyl. 4: 431. 1983; Raj, Rev. Palaeobot. Palyn. 39: 358 & 374. 1983; P. Holmgren & al., Ind. Vasc. Pl. Type Microf. 441. 1985; Mold., Phytologia 57: 400 & 404 (1985), 59: 469 (1986), 60: 182, 282, 361, & 495 (1986), and 61: 101. 1986.

Illustrations: Jacq., Collect. Suppl. 118, pl. 5, fig. 1. 1796; Drapiez, Herb. Amat. Fl. 5: pl. 323 (in color). 1831; Gibson, Fieldiana Bot. 24 (9): 194, fig. 36. 1970.

A regular, weak shrub, 0.5--3 m. tall, or small, low, erect, shrubby tree, 4--5 m. tall, sometimes clambering or vine-like, widely branched; branchlets long, slender, very obtusely tetragonal or subterete, the young ones brownish, the older ones light-gray, conspicuously lenticellate, the youngest minutely puberulent, the older very minutely strigillose or glabrous, sometimes very obscurely spinulose; leaves decussate-opposite, very variable in size and shape; petioles very slender, 5--9 mm. long, minutely puberulent, sometimes articulate and obscurely spinescent at the base; leaf-blades chartaceous or membranous, elliptic or elliptic-oblong to elliptic-lanceolate or lanceolate, 1.5--10 cm. long, 0.6--5.1 cm. wide, apically acute or occasionally subacuminate, marginally entire, basally acute or subacuminate, glabrous on both surfaces or under a handlens obscurely puberulent on the midrib and larger venation, densely punctate beneath; inflorescence supra-axillary or rarely terminal, cymose, the cymes solitary, opposite, 3--7.5 cm. long, 2--7 cm. wide, laxly few-flowered, usually only 3- or 4-flowered, often twice dichotomous and then 7-flowered, the terminal ones (when present) similar but usually smaller; peduncles widely divaricate, very slender, 1.5--4 cm. long, shorter than the subtending leaf, minutely puberulent or subglabrate; bracts few, foliaceous, stipitate, 1--1.5 cm. long, 3--6 mm. wide, caducous, minutely puberulent or glabrate, punctate beneath; bractlets and prophylla linear, 1--6 mm. long, puberulent; pedicels elongate, very slender, 3--6 mm. long, puberulent, in fruit to 13 mm. long; calyx campanulate, 6--8 mm. long, deeply 5-fid, externally villosulous, the lobes lanceolate or deltoid, apically acute or acuminate, marginally ciliate; corolla hypocrateriform, white or very pale-yellow, the tube narrow-cylindric, straight, 1--1.2 cm. long, slightly ampliate at the mouth, the limb spreading, 5-lobed, the lobes subequal, shorter than the tube; stamens long-exserted, involute in bud; filaments white; anthers brown or purple; style equaling the stamens; stigma bifid; ovary 4-sulcate; fruit drupaceous, green, drying brown when mature, 1--1.2 cm. long and wide when mature, externally smooth, splitting into two 2-seeded pyrenes at maturity.

Jacquin (1796) originally described this species, in error, from Mauritius, but on the basis of material cultivated in his greenhouse in Vienna, Austria. He comments that it "Differt a *Volkameria inermi*, villositate petiolorum pedunculorum & calycis, brevitate tubi corollae, tum figura foliorum, & filamentorum colore". In case there may be some question as to the true identity of his plant [vis-a-vis *C. heterophyllum* (Vent.) R. Br. native to Mauritius], his original description is reproduced herewith: "Crescit in insula Mauritii. In caldariis nostris floret Julio, fructescit Novembri. Truncus arboreus, carpum crassus, cinereus, teres, erectus, decempedalis, superne in ramos longos & subdivisos patens, a petiolorum articulis superstitibus tuberculatos quidam, at minime spinosos. Folia omnia opposita, nulla terna, lanceolata, utrinque acuta, integerrima, ad oras & nervum medium per lentem obiter villosula, caeterum glaberrima, duas tresve uncias longa cum petiolo villosulo & breviter ad basin articulato. Pedunculi axillares, solitarii, teretes, villosuli, graciles, foliis breviores, tres quatuorve flores pedicellatos sustinentes, saepe bis dichotomi & sic septemflori. Bracteolae ad pedicellos minutissimae, villosae. Calycis villosi laciniae semiovatae, acutae, & ciliatae. Corolla cum aliqua flavedine alba, limbo tubo haud multum superante. Filamenta alba. Fructus magnitudine ciceris, fuscescentes, pulpa pauca molli & fatua. Semina bilocularia. Et alia generis." Dietrich (1842) also credits the species to the Mascarene Island ("Ins. Mascar.").

*Clerodendrum ligustrinum* actually appears to be native from northern Mexico to Panama. Collectors have found it growing in thickets, along roadsides, on the banks of creeks and rivers (even "overhanging the river"), in marshes and swamps, on natural levees, in beach-ridge forests, high forests, and secondary low forests, in cleared forest areas and open grazed areas, in lagoons, on inundated land,on marshy lake shores, in littoral habitats, at the margin of woodland, in high evergreen or subevergreen woods, in sandy bushy areas and among secondary vegetation, in the open sun in rocky-sandy soil, in "suela calizo pedregosa", "suela negro arcillozo calido", and clay soil, in acahual, corozal, tintal, and flat places in matorral, at altitudes from sealevel to 800 meters, in flower in October and from December to July, and in fruit from March to July and November to January.

Standley (1924) lists the species from Campeche, Oaxaca, Puebla, Tabasco, Tamaulipas, Veracruz, and Yucatán, Mexico; Gonzalez (1881) reports it from Nuevo León, and Sousa, in a personal communication to me, from Quintana Roo. Millspaugh (1896) reported it "common in open lands near Izamal" in Yucatán. Lundell (1937) avers that in El Petén, Guatemala, it grows densely along riverbanks which are not too shaded, is common on swampy banks, and is an occasional shrub "less than 4 m. tall" in marginal forests there.

Ventura describes the species as "very scarce" in Veracruz, but Calzada refers to it there as an "abundant shrub", but "rare" in Tabasco; King found it to be a common shrub in Oaxaca.

Sweet (1827) states that *C. ligustrinum* was introduced into cultivation in England in 1789 from "Mauritius" -- as stated above, Jacquin, in 1796, also thought that it originated in Mauritius. Actually, in Mauritius the related species, *C. inerme* (L.) Gaertn. and *C. heterophyllum* (Vent.) R. Br., are known to grow, but I have yet to see any material of *C. ligustrinum* from that island.

Williams reports *C. ligustrinum* cultivated in Veracruz, Mexico, while Molina (1975) found it in cultivation in Honduras.

The species is apparently very variable as to stature -- it is described as a "tree" on *Gentle 394* and *West 22/12*, as a "clambering shrub" on *Lundell 6962* & *17625*, as a "woody climber" on *Lundell 18026*, as a "woody vine" on *Contreras 7416*, *Gentle 2184*, and *Matuda 3168*, as a "vine" on *Lundell 1472*, and as "a vine climbing up through vegetation" on *Sohns 1655* All other collectors and authors describe it merely as a "shrub". Johnson, in original longhand notes preserved in the Columbia University herbarium, states for his *no. 12*: "Can discern no difference between the flowers of this & the preceding [*no. 63*], yet this was a long slender stem, supporting itself by other trees, something between climbing and standing erect."

The corollas are described as "white" by all collectors who mention corolla-color at all (on no less than 24 of the collections cited below) and by authors such as Loesener (1912) and Standley (1930).

Common and vernacular names reported for the species are the following: "itzimte", "itzimté", "itzinté", "iuimte", "mosté", "muste", "palo blanco cimarron", "privet-leaved clerodendrum", "snake-tree", "volcameria", "volkameria à f. de troéne", "y'imte", and "yɔimte".

Poiret (1808) says: "Cette plante ressemble beaucoup au *Volkameria inermis*; elle en diffère par ses feuilles oblongues-lancéolées, plus étroites, point ovales, glabres à leurs deux faces, vertes en dessus, plus pâle en dessous, très-entières à leurs bords, aiguës à leur sommet, rétrécies à leur base, & soutenues par des pétioles velus. Les fleursont la même disposition, mais leur pédoncule, ainsi que leur calice, est hérissé de poils. La corolle est plus coutré: son tube est à peu trois fois plus long que le calice, de moitie moins long que celui du *Volkameria inermis*. Les filamens sont blancs & non de couleur purpurine; les anthères brunes & non violettes."

Bentham (1876) places C. *ligustrinum* in the group of *Volkameria*, where it certainly belongs if habit means anything. He says: "*Volkameria*, Linn., inclusit species plures charactere vago a *Clerodendro* separates, ab auctoribus recentioribus ad *V. aculeatam* limitatur, speciem habitu plerisque notis C. *inermi*, C. *ligustrino* aliisque affinem sed pyrenis per paris cohaerentibus; in C. *inermi* tamen aliisque speciebus pyrenae per paria arcte contiguae sunt, dum in aliis lacunis v. mesocarpio succoso plusminus seperatae, et Grisebach in Fl. Brit. W. Ind. 500 aptius *V. aculeatem* cum caeteris *Volkameriis Clerodendro* adjunxit."

He goes on to include the genus *Torreya* of Sprengel here, too, saying: "*Torreya*, Spreng. Neue Entd. ii. 121, est ex Arn. in Ann. Nat. Hist. ser. 1, i. 130, *Clerodendri* species ex India occidentali nec a Brasilia et ex descr. Sprengelii forte a C. *ligustrina*, Br., planta Mexicana non diversa." On the contrary, I have examined the type specimen and it proves to be C. *volubile* P. Beauv., which see.

Bojer (1837) regarded C. *ligustrinum* as a synonym of the native C. *heterophyllum* (Vent.) R. Br. of Mauritius and this is of interest in view of Jacquin's and Sweet's opinion that C. *ligustrinum* came into cultivation from Mauritius. If the two names should prove to be synonymous, then C. *culinare* of Sessé & Mociño would be the proper name for the New World plant. Gonzales (1881) identifies *Volkameria ligustrina* with *V. inermis* L.

Sesse & Mocino (1894) report that the leaves of *Clerodendrum ligustrinum* are used in Mexico by the natives to flavor fish, forming the basis for their use of the epithet "*culinare*" for the species. This culinary use is verified by Lundell (1937).

Roys (1931) states that this is "A plant with which the Indian women season posole, camote-stew and other things....The Maya text prescribes the boiled leaves as a wash for snake-bites."

As indicated above, C. *ligustrinum* is typified by a specimen cultivated in Vienna. The type of C. *mexicanum* T. S. Brandeg. was collected by C. A. Purpus (*no. 3336*) at Santa Lucia, in the vicinity of San Luis Tultitlanapa, Puebla, near Oaxaca, Mexico, in January, 1908 and is deposited in the University of California herbarium at Berkeley. It differs slightly from the common form of C. *ligustrinum* in having lighter and brighter leaf-blades when pressed and dried. *Clerodendron fortunatum* Sessé & Moc.seems to be based on *Sesse, Mocino, Castillo, & Maldonado 2182* from fields at Tehuacan, Puebla. *Clerodendron culinare* Sesse & Moc. is typified by a drawing on *Macbride photos 30831*.

The so-called *Volkameria ligustrina* var. *rotundifolia* Gmel. is a synonym of *Clerodendrum inerme* f. *parvifolium* Mold.

*LeSueur 548* appears to represent a very narrow- and small-leaved form of C. *ligustrinum* . Similarly, the Fendler specimens from Panama are anomalous in their very small, distinctly acuminate leaf-blades and may possibly represent a distinct form or variety. Small-leaved specimens of *C. ligustrinum* are, indeed, not uncommon, but not with the leaf-blades so acuminate at the apex.

For the record, the original description of some of the important conspecific synonyms are reproduced here:

(1) *Clerodendron mexicanum* T. S. Brandeg. -- "Frutex, ramis viridibus, novellis pubescentibus: foliis ovato-acuminatis, basi cuneatis, integris supra glabris, subtus dense minute furfuraceis, 8 cm. longis, 4 cm. latis; floribus cymoso-paniculatis ex axillis foliorum superiorum: calyce campanulato, 3 mm. longo, 5-fido, lobis 5 deltoideis: corollae tubo tenuiter cylindraceo recto, ad faucem leviter ampliato, circa 12 mm. longo; limbo patenti 5-fido, lobis subaequalibus: staminibus 4 longo exsertis, in alabastro involutis: stylo staminibus aequanti 2-fido: ovario 4-sulcato. Fructus ignotus. The dried specimens indicate that the petals are white and the anthers purple. *No. 3336*." [Note the statement that the leaf-blades are densely furfuraceous beneath!]

(2) *Clerodendrum culinare* Sessé & Moc. -- "*Clerodendron* foliis ovalibus, acutis, integerrimis. F.M. Caulis frutescens, sesquiorgyam longus, obtuse angulatus, glaberrimus. Rami oppositi, cauli similes. Folia opposita, ovalia, acuta, acuminata, integerrima, utrinque glabra, brevissime petiolata. Racemi axillares, solitarii, dichotomi, patentissimi. Pedunculus communis compressus, petiolo duplo longior, partiales filiformes, triflori, unicus uniflorus in dichotomia. Bracteae oppositae, lineares, erectae. Flores candidissimae, elegantes. Habitat in mexicanis arenosis litoribus. Floret Novembri. ♄. Usus. Folia piscibus condiendis adhibentur non ingrato sapore."

(3) *Clerodendron fortunatum* Sessé & Moc. -- "*Clerodendron* foliis lanceolatis, integerrimis. Calyx: perianthium monophyllum, campanulatum, ore partito laciniis ovatis, acutis, patentissimis, persistens. Corolla monopetala, ringens. Tubus longissimus, subincurvatus.....tribus ascendentibus. Stamina tubi inserta, corolla triplo longiora; quorum duo breviora. Antherae simplices. Pistillum. Germen subrotundum; stylus figura, situ et longitudine staminum; stigma bifidum laciniis acutis. Pericarpium.....Semina.....Caulis fruticosus, obtuse angulatus, scaber, sesquiulnam longus. Rami terni, patentes, glaberrimi. Folia opposita, lanceolata, integerrima, utrinque glabra, breviter petiolata. Pedunculi ex summis foliorum axillis, subsexflori, erecti, foliis paulo breviores. Bracteae subulatae, ad basim pedicellorum. Flores albi, elegantes, insipidi, inodori. Habitat in Tehuacani agris. Floret Junio. ♄."

(4) *Clerodendron inermis* Sessé & Moc. -- "*Volkameria* ramis inermibus. Calyx: perianthium monophyllum, campanulatum, semiquinquefidum laciniis acutis, aequalibus. Corolla monopetala, inaequalia. Tubus tenuis, longus. Limbus 5-fidus, laciniis oblongis, superioribus paulo brevioribus, profundioribus. Stamina. Filamenta quatuor, filiformia, longissima, ascendentia. Antherae oblongae, incumbentes. Pistillum. Germen quadrangulare; stylus filiformis, ascendens, parum staminibus brevior; stigma bifidum, acutum. Pericarpium. Bacca subrotunda, bilocularis, quadrisulcata. Semina bina, oblonga. Radix fibrosa, perennis, horizontalis. Caules numerosi, sesquidodrantales, ramosissimi. Rami oppositi, teretes, glabri. Folia op-

posita, ovata, serrata, glabra. Petioli brevissimi. Pedunculi axillares, inferiores uniflori, superiores triflori, longitudinem foliorum. Bracteae setaceae. Corollae albae, nonnil subroseae, jasminum redolentes, *Clerodendro fortunato* similes. Baccae magnitudine Pisi, tetraspermae. Habitat in aridis Tehuacani. Floret Junio. ⓘ." [Note the statement that the leaf-blades are serrate and that the plant is an annual].

For *Clerodendrum ligustrinum* Millspaugh (1898) cites *Gaume 736* & *875* and *Schott 27* from Yucatán; Loesener (1912) cites *Seler 1896* from Chiapas; Lundell (1942) cites *Matuda 3168* & *3169* from Tabasco; and Matuda (1950) cites *Matuda 17323*.

Material of C. *ligustrinum* has been misidentified and distributed in some herbaria as C. *aculeatum* (L.) Griseb., C. *aculeatum* (L.) Schlecht., *Volkameria aculeata* L., *V. inermis* L., *Aegiphila paludosa* T. S. Brandeg., and *Rubiaceae*. On the other hand, the *Breedlove & Thorne 20913* and *Wedel 67, 1955,* & *2732,* distributed as typical C. *ligustrinum*, actually are its var. *nicaraguense* Mold., *Alexander 248* is var. *paludosum* (T. S. Brandeg.) Mold, and *Flecker s.n.* and *Herb. Hort. Bot. Imp. Pet. Mag. s.n.* are C. *heterophyllum* (Vent.) R. Br.

It should be mentioned that the labels accompanying *E. P. Johnson 12* & *63* are inscribed "Yucatán and Tabasco", but the plants were apparently collected on the banks of the Rio Palizado in Campeche; *Karwinski 704*, cited below as from Querétaro, may actually have been collected in Hidalgo -- the label is inscribed "entre Cazadero & Meta de St. Juan".

Citations: MEXICO: Campeche: *Goldman 446* (W--396809); *E. P. Johnson 12* (C, K), *63* (C, K); *Marroquín 140* (Ip); *Steere 1912* (F--668821, Mi). Chiapas: *Linden s.n.* [Chiapas, Mars 1840] (Cb, P); *Seler & Seler 1896* (B); *Sohns 1655* (Ba--388915. Ca--43979, Mi, N). Oaxaca: *E. J. Alexander 248* (Ld, N); *Galeotti s.n.* [Oaxaca] (V, V); *R. M. King 1982* (Au--186273, Mi); *Ll. Williams 8470* (Mi). Puebla: *Purpus 3336* (B, Bm, Ca--125372, E--118867, Ed, F--244046, G, Ld--photo, N, N--photo, P, W--840976); *Sessé, Mociño, Castillo, & Maldonado 2182* (F--847137, Ld--photo, N--photo, Q, Q), *s.n.* [Macbride photos 30831] (F--929248, Ld--photo, N--photo, Ur--photo). Querétaro: *Karwinski 704* (L, L, N), *704b* (L). Quintana Roo: *Davidse, Sousa, Chater, & Cabrera 20223* (E--2941995). Tabasco: *Barlow 18/3* (Ws), *36/1* (Mi, Ws); *Calzada 2338* (N); *Matuda 3168* (F--1026897, Mh, Mi, N), *3169* (F--1026889, Mh, Mi, N); *Rovirosa 119* (D, K, W--40172, W--1323371); *Seler & Seler 5439* [359] (B, B); *R. C. West 3/11* (Ws), *22/12* (Ws). Tamaulipas: *Berlandier 181* (B, B, B, Bm, Cb, Cb, Cb, Cb, Dc, E--118690, L, P, P, P, S, V, V, V, X); *Edw. Palmer 186*(Bm, E--778771, F--436228, G, Gg--32042, K, N, W--463122). Veracruz: *Beaman 5645* (Ld); *Calzada 647* (W--2790275, W--2790983); *Dorantes López 56* (Ac); *Faberge s.n.* [Laguna Encantada, 8 Jan. 1971] (Au--291890); *Finck 1* (K); *Hahn 147* (P, P), *s.n.* [9 Avril 1866] (P), *s.n.* [Tlacatalpan] (G, K, L); *LeSueur 548* (Au, F--1003675, Tu--98524); *Liebmann 11196* (Cp, W--1315038), *11197* (Cp, W--1269905), *11198* (Cp, W--1315039); *Marquez & Dorantes 27* (N); *E. W. Nelson 489* (W--569127); *Edw. Palmer 407* (Bm, Cb, E--777733, G, Gg--32036, K, N, W--463363), *450* (E--778663, F--436406, Gg--34498, K, N, W--568029); *Purpus 8605* (Ca--

206741, E--913517, G, N, W--1206795); *Seler & Seler 672* (B); *Ventura A. 3386* (Au--304005, Mi); *Ll. Williams 8470*(F--896574, N). Yucatán: *G. F. Gaumer 736* (B, Bm, G, I, Lu, N, S, Us, W--268427), *875* (E--118963, F--36678. G, N, S, W--268624, X), *1933* (B, Ca--385156, Cp, E--954102, F--58731, G, S), *s.n.* [Izamal 1888] (F--181588, G, K), *s.n.* [1913] (Me); *Gaumer & sons 736* (A, Br, Br, Ca--446252, Cp, Du--207700, E--118964, F--36539, Gg--160800, K, L, Mi, V), *1933* (Po--174966); *Schott 27* (F--40025), *807* (Bm). State undetermined: *Herb. Harvey s.n.* (Du--166591); *Herb. Pavon s.n.* (X); *Miller s.n.* [1853] (M); *Quarles v. Ufford 505* (Ut). GUATEMALA: El Petén: *Aguilar Hidalgo 353* (F--759462, I, Mi), *433* (E--1097747, F--790934, Mi, N, N); *Contreras 7416* (Au--278875, Ld, Ld), *8303* (Ld, Ld, W--2795351); *C. L. Lundell 1472* (Du--248371, F--662827, Mi, W--1588968), *17675* (Au--278481, Ld, Ld, W--2795344), *17775* (Au--278578, Ld, Ld), *18026* (Au--278474, Ld, Ld, W--2795343), *18083* (Au--278482, Ld, Ld), *18238* (Au--278473, Ld, Ld); *Steyermark 45943* (Mi, N), *46034* (Ld). BELIZE: *Dwyer 10351* (Au), *11039a* (W--2787872); *Gentle 394* (E--1091152, F--659132, Gg--235235, Mi, W--1587461), *1476* (E--1083642, E--759525, I, Mi, N), *2184* (Mi); *A. Gentry 7591* (Ld, W--2787755, Ws); *Liesner & Dwyer 1649* (Au, W--2800456); *C. L. Lundell 4319* (F--699485, G, Mi), *4344* (F--692303, G, I, Mi, Mi, S), *6962* (Au, F--894480, Mi, Mi, N); *Puleston 7719* (E--3020133). PANAMA: Colón: *Fendler 300* (K). Province undetermined: *Herb. Mell s.n.* (Bm). CULTIVATED: Honduras: *Molina R. 21922* (N). LOCALITY OF COLLECTION UNDETERMINED: *Herb. Desvaux s.n.* (P); *Parkinson s.n.* (Ed). MOUNTED ILLUSTRATIONS: Gibson, Fieldiana Bot. 24 (9): 194, fig. 36. 1930 (Ld); Jacq., Collect. Suppl. pl. 5, fig. 1. 1796 (Ld).

*CLERODENDRUM LIGUSTRINUM* var. *NICARAGUENSE* Mold., Alph. List Comm. Names 16 & 28 nom. nud. 1939; Phytologia 1: 416. 1940.

Bibliography: Mold., Alph. List Comm. Names 16 & 28. 1939;Mold., Geogr. Distrib. Avicenn. 16 & 32. 1939; Mold., Phytologia 1: 416. 1940; Mold., Known Geogr. Distrib. Verbenac., ed. 1, 22, 23, 72, & 90. 1942; Mold., Phytologia 2: 100. 1945; Mold., Alph. List Cit. 1: 100, 193, & 319 (1946), 2: 340 (1948), 3: 666 (1949), and 4: 999, 1053, & 1099. 1949; Mold., Known Geogr. Distrib. Verbenac., ed. 2, 38, 40, 159, & 182. 1949; Mold., Résumé 45, 48, 216, & 451. 1959; Mold., Résumé Suppl. 16: 4 (1968) and 17: 2. 1968; Mold., Fifth Summ. 1: 85, 90, & 359 (1971) and 2: 868. 1971; Mold. in Woodson, Schery, & al., Ann. Mo. Bot. Gard. 60: 138 & 143--145. 1973; Mold., Phytologia 36: 30. 1977; Mold., Phytol. Mem. 2: 61, 78, 83, 349, & 539. 1980; F. C. Seymour, Phytol. Mem. 1: 242. 1980.

This variety differs from the typical form of the species in its leaves and axillary cymes usually being ternate and the leaf-blades being regularly puberulent or pubescent beneath.

The variety is based on *Chaves 227* from Managua, Nicaragua, collected on July 26. 1926, and deposited in the United States National Herbarium in Washington.

Collectors describe this plant as a shrub, 2 m. tall, or small tree, 5 m. tall. Englesing describes his collection as "probably an escape from cultivation.....growing among low second growth in full sunlight in old clearings....the diameter of the stems near their base 1 to 2 cm.....stems many from the same base, erect, arcuate outward, cylindrical,, the branches minutely furrowed vertically, gray-white, sparsely branched, the branches generally opposite, arcuately curved downward or stiff and straight, cylindric, light gray-green in color, with many minute raised lenticels, the leaves opposite in whorls, seemingly 4-ranked, smooth, dull dark-green above, lighter green beneath, the flowers white, on axial cymes near the apices of the branches, the fruit 4-celled, green, oblate-spheroid. [Grows in] Society [with] mostly herbs and grasses."

Collectors have encountered the plant in dense wet forests, on extensive sand-dunes, and around roadside ponds, from sealevel to 1100 m. altitude, in anthesis from December to March and July to October, and in fruit in December. Standley reports it "rare" in Chinandega. The corollas are described as "white" on all the Breedlove & Thorne, Standley, and Wedel collections cited below, but on *Lewis & al. 998* the "flowers" are said to have been "brown" and the fruit "yellow-brown" -- there are no corollas or fruit on the specimen examined, but there are brown fruiting-calyxes.

Vernacular names recorded for this plant are "jasmin", "si me miras", and "si me miras te enamoras".

The Lindsey collection, cited below, is anomalous in having opposide leaves, many of which have a pair of coarse teeth 2/3 the distance to the apex from the base.

Material of this taxon has mostly been identified and distributed in herbaria as typical C. *ligustrinum* (Jacq.) R. Br.

Citations: MEXICO: Chiapas: *Breedlove & Thorne 20913* (Ld, Mi). NICARAGUA: Chinandega: *P. C. Standley 11488* (N); *E. Wall s.n.* [Corinto, 15/4/28] (Ew, Ew). Managua: *Chaves 227* (Ld--photo of type, N--photo of type, S--photo of type, W--1266749--type). Zelaya: *Englesing 120* (F--572529, N, N, Y). Corn Island: *F. C. Seymour 4411* (Ld). PANAMA: Bocas del Toro: *Lewis, Dwyer, Elias, & Robertson 998* (N). Canal Zone: *W. R. Lindsay 395* (Ba, F--855590). Colon Island: *Wedel 67* (E--1218008). Old Bank Island: *Wedel 1955* (E--1232155). Shepherd Island: *Wedel 2732* (E--1244912). CULTIVATED: Costa Rica: *Tonduz 129* (B, Ld--photo, N--photo, S--photo). Honduras: *P. C. Standley 24599* (N).

*CLERODENDRUM LIGUSTRINUM* var. *PALUDOSUM* (T. S. Brandeg.) Mold., Geogr. Distrib. Avicenn. 14 nom. nud. 1939; comb. nov.

Synonymy: *Aegiphila paludosa* T. S. Brandeg., Univ. Calif. Publ. Bot. 6: 191. 1915.

Bibliography: T. S. Brandeg., Univ. Calif. Publ. Bot. 6: 191. 1915; Prain, Ind. Kew. Suppl. 5, imp. 1, 6. 1921; Fedde & Schust., Justs Bot. Jahresber. 44: 253. 1922; Mold., Geogr. Distrib. Avicenn. 14. 1939; Mold., Prelim. Alph. List Inv. Names 3. 1940; Mold., Suppl. List Comm. Vern. Names 11. 1941; Mold., Alph. List Inv. Names 3. 1942; Mold., Known Geogr. Distrib. Verbenac., ed. 1, 16 & 90. 1942; Mold., Alph. List Cit. 1: 315 & 319 (1946) and 2: 423, 500, & 578. 1948; Mold., Known Geogr. Distrib. Verbenac., ed. 2, 29 & 182. 1949;

Mold., Résume 35, 230, & 451. 1959; Prain, Ind. Kew. Suppl. 5, imp. 2, 6. 1960; Mold., Fifth Summ. 1: 69 & 382 (1971) and 2: 868. 1971; Mold., Phytol. Mem. 2: 61 & 539. 1980.

This variety differs from the typical form of the species in its much shorter calyx-lobes.

The variety is based on *Purpus 7181* from around ponds near San Geronimo, Oaxaca, Mexico, collected in July, 1914, and deposited in the herbarium of the University of California at Berkeley.

The leaves of this plant often have very much abbreviated leaf-bearing twigs in their axils so that they appear, on first glance, to be fascicled. Collectors describe it as a shrub, 0.5--3 m. tall, or a tree, to 5 m. tall, the stems to 3 cm. in diameter, the bark deeply and coarsely furrowed, the lenticels very abundant, elongate, white, conspicuous (more so than in the typical form), the corollas white, filaments white, and anthers brown.

They have found it growing in open sunshine in clay-loam soil, on flat grazed areas, and among vegetation composed mostly of leguminous shrubs and cacti, at altitudes of less than 50 m., in flower in January and July, and in fruit in January.

Material has been identified and distributed in some herbaria as typical C. *ligustrinum* (Jacq.) R. Br.

Citations: MEXICO: Oaxaca: *E. J. Alexander 248* (Ld); *R. M. King 873* (Au--214228, Ld, Mi, W--2301526), *1982* (N); *Purpus 7181* (B--isotype, Bm--isotype, Ca--175009--type, E--765041--isotype, F--424587--isotype, F--photo of type, G--isotype, Ld--photo of type, N--isotype, N--photo of type).

*CLERODENDRUM LINDENIANUM* A. Rich. in Sagra, Hist. Cub. Bot. 2: 147 [as "*Clerodendron*"]. 1850; Mold., Alph. List Comm. Vern. Names 26 & 31. 1939.

Synonymy: *Clerodendron lindenianum* A. Rich. in Sagra, Hist. Cub. Bot. 2: 147. 1850. *Clerodendron lindenianum* Schau. ex Mold., Prelim. Alph. List Inv. Names 20 in syn. 1940. *Clerodendron lindelianum* Rich. ex Mold., Prelim. Alph. List Inv. Names 20 in syn. 1940. *Clerodendron lindeniana* A. Rich. ex Roig, Dicc. Bot. 2: 1005 sphalm. 1953. *Clerodendrum lindenianum* var. *lindenianum* [Alain] in Leon & Alain, Fl. Cuba, imp. 1, 4: 322. 1957.

Bibliography: A. Rich. in Sagra, Hist. Fis. Polit. Nat. Cuba 11 (2) [Fl. Cub. Fanerog. 2]: 147. 1850; C. Muell. in Walp., Ann. Bot. Syst. 5: 710. 1860; Sagra, Icon. Pl. Fl. Cub. 41. 1863; Griseb., Cat. Pl. Cub. 216. 1866; Jacks. in Hook. f. & Jacks., Ind. Kew., imp. 1, 1: 561. 1893; Mold., Alph. List Comm. Vern. Names 26 & 31. 1939; Mold., Geogr. Distrib. Avicenn. 5. 1939; Mold., Prelim. Alph. List Inv. Names 20 & 22. 1940; Mold., Alph. List Inv. Names 21. 1942; Mold., Known Geogr. Distrib. Verbenac., ed. 1, 25 & 90. 1942; Mold., Phytologia 2: 100. 1945; Jacks. in Hook. f. & Jacks., Ind. Kew., imp. 2, 1: 561. 1946; Mold., Alph. List Cit. 1: 3, 63, 75, 185, 187, 302, & 312. 1946; H. N. & A. L. Mold., Pl. Life 2: 69. 1948; Mold., Alph. List Cit. 2: 415, 418, 569, 578, 579, & 648--651 (1948), 3: 664, 675, 757, 826, 867, 889, 928, & 929 (1949), and 4: 1026, 1035, 1068, 1144, & 1206. 1949; Mold., Known Geogr. Distrib.

Verbenac., ed.2, 43 & 182. 1949; Roig, Dicc. Bot. 2: 898 & 1005. 1953; Alain in León & Alain. Fl. Cuba, imp. 1, 4: 319 & 322. 1957; Mold., Résumé 51, 216, 266, 271, 273, & 451. 1959; Jacks. in Hook. f. & Jacks., Ind. Kew., imp. 2, 1: 561. 1960; Mold., Fifth Summ. 1: 95, 359, 449, 461, & 463 (1971) and 2: 868. 1971; Alain in León & Alain, Fl. Cuba, imp. 2, 2: 319 & 322. 1974; Mold., Phytol. Mem. 2: 88, 350, & 539. 1980; Mold., Phytologia 57: 478 (1985) and 60: 130 & 131. 1986.

Illustrations: Sagra, Icon. Pl. Fl. Cub. 41. 1863.

A shrub or small tree, 1--7 m. tall, usually only a shrub 1--4 feet tall; branches and branchlets stoutish, very light-gray or whitish, obscurely tetragonal or subterete, tuberculate, glabrate; twigs more slender, yellow-brown or buff, more or less densely pubescent with brownish often hirsutulous hairs; nodes not annulate, usually much thickened because of the very heavy, corky, prominent leaf-scars; principal internodes 0.3--3 cm. long, often extremely abbreviated on branchlets and twigs; leaves decussate-opposite; petioles stout, 3--9 mm. long, densely short-pubescent with brownish hairs; leaf-blades tremendously variable in size, shape, and texture, coriaceous, gray-green on both surfaces or brighter green beneath, varying from oblong, elliptic, or oblong-elliptic to oblong-lanceolate, oblanceolate, or obovate, 4--20.5 cm. long, 1.5--8 cm. wide, apically usually obtuse or rounded, varying to sharply acute or short-acuminate, marginally entire (and often more or less revolute in drying) or denticulate to subdenticulate-spinose, basally acute or cuneate (varying to deeply cordate), glabrous above (except for the pilose midrib), sparsely and often obscurely strigillose-puberulent (or subglabrate on the lamina) beneath, especially along the larger venation; midrib slender or stoutish, sharply prominulent within a furrow above, very prominent beneath, pilose above; secondaries slender, 5--7 per side, arcuate-ascending, flat or slightly impressed above, very prominent beneath, often arcuately joined close to the margins beneath; vein and veinlet reticulation rather abundant, the larger portions decidedly prominulent beneath, mostly obscure above; inflorescence axillary, often only in the uppermost leaf-axils, the cymes opposite, solitary, 4--10 cm. long, 2--5 cm. wide, 2--5-flowered (mostly 3-flowered); peduncles slender, 0.1--5 cm. long, usually elongate, sparsely and obscurely strigillose or glabrate, yellow-brown or buff; pedicels similar to the peduncles in color and texture, 6--35 mm. long, very divaricate, usually jointed and bracteolate near the middle (from which joint another flower may arise); bracts absent; bractlets and prophylla linear or setaceous, minute; flowers fragrant; calyx obconic, 3--4 mm. long, apically ampliate, the rim truncate and undulate, externally hirtellous; corolla hypocrateriform, white, 2--2.5 cm. long, the lobes oblong, 5 mm. long; fruit drupaceous, fleshy, light-blue.

This endemic Cuban species is based on *J. Linden 1775* from the mountains near Pinal de los Hondones, Oriente, Cuba, collected in May, 1844. The type collection represents a form with thinner and less coriaceous, almost flat-margined, leaf-blades, well represented also by *Jack 5628* in the Arnold Arboretum herbarium and by *Pollard,* *Palmer, & Palmer 216.*

Leaf-blades with denticulate margins are seen on *Britton, Britton, & Shafer 277, Roig 1642, Shafer 4175, 7743, & 8307,* and *C. Wright 3177; Jack 5628* in the Britton Herbarium exhibits leaf-blades very distinctly and sharply dentate with irregular teeth.

Collectors have encountered this plant in pine woods. grassy pineland, and pineland thickets, among limestone rocks, and on coral rock hills, at 600 m. altitude, in flower from January to March, as well as in May and September, and in fruit in February, May, and July.

A key to help distinguish *C. lindenianum* from other Cuban taxa in this genus will be found under *C. grandiflorum* (Hook.) Schau. in the present series of notes [60: 130--131].

Vernacular names reported for *C. lindenianum* are "roble guayo" and "turquesa".

It should be noted that the *León 18548* collection, cited below, seems to be very close to *C. anafense* Britton & P. Wils., at least in general habit.

Material of *C. lindenianum* has been misidentified and distributed in some herbaria as *C. cubense* Schau., *C. tuberculatum* A. Rich., and *Aegiphila* sp. On the other hand, the *Alain 6875,* distributed as *C. lindenianum,* actually is *C. grandiflorum* (Hook.) Schau.

Citations: CUBA: Havana: *Britton, Britton, & Shafer 777* (Cm, N); *León 13654* (D--694850, Y--13607). Las Villas: *J. G. Jack 5628* (A, Bm, N, N, P), *5707* (A, N, W--1555504), *s.n.* [León 18548] (Ha), *s.n.* [Soledad, Oct. 7, 1927] (Du--348517); *Luna 985* (Ha, N). Oriente: *Alain 3157* (Hk); *Mrs. G. C. Bucher 2* (N); *Clemente 4529* (Ha, N); *Clemente, Alain, & Chrysogone 6992* (Ha); *Curbelo s.n.* [Herb. Roig 6220] (N); *Ekman 3991* (B, S), *4018* (B, N, S), *4219* (B, N, S), *6736* (B, S); *R. A. Howard 6041* (G); *León & Alain 19159* (Ha); *León & Clemente 20380* (Ha); *León & Victorin 19814* (Ha); *Linden 1775* (B--isotype, Bm--isotype, Cb--isotype, K--isotype, K--isotype, Ld--photo of isotype, N--photo of isotype, P--isotype, V--isotype, X--isotype); *Lopez F. 1917* (W--2227105); *Pollard, Palmer, & Palmer 2161*(E--40801, F--125724, G, N, W--402947); *Roig 1642* (Es), *6640* (Es); *Shafer 3622* (N), *7743* (N), *8307* (G, K, N, N, W--696507); *Van Hermann 11761* (Es, N). Province undetermined: *Sagra 219* (K), *s.n.* (V, V); *C. Wright 3177* [1860--1864; Herb. Sauvalle 1781] (B, Bm, Cb, E--118857, G, Hv, K, Os, P, X). CULTIVATED: Florida: *H. N. Moldenke 21450* (Ld).

*CLERODENDRUM LINDENIANUM* var. *CAMAGUEYENSE* (Britton & P. Wils.) Mold., Geogr. Distrib. Avicenn. 5. nom. nud. 1939; stat. nov.

Synonymy: *Clerodendrum camagueyense* Britton & P. Wils., Mem. Torrey Bot. Club 16: 99. 1920. *Clerodendron camagueyense* Britton & P. Wils. apud A. W. Hill, Ind. Kew. Suppl. 6, imp. 1, 49. 1926. *Clerodendron camagueyensis* Britton & P. Wils. ex Roig, Dicc. Bot. 2: 741 & 1005. 1953.

Bibliography: Britton & P. Wils., Mem. Torrey Bot. Club 16: 99. 1920; A. W. Hill, Ind. Kew. Suppl. 6, imp. 1, 49. 1926; Mold., Geogr. Distrib. Avicenn. 5. 1939; Mold., Prelim. Alph. List Inv. Names 22. 1940; Mold., Alph. List Inv. Names 21. 1942; Mold., Known Geogr.

Distrib. Verbenac., ed. 1, 25 & 90. 1942; Mold., Alph. List Cit. 1: 3, 187, & 312 (1946), 3: 867 & 928 (1949), and 4: 1033. 1949; Mold., Known Geogr. Distrib. Verbenac., ed. 2, 43 & 182. 1949; Roig, Dicc. Bot. 2: 741 & 1005. 1953; Alain in León & Alain, Fl. Cuba, imp. 1, 4: 322. 1957; A. W. Hill, Ind. Kew. Suppl. 6, imp. 2, 49. 1959; Mold., Résumé 51, 271, & 451. 1959; Mold., Fifth Summ. 1: 95 & 461 (1971) and 2: 868. 1971; Alain in León & Alain, Fl. Cuba, imp. 2, 2: 322. 1974; Mold., Phytol. Mem. 2: 88 & 539. 1980; P. Holmgren & al., Ind. Vasc. Pl. Type Microf. 441. 1985; Mold., Phytologia 57: 478. 1985.

This variety differs from the typical form of the species in its longer corolla-tubes, the corolla being to 4 cm. in length.

Britton & Wilson's origonal (1920) description is: A shrub 1--1.2 m. high, the twigs and petioles tuberculate and minutely hispidulous with mostly appressed hairs. Leaves obovate or elliptic-obovate, 7--11 cm. long, 3.5--6 cm. wide, dark green, lustrous and hispidulous on the veins above, the secondary veins inconspicuous, paler, coarsely reticulate-veined and minutely hispidulous on the veins beneath, the margin denticulate; petioles 1 cm. long; calyx narrowly campanulate, subtruncate at the apex, glabrous; corolla about 4 cm. long, white, the lobes oblanceolate; stamens exserted."

The variety is based on *Shafer 496* from savannas south of Sierra Cubitas, Camagüey, Cuba, collected on February 20 and 21, 1909, and deposited in the Britton Herbarium at the New York Botanical Garden. Roig describes the plant as an "Arbusto silvestre de hojas coriáceas, que crece en las sabanas al sur de la ciudad de Camagüey. Tiene las flores blancas de tubo largo y estambres salientes". Its vernacular name is "palo sabanero". It has been collected in anthesis in December and February.

Citations: CUBA: Camagüey: *Acuña 13783* (Es); *Roig 3428* (N); *Shafer 496* (F--284445--isotype, N--type, W--659156--isotype). Oriente: *Ekman 15027* (B, N, S). MOUNTED CLIPPINGS: Britton & P. Wils., Mem. Torrey Bot. Club 16: 99. 1920 (W).

*CLERODENDRUM LINDIENSE* Mold., Phytologia 5: 83. 1954.

Synonymy: *Clerodendrum lindeniense* Mold., Phytologia 5: 97 sphalm. 1954.

Bibliography: B. Thomas, Engl. Bot. Jahrb. 68: [Gatt. Clerod.] 89. 1936; Mold., Phytologia 5: 83 & 97. 1954; Anon., Trav. Lab. Bot. Syst. Brux. 16: 66. 1955;Anon., Assoc. Etud. Tax. Fl. Afr. Trop. Ind. 1954: 66. 1955; Mold., Résumé 144, 273, & 451. 1959; G. Taylor, Ind. Kew, Suppl. 12: 36. 1959; Mold., Fifth Summ. 1: 235 & 463 (1971) and 2: 868. 1971; Mold., Phytol. Mem. 2: 225 & 539. 1980; P. Holmgren & al., Ind. Vasc. Pl. Type Microf. 441. 1985; Mold., Phytologia 57: 390 & 391 (1985) and 60: 60. 1986.

A woody plant, about 1 m. tall; branches and branchlets tetragonal, rather slender, very densely spreading-hirsute with yellowish-gray hairs 1--2 mm. long; leaves decussate-opposite; petioles slender, 4--9 mm. long, flattened-sulcate above, densely villous-hirsute with yellowish-gray hairs like on the branchlets; leaf-blades chartaceous, grayish-brown when dry, lighter beneath, elliptic, 3--7 cm.

long, 1.3--3.4 cm. wide, apically acute or very shortly acuminate, marginally entire, basally acute or short-acuminate, lightly pubescent above, with the hairs eventually wearing off, densely grayish-tomentose beneath; midrib slender, flat above, prominulous beneath; secondaries very slender, 3 or 4 per side, arcuate-ascending, prominulous beneath, flat above, not anastomosing at the margins; veinlet reticulation abundant but difficult to distinguish; peduncles slender, 3.5--4.3 cm. long, densely hirsute with yellowish-gray hairs 1--2 mm. long like on the branchlets; cymes 3--4 cm. long and wide, several times dichotomous, rather densely flowered, its branches densely hirsute like the peduncles; bractlets narrow-elliptic, about 5 mm. long, densely villous, attenuate at both ends; pedicels filiform, 1.5--2 mm. long, villous; calyx campanulate, its tube about 5 mm. long and 2 mm. wide, externally villous-hirsutulous with many-celled white hairs, the rim 5-toothed, the teeth about 3 mm. long, apically long-caudate, villous; corolla hypocrateriform, white, the tube narrow-cylindric, about 1 cm. long, less than 1 mm. wide, externally lightly puberulous, the limb ampliate to about 5 mm.; stamens exserted about 1 cm. from the corolla-mouth.

This species is based on *H. J. Schlieben 5866* from open woods on hills at Lindi, by Lake Lutamba, at an altitude of 240--250 m. Tanganyika (Tanzania), collected on January 11, 1935, and deposited in the Brussels herbarium. The collector notes that the plant grows "solitary". Thus far it is known to me only from the type collection, which was cited by Thomas (1936) and distributed in herbaria as *C. acerbianum* (Visian.) Benth. Thomas gives the date of collection as January "12".

Citations: TANZANIA: Tanganyika: *Schlieben 5866* (B--isotype, Br--type, Mu--isotype, N--isotype, S--isotype.

*CLERODENDRUM LINDLEYI* Decaisne ex Planch., Fl. Serr. Jard., ser. 1, 9: 17 [as "*Clerodendron*"]. 1853; Mold., Geogr. Distrib. Avicenn. 5, 14, 26, & 37. 1939.

Synonymy: *Clerodendron foetidum* Hort. Paris ex Planch., Fl. Serr. Jard., ser. 1, 9: 17. 1853 [not *C. foetidum* Bunge, 1833, nor (Burm.) Bunge, 1985, nor (L.) Bunge, 1985, nor D. Don, 1825, nor Miq., 1921, nor *Clerodendrum foetidum* Bunge, 1840]. *Clerodendron fragrans flore simplici* Lindl. ex Voss in Vilm., Blumengart. 1: 830 in syn. 1895. *Clerodendron lindleyi* "Decne. ex Planch." apud Bakh. in Lam & Bakh., Bull. Jard. Bot. Buitenz., ser. 3, 3:88 & 109. 1921. *Clerodendron foetidum* Hort. ex Rehnelt, Pareys Blumengärtn., ed. 1, 282 in syn. 1932.

Bibliography: Planch., Fl. Serr. Jard., ser. 1, 9: 17. 1853; Regel, Gartenfl. 6: 363 (1857) and 11: 64/65, pl. 353. 1862; Regel, Trans. Russ. Hort. Soc. 1862: pl. 79. 1862; Maxim., Bull. Acad. Imp. Sci. St.-Pétersb. 31: 84. 1886; Forbes & Hemsl., Journ. Linn. Soc. Lond. Bot. 26 [Ind. Fl. Sin. 2]: 260. 1890; Jacks. in Hook. f. & Jacks., Ind. Kew., imp. 1, 1: 561. 1893; Voss in Vilm., Blumengärt. 1: 830. 1895; H. J. Lam, Verbenac. Malay. Arch. 259 & 363. 1919; Bakh. in Lam & Bakh., Bull. Jard. Bot. Buitenz., ser. 3, 3: 88, 109, & IX. 1921; Stapf, Ind. Lond. 2: 239. 1930; P'ei, Mem. Sci. Soc.

China 1 (3): 133. 1932; Rehnelt, Pareys Blumengärtn., ed. 1, 282. 1932; Mold., Geogr. Distrib. Avicenn. 5, 14, 26, & 37. 1939; Mold., Known Geogr. Distrib. Verbenac., ed. 1, 16, 25, 36, 58, 72, & 90. 1942; Jacks. in Hook. f. & Jacks., Ind. Kew., imp. 2, 1: 561. 1946; Mold., Alph. List Cit. 1: 17 & 187 (1946) and 2: 353, 359, 413, 414, 538, 561, 563, 564, 572, 608, 644, & 646. 1948; H. N. & A. L. Mold., Pl. Life 2: 69. 1948; Mold., Known Geogr. Distrib. Verbenac., ed. 2, 29, 43, 76, 131, 135, 159, & 182. 1949; Mold., Alph. List Cit. 3: 708, 712, 719, 748, 801, 844, 879, & 928 (1949) and 4: 987, 1052, 1096, & 1299. 1949; Pételot, Pl. Med. Camb. Laos Vietn. 2: 253 (1954) and 4: 99. 1954; Alain in León & Alain, Fl. Cuba, imp. 1, 4: 319 & 321. 1957; Mold., Résumé 35, 51, 88, 169, 174, 181, 216, 263, 266, & 451. 1959; Jacks. in Hook. f. & Jacks., Ind. Kew., imp. 3, 1: 561. 1960; Mold., Résumé Suppl. 3: 17 & 19 (1962) and 6: 8. 1963; Mold., Biol. Abstr. 47: 6794. 1966; Howard & Powell, Taxon 17: 55. 1968; Mold., Résumé Suppl. 16: 11 & 19. 1968; Mold., Fifth Summ. 1: 69, 95, 148, 288, 292, 300, 311. 359, 444, 445, & 449 (1971) and 2: 868. 1971; Rouleau, Taxon Ind. 1: 92. 1972; Alain in León & Alain, Fl. Cuba, imp. 2, 2: 319 & 321. 1974; Mold., Phytologia 28: 449 (1974), 31: 390 (1975), and 34: 245 & 249. 1976; E. H. Walker, Fl. Okin. South. Ryuk. 890 & 892. 1976; Hocking, Excerpt. Bot. A.30: 419. 1978; Mold., Phytol. Mem. 2: 41, 61, 88, 140, 259, 277, 281, 282, 291, 302, 313, 350, & 539. 1980; Reis & Lipp, New Pl. Sources Drugs 251. 1982; H. N. & A. L. Mold. in Dassan. & Fosb., Rev. Handb. Fl. Ceyl. 4: 411, 459--461, & 472. 1983; Mold., Phytologia 52: 466 (1983), 57: 36 & 338 (1985), 58: 286, 332, 338, 343--345, 417, & 460 (1985), and 60: 62 & 130. 1986.

Illustrations: Regel, Gartenfl. 11: 64/65, pl. 353 (in color). 1862; Regel, Trans. Russ. Hort. Soc. 1862: pl. 79. 1862.

A bush or small, erect, bushy shrub or undershrub, 0.9--3 m. tall; branchlets rather obtusely tetragonal, brownish, more or less pulverulent-puberulent or subglabrous in age, usually pilose at the nodes; twigs densely glandular-pubescent with short irregular hairs or puberulent; nodes not annulate, usually pilose; principal internodes 1.3--11 cm. long; leaves decussate-opposite; petioles rather stoutish, 1.5--10.5 cm. long, medullose almost to the base, usually collapsing at the base in drying, not much ampliate basally, densely short-pubescent or puberulent; leaf-blades membranous or subchartaceous, somewhat darker green above than beneath, ovate to broadly ovate or deltoid, 6.5--16.5 cm. long, 6.5--15.5 cm. wide, apically acute or short-acuminate, marginally entire or denticulate to rather coarsely and irregularly sharp-dentate and usually more or less ciliate, basally subcordate or subtruncate (the central part of the base more or less cuneate-acute), very shortly and sparsely pilose with scattered hairs or puberulent-pulverulent above, more or less puberulent beneath or pilose-pubescent with short irregular hairs especially on the venation, usually marked with several, black, discoid glands at the very base and also sometimes scattered over other parts of the lamina; secondaries 3--6 per side, the 2 lowest issuing from the midrib at the very base of the blade and very decidedly pinnately branched from the basal side, all arcuate-ascending, distant, joined in many loops near the margins; inflorescence terminal, paniculate but densely compact, many-flowered, 4--12.5 cm. long, 6--9 cm. wide, very conspicuously bracteate and bracteolate, puberulent or pilose to short-pubescent throughout; peduncles continuous with the apex of the twigs and similar in all respects, 0.5--6 cm. long, usually with a pair of large foliaceous bracts, similar in all respects to the leaves but smaller, at or near the apex; bractlets very numerous, lanceolate or oblong, 1.2--3.5 cm. long, 3--5 mm. wide, surpassing the calyx, acuminate at both ends, pulverulent or pilose-pubescent on both surfaces, marked with numerous, subcutaneous, black, discoid glands, stipitate; pedicels slender, 1--7 mm. long; flowers showy, slightly fragrant or malodorous; calyx obconic-tubular or oblong-campanulate, 1--1.5 cm. long, often magenta-crimson, externally puberulent, the rim 5-lobed, the lobes linear or linear-lanceolate, apically purplish; corolla hypocrateriform, light purple or deep purplish-pink to purplish, pink, red. pink-lavender, or flesh-color, darker externally, the tube slender, 2.5--3 cm. long, mostly 4 times as long as the calyx, the limb mostly 5-lobed, the lobes obovate, 5--8 mm. long; stamens 4, long-exserted; filaments white; anthers deep-purple; fruiting-calyx red; fruit drupaceous, at first green.

This species is native to southern China, Hainan island, and Himalayan India and Burma. It is rather abundantly cultivated and tends to escape and become naturalized (as in Cuba). It has been widely confused in botanical and horticultural literature, as well as in herbaria, with *C. bungei* Steud. and the simple-flowered form of *C. philippinum* Schau. Its roots, dried well for about 5 hours, are sold on the Canton market as "ch'au shi mut li" and are employed in the manufacture of a medicine taken orally for the strengthening of the leg muscles. The fruit is edible and the leaves are used for brewing a tea in China.

*Clerodendrum lindleyi* is a valid species and is most definitely not the single-flowered form of *C. philippinum* as maintained by Schauer, Merrill, and so many other authors. The true single-flowered form of *C. philippinum* is well represented by such collections as *León 6320* in the Havana herbarium and is exactly like the common double-flowered form in its foliar characters, flower-size, etc., except for the simple nature of its corollas; *C. lindleyi*, on the other hand differs notably in its leaf characters, flower size, etc.

Planchon (1853) comments that "Trois arbustes bien distincte ont reçu le nom de *Clerodendron foetidum*. D'abord, l'espèce primitive à laquelle ce nom doit rester, et dont nous transcrivons en note la diagnose, comme objet de comparaison. C'est une plante du Népaul, à feuilles elliptiques, à calice plus long que le tube de la corolle: elle n'existe pas, que nous sachions, dans nos jardines [This is *Caryopteris foetida* (D. Don) Thellung]. La second espèce, signalée dans le Revue horticole, en 1851, d'aprés des exemplaires que l'on cultive à Paris depuis une douzaine d'années, nous parait presque identique avec une prétendue forme á fleurs simples du *Clerodendron fragrans*, forme déjà publiée dans le Botanical Register, en Août 1838, mais sans indication d'origine [This is *C. lindleyi* Decaisne].

Reste la troisiéme espèce que nous appellerons avec Steudel, *Clerodendron Bungei* et dont le portrait dessiné sur le vivant dans l'etablissement Van Houtte, n'existe dans aucune publication horticule [This is the plant we now call C. *bungei* Steud.]" He continues further about C. *lindleyi* as follows: "C'est évidèmment cette plante du Botanical Register que M. Schauer, dans le Prodromus de De Candolle (Tom. XI, p. 666), signale, après Lindley, comme le type à fleurs simples du *Clerodendron fragrans*, et dont il indique l'introduction comme recente à la date de 1847. Voici pourtant sur quelles raisons se fonde notre savant collaborateur, M. Decaisne, pour considérer cette plante comme espèce à part, sous le nom manuscrit de *Clerodendron Lindleyi*, lo Le type à fleurs simples du *Clerodendron fragrans* figuré par Ventenat, (Malmais. t. 70) et qui fleurit en France, dans le jardin de Cels, vers le commencement du siécle, a des corolles à limbe bien plus large que le *Cl. Lindleyi*. 2o Le *Clerodendron fragrans* est une plante delicate, qu'on ne cultive jamais en pleine terre à Paris, et dont les racines ne tracent pas: l'autre espèce est, au contraire, rustique et ses racines traçantes. Ce que nous disons ici, du reste, se rapporte spécialement à la plante cultivée au Museum de Paris, sous le nom de *Clerodendron foetidum*, plante qui diffère un peu de celle du Botanical Register en ce que ses fleurs sont inodores (et non presque aussi odorantes que celles du C. *fragrans*) et que ses jeunes pousses surtout sont couvertes d'un velouté de couleur violette. Y aurait-il encore lá deux espèces confondues? Qui étudiera jugera."

In this connection it may be noted that Howard & Powell (1968) also assert: "It should also be noted that the plant called *Clerodendrum lindleyi* often referred to the synonymy of '*Clerodendrum fragrans*' does not, in our opinion, belong there."

Voss (1895), in reviewing this involved situation, states that, in his opinion, *Clerodendrum lindleyi* "ist vielleicht nur eine Abtreibend; Aste stumpf-4 kantig, kurz haarig (anscheinend grün bleibend. Blätter ziemlich langgestielt, fast herzförmig, breit-eirund oder fast rundlich, zugespitzt, schön grün, am Rande ausgeschweiftgezähnelt oder fast ganzrandig, am Grunde diesseits der Blattstiel-Einfügung drüsentragend, beiderseits kurzhaarig. Blüten in groszen, endständigen, vielblütigen, gedrungenen, bouquetförmigen Doldentrauben, deren Spindel, Blütenstiele und Kelche dicht flaumig sind. Deckblättchen lanzettlich oder linealisch-lanzettlich, die Kelche überragend und wie diese drüsentragend. Kelch verkehrt-kegelförmigröhrig mit 5 spaltigen Saum und linealisch-lanzettlichen pfrienlichzugespitzten Zipfeln. Blumenkrone ausser kaum kurzhaarig, nur schwach duftent, mit schmaler Röhre, die meist 4 mal so lang als der Kelch ist; Kronsaum meist 5 teilig. Blüten fleischfarbig oder rot, aussen dunkler, weniger schön als bei C. *foetidum*."

Collectors have encountered C. *lindleyi* along roadsides, in forests and roadside thickets, along railroad tracks, in green valleys, on wooded and damp grassy hillsides, in hedges and on dry land, in open brush, in uncultivated ground near houses, in waste places, and on garbage dumps, at 60--1450 m. altitude, in flower in March, April, June to August, and October to December. Hu reports finding it "growing over large areas by the village" of Hong Kong. Walker reports it naturalized on Okinawa; Pittier says of it in Venezuela: "Introduced but said to be indigenous". Alain (1924) reports it escaped in Pinar del Río, Cuba, "originally from tropical Asia".

A key to help distinguish this species from other Cuban species will be found under *C. grandiflorum* (Hook.) Schau. in the present series of notes [60: 130--131].

The corollas are described as having been "red" on *Chung 2395* and *Herb. Canton Chr. Coll. 12501*, "reddish-purple" on *Rock 6621*, "purplish" on *Ching 1994* and *Chun 5999*, "light-purple" on *Hu 13126*, "deep purplish-pink" on *Walker 8136*, and "pink-lavender" on *Gressitt 1333*.

The leaves on *Boeea 6473* and *Koelz 25301* look remarkably like those of *C. philippinum* Schau., without regular marginal teeth visible and with elongated corolla-tubes; on *Ging 5537* the leaf-blades have regular teeth plainly visible over almost the whole margin.

Vernacular and common names recorded for *C. lindleyi* are "chau fung t'an", "ch'au shi mit li", "chau ti fung". "Lindley's clerodendrum", "rindiri-kusagi", "sarang banoea", "yaezaki-kusagi", and "yuen tau fung".

It may be pointed out here that the *Clerodendron foetidum* Bunge, *C. foetidum* (Burm.) Bunge, *C. foetidum* (L.) Bunge, and *Clerodendrum foetidum* Bunge, referred to in the synonymy (above), all apply to the last-mentioned, a valid species, which see, while *Clerodendron foetidum* D. Don is a synonym of *Caryopteris foetida* (D. Don) Thellung and *Clerodendron foetidum* Miq. is a synonym of *Clerodendrum buchanani* (Roxb.) Walp., which see.

Walker (1976) cites from cultivation on Okinawa: *Amano 6251, SIRI 6894, Tamayose s.n.*, and *Walker 8136*; Reis & Lipp (1982) cite *Tsang 21353* from Kwangtung, China.

Material of *C. lindleyi* has been misidentified and distributed in some herbaria as *C. bracteatum* Wall., *C. bungei* Steud., *C. canescens* Wall., *C. foetidum* Bunge, *C. fragrans* Vent., *C. fragrans* Willd., *C. glandulosum* Colebr., *C. roseum* Poit., *C. trichotomum* Thunb., and *C. violaceum* Gürke.

On the other hand, the *Kingdon-Ward 18191, Liang 61691, McClure 9207*, and *Nooteboom 1246*, distributed as typical *C. lindleyi*, actually represent its f. *albiflorum* Mold., while *Roig 8157* is *C. splendens*

Citations: MEXICO: Veracruz: *Quarles van Ufford 516* (Ut). CUBA: Havana: *Ekman 13181* (Ld--photo, N, N--photo, S); *León 3367* (Ha, N); *Morales & Bosque 348* (B); *Shafer 419* (Cm, N). Pinar del Río: *Shafer 419a* (Es, Es). BRAZIL: Bahia: *Paulay s.n.* (V). Rio de Janeiro: *Rudio 146* (B, W--1234147); *Sampaio s.n.* [Campos, Jan. 1935] (Ja--44982). INDIA: Assam: *Koelz 25304* (Mi). CHINA: Chekiang: *Ching 1994* (Ca--281707, W--1246853). Fukien: *Chang 4577* (Ca--303266); *Chang & Po 3945* (Ca--300372); *Cheng 1317* (Ca--286970), *3237* (Ca--299489); *Chung 2395* (Ca--232902), *5534* (N); *En 2021* (Ca--288341); *Fong 19* (Ca--300037); *Ging 5537* (Mi), *5840* (Ws), *6872* (Gg--151506); *Po 12324* (Ca--325797); *Tai 11033* (Ca--325798). Kiangsi: *Lau 4731* (N, W--1753359). Kwangsi: *Ching 5278* (Ca--409768, W--1248669); *Steward & Cheo 606* (N). Kwangtung: *Chun 5999* (Ca--347366);

[to be continued]

Alma L. Moldenke

"THE BIOLOGY OF MARINE FUNGI" edited by S. T. Moss, xii & 382 pp., 79 b/w fig. incl. 261 EM photo., 34 tab. & 2 maps. Cambridge University Press, Cambridge, London & New York, N. Y. 10022. 1986. $49.50.

Herein are 30 invited papers of the 4th International Marine Mycology Symposium held as recently as August '85 at the Portsmouth Polytechnic, U. K., yet very neatly printed, organized and variously illustrated with many excellent EM photographs, charts, figures and tables and actually off the press in the next calendar year. The main topics embraced by these papers are ecological, taxonomic, physiological and applied biotechnological. Recent studies in these fields are carefully presented and directions for future work suggested. Bibliographies are intentionally very full. This book will be very important for scientists and students in the four fields of research just mentioned.

"THE FLORA OF THE HORTOBÁGY NATIONAL PARK" edited by J. Szwjkó-Lacza, 172 pp., 2 b/w fig., 23 photo., 17 tab., 18 draw. pl., 1 map & 1 end-page map. Akademiae Kaidó, Budapest, Hungary. 1982.

After a general description of this park area established in 1972 and the methods of this floral study, chapters by 13 taxonomic and ecologic specialists consist of descriptive check-lists of aquatic algae, contributions to the soil algal flora, some microscopic fungi, higher fungi, lichens, bryoflora, and the vascular plants, all with species lists. The paper jacket reports a total listing of 1,772 taxa. This book presents very carefully detailed studies and is No. 3 in the Natural History of the National Parks of Hungary series. Nos. 1 and 2 in the series treat the fauna.

"GREEN IMMIGRANTS - The Plants That Transformed America" by Claire Shaver Haughton, xii & 450 pp. & 27 chapter-letter captions. Harcourt, Brace, Jovanovich, Inc., London & New York, N. Y. 10017. 1978 - $12.95 clothbound & 1980 - $5.95 paperbound.

The idea for this book is an excellent one - to relate "the history and romance, the legend and folklore, of nearly one hundred growing plants, telling where they came from, how they arrived, and what has happened to them since" (in alphabetical order). It makes for pleasant casual reading by those of almost all ages and interests as well as careful reading of the collected descriptive historical recorded source materials from various ports on the other side of the Atlantic and elsewhere -- not forgetting the potato and tomato which became important to the New World settlers only after reentry from Europe. It relates the advents and effects of introduced food crops, fodder, horticulturals and weeds.

"CATOLOGO PARA UNA FLORA APICOLA VENEZOLANA" by Santiago López-Palacios, 211 pp., 2 color pl., 14 b/w plant draw. pl. & 8 "honey" pl. Publicacion auspiciada por el Humanistico = CDCH, Mérida, Venezuela. 1986. Paperbound.

This is a carefully prepared and annotated inventory of the native and introduced plants of Venezuela which are bee-pollen plants important in the honey industry. The plants are listed alphabetically by families and the involved genera and species with scientific and vernacular names, geographic locations and often down-to-the-hour records of bee-flower visitations.

"FRUIT KEY AND TWIG KEY TO TREES AND SHRUBS" by William M. Harlow, 1 & 50 & 1 & 56 pp., 139 & 148 b/w draw. & photo. Dover Publications, Inc., New York, N. Y. 10014. 1959 reprint. $2.25 paperback.

The full and subtitle to this ever useful book is "Fruit Key to Northeastern Trees and Twig Key to the Deciduous Woody Plants of Eastern North America" - "And to wherever else these trees have been introduced" could well have been added and thus stretch the range of the book's applicability. Even so, many foresters, ecologists, naturalists, teachers, students, etc. have depended upon these handy little illustrated and functionally keyed guides (really two books in one) since 1946 and 1941. Students in the field or in the classroom with hands full of twigs can get accurate identifications faster with these guides than with any of the many teachers' mimeographed ones that I have seen. This book should prove useful for many years to come!

"WHERE DOES IT HURT - A Guide to Symptoms and Illnesses" by Susan C. Pescar & Christine A. Nelson, M.D., iii & 313 pp. Facts on File Publications, New York, N. Y. 10016. 1983. $15.95.

This lay-person medical guide is truly "conveniently organized the way a layman thinks about illness -- either by disease or symptom" and offers advice needed to evaluate medical problems. In dictionary format it describes with clarity symptoms, causes, degrees of severity, contagiousness, and the usual and the possible means of treatment for over 300 of the most common disease conditions. The most useful sections of the book are the Quick-Reference Symptoms Guide with its many references to the disease and unusual but harmless symptoms section and the Index to Cross References. Following the recommendations given therein can make readers more intelligent about the workings of their bodies and recognized symptoms and thus better able to communicate with their medical doctors about their problems.

"THE FERN HERBAL - Including the Ferns, the Horsetails and the Club Mosses" written and illustrated by Elfriede Abbe, viii & 103 pp., 44 color & 36 b/w fig. Cornell University Press, Ithaca, New York 14850. 1985. $35.00.

This is a fine, corrected, offset reprint edition of the author's 1981 limited edition from her own press. There are accuracy and beauty of texture and form in the illustrations. There are 23 ferns, 4 horsetails, 2 clubmosses and 2 spermatophytes included in the work, with common leaf-descriptive names for the ferns and for *Asparagus plumosus* and *Myrrhis odorata* which are also treated. For each beautiful illustration are given the scientific and common names (the latter in English, French, German, and Italian), descriptions, habitat and distribution, culture, and fascinating bits of history and uses. This book will do so well on naturalists' and gardeners' coffee-tables, as a supplementary botany text, and as an important library acquisition, especially if the original edition was too expensive to acquire or regarded as too precious for ordinary handling.

"MARIHUANA - DECEPTIVE WEED" by Gabriel G. Nahas, O.B.E., M.D., Ph. D., xviii & 334 pp., 24 b/w fig., 23 tab., 1 map & 2 botanical pl. Raven Press Publishers, New York, N. Y. 10036. 1974. $27.50.

"Its realistic, medically responsible approach" by an "author experienced in pharmacology as well as medicine" gives "not only a general account of the plant and of the history of its use but also the scientific and medical evidence so often neglected or discounted". This book is a worthy pioneer, other authors and Dr. Nahas himself have followed suite. There are two clear botanical plates of this *Cannabis sativa* which are a marked improvement over many recent publications. The author's report on the considerable variability in the chemical strength of its incipient narcotic principle is often overlooked in the literature. "*Cannabis* intoxication prevails in the world under two completely different sets of social circumstances: (1) Endemically in poor agrarian societies (Middle East, India, Jamaica).....it is the opium of the poor. These societies are stagnant. (2) Epidemically amidst the educated affluent youth who are disenchanted by the offerings of a technical society and who seek instant pleasure.....Chronic users present a significant decrease in their productivity, efficiency and dependability."

"ECOLOGY OF TROPICAL PLANTS" by Margaret L. Vickery, vii & 170 pp., 59 b/w fig., 24 photo. pl., 7 tab. & 1 map. John Wiley & Sons, New York, N. Y. 10158. 1984. $36.00.

This is an excellent text because of its simple direct descriptions, forthright logical explanations, clear uncomplicated examples and illustrations, highly appropriate choices in end-of-chapter suggestions for further reading, and effective emphases on human responsibility for environmental damaging. A final chapter on "Investigating the environment" is supplied by John H. Hall of the University of Dar es Salaam, Tanzania. Author Vickert spent 10 years in tropical Africa where she witnessed "the disastrous effects on the environment of forest clearing, overcultivation and overgrazing". She adapted this book from R. F. Daubenmire's wonderful "Plants and Environment - A Textbook of Autoecology", 3rd edition, 1974, same publisher, so that it can be used in beginning college and technical school courses for teachers, nature guides and national park staffs. It makes good reading here in the U.S.A., too,

"PHYSIOLOGICAL PLANT ECOLOGY" by W. Larcher, translated and revised by M. A. Biederman-Thorson, xiv & 252 pp., 152 b/w/ fig. incl. 8 maps, & 40 tab. Springer-Verlag, Berlin, Heidelberg & New York, N. Y. 10010. 1975. $28.00.

This is a "rich" book with high quality and effectively selected and displayed information presented very efficiently in neat printed word and excellent full illustrative figure and table. The major topics presented are: the environment of plants, sun's radiation, carbon utilization, cycling of nitrogen and mineral elements, water relations, effects of temperature, and periodicity of climate and vegetation. Since ecologists today are becoming more and more specialized within this discipline it is fortunate that this book is still available for interested individuals, university courses, scientific laboratories and libraries. Both the author and the translator have performed so very well!

"HANDBOOK OF PHYCOLOGICAL METHODS - Developmental and Cytological Methods" edited by Elizabeth Gantt, xii & 425 pp., 39 b/w fig., 24 tab. & 40 photo. incl. 12 SEM. Cambridge University Press, Cambridge & London, U. K., & New York, N. Y. 10022. 1980. $29.95.

Sponsored by the Phycological Society of America, this third, well prepared volume in the series has 32 papers by 46 contributors. Under "Experimental algal systems and techniques" there are papers on such topics as "Control of development in *Scenedesmus*", "Gamete release, fertilization, and embryogenesis in the *Fucales*" and "How to detect the presence of a circadian rhythm". Under "Light and electron microscopy: preparative methods" there are papers on "Immunochemistry:

labeled antibodies", "Freeze-fracture and freeze-etch techniques" and "Stereology: quantitative electron microscopic analysis." The list of suppliers of equipment and materials is international but mostly American. There are separate author, subject and taxonomic indexes.

"BREEDING PLANTS RESISTANT TO INSECTS" edited by Fowden G. Maxwell & Peter R. Jennings, xvii & 684 pp., 59 b/w fig. incl. 37 photo., 51 tab. & 26 photo pl., John Wiley & Sons, New York, N. Y. 10158. 1980. $40.00.

This book, fully rich in subject matter, contains 21 papers by 35 authors who approach this huge problem so important to the world's economy and human living quality from many angles. A brief survey of the topics chosen include: biochemical and morphological bases of resistance, genetic factors affecting expressions and stability of it, insect behavior, plant pathogens and resistance, the inevitable present-day use of plant and insect models, breeding approaches in such crops as alfalfa, cassava, cotton, maize, rice, sorghums, wheat, and forest trees. The first editor of this book discusses future opportunities and directions. This book will continue to be important for quite a few years to come for advanced students, agricultural and horticultural crop and entomological technicians, and for the practical and classroom professors in this extensive field. The book is cleverly written, very fully illustrated with even a few "overdone" tables and figures, provided with a very full bibliography, and a separate listing of insect, mite and plant species with their scientific and common names and page references.

"ECOLOGY - A Textbook" by Hermann Remmert, contemporaneous English translation of "ÖKOLOGIE", 2nd edition by Marguerite A. Biederman-Thorson, viii & 289 pp., 189 b/w fig. incl. 9 maps & 6 photo. & 12 tab. Springer-Verlag, Berlin, Heidelberg & New York, N. Y. 10010. 1980. $25.00 clothbound; also paperbound.

Germany, Britain and the United States have long been the richest sources of the leaders in ecology and its various subdivisions, as well as of its researchers, professors, courses and texts. It is fortunate that all levels of students and workers in English-language areas can have access to this author's fine text presented in straightforward, easy reading English. It is an excellent supplement for the beginner and an important reviewer, evaluator or orientor for the more advanced student or worker in this field or any of its presentday subdivisions. The figures are plentiful and very effective. After explaining the author's basic concept, the text develops the factors affecting autecology, those of population ecology and those of ecosystems, always emphasizing that "things are not always as simple as they seem".

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